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Odisha Economic Journal expresses sincere gratitude to the following experts for their comments, suggestions and recommendations on draft papers:

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Editorial

The Presidential Address (by Rabinarayan Patra) delves into the futuristic ponderables for a growing subnational entity engaging with sustainability of diverse dynamic sectors and subsectors of the economy. Strengthened by evidence-based discourse, this address takes an objective view on limits to growth and opportunities for progress focusing on natural resource availability/constraints, demographic patterns, achieving subsectors and pollution challenges. With SDGs to attain by 2030, the state is unevenly poised to achieve them. The paper implicitly cautions about the price the society might pay for indiscrete and non-vigilant economic growth. Growth must pay special attention to sustainable use of resources with a thought for the generation yet to arrive.

The article (by Prasanta K. Pattanaik) is a revised version of the acceptance speech given following the conferment of the OEA Lifetime Achievement Award upon the eminent professor. Having been a prominent contributor-thinker in the broad domains of welfare economics and choice-preference conundrum, the rather compact paper offers a critical perspective on the functioning and capability approach (FCA) to the notion of individual well-being as has been propounded through some of the writings of both Amartya Sen and Martha Nussbaum.

The article (by Priyabrata Sahoo, Kalandi Charan Pradhan and Vinay Kumar) attempts a long view of employment patterns in both rural and urban Odisha. While diversification away from farming to myriad activities as construction, wholesale/ retail trade, transport and education has occurred, the coastal belt has performed well in the process. Self-employment in the non-farm sector as between rural and urban areas remains elusive as the question of quality is raised.

Dealing with the delicate issue of childhood vaccine-preventable diseases (CVPDs) in India, the article (by Tulika Tripathi and Malaya Ranjan Mohapatra) provides a detailed state and district level analysis by triangulating health and demographic data from NFHS-5 and HMIS 2019-20. At the district-level, it identifies factors such as the average number of children per woman, antenatal care coverage, and the share of Scheduled Castes and Scheduled Tribes population as influencing the CVPD burden which requires special policy attention at the local level.

Concerned with if and how recent policy, namely, the Pradhan Mantri Jan Dhan Yojana has helped financial inclusion the article (by Kusha Tiwari, Rabi Narayan Kar, Amanpreet Kaur and Varun Bhandari) examines experiences across two states -

Madhya Pradesh and Rajasthan - with different levels of development. In terms of implementation, it points to the need for gender-sensitive measures to raise representation of female beneficiaries, enhance financial literacy, increasing infrastructural investments, and improving transparent communication.

Drawing upon micro evidence as collected through primary surveys in the districts of Cooch Behar and North 24 Parganasin West Bengal, the article (by Neeloy Gupta and Archita Ghosh) engages with the manifestation of informality in the sphere of construction work. It considers such aspects as skill level, workplace location, gender, and experience to assess if the variations in remuneration are influenced by these. Inter alia, it makes a case for skill enhancement programmes to improve wages in the sector.

Focusing on the growing platform-based services particularly in urban India, the article (by Minaketan Behera, Prashun Pranav and Sourav Nigam) provides an interesting on-ground picture of elements of precarity, restricted accessibility to social security benefits and lack of space for registering of workers' rights overwhelming the work mediated through apps and algorithms. Mere opportunities for employment are no guarantee for decent working conditions unless the state intervenes in a substantive manner.

Child undernutrition remains the key concern of this detailed empirical analysis undertaken in the paper (by Tulasi Malini Maharatha and Manas Kumar Pedi). Based upon data gleaned from NFHS 4 and NFHS 5, this cross-sectional exercise focuses on district-level movements and socioeconomic inequalities in Minimum Dietary Diversity among children aged 6–23 months in Odisha. It points to the discrepancies in access to nutrition as impacted by household economic position and social identity. As underscored in no uncertain terms, while state level coverage has risen inequity in access could spoil the "translation of dietary improvements into anthropometric progress."

This issue also carries an incisive review (by Tara Nair) of an edited volume that pays attention to workers and their power to transform social relations under contemporary capitalism."

Keshab Das
Editor-in-Chief,
Odisha Economic Journal

Growth, Limits and SDGs: A View from Odisha

Rabinarayan Patra

Introduction

In not keeping with offering formal gratitude to all the Life Members, Executive Committee members and everyone associated with the Odisha Economic Association (OEA), let me express my immense satisfaction at the steady progress and reputation that this regional academic body has acquired, exemplifying what earnestness in a collective could contribute despite expected and unexpected odds. As my belongingness to the OEA is far beyond my being the President this year (and, in the past, about 22 years of its Secretary), it is a very special moment for me to share some of my concerns over and shower accolades upon how the economy of Odisha has emerged from what may be termed a 'resource curse' to become an example of what may be termed a 'rise like a phoenix.'

Before I share my views through this Presidential Address, I have some names to take of those who stood by me during the highs, lows, and normals as this paper was prepared and revised. The writer gratefully acknowledges the help received from Keshab Das for fine-tuning, consolidation, and suggesting the title of the paper; young friends Amarendra, Himanshu and Laxmikanta for ideas; Pragyan for preliminary groundwork; Ashwini-Anirudha-Sunil for calculations; and Sagarika for streamlining references. Finally, I am grateful to the Members of the EC and OEA for making me their President for 2025.

Odisha's recent economic trajectory presents a compelling, yet complex, narrative of economic progress and challenges. The state has achieved significant strides, marked

by a burgeoning population that provides both a demographic dividend and a growing consumer base. It has achieved robust economic growth, complemented by significant strides in food grains production ensuring food security, remarkable increase in industrial output, positioning it as a key player in the national industrial landscape, and these economic gains have translated into broad-based improvements in living standards. However, the economic surge has brought critical environmental and social costs of substantial pollution and accelerated resource depletion of its natural capital to the forefront. In the context of Sustainable Development Goals (SDGs), Odisha has demonstrated commendable performance in certain indicators, but slow progress in reducing inequality, achieving quality health care for all and environmental sustainability. The state's future prosperity hinges on addressing these negative externalities by enhancing its ability to transition to a more inclusive and sustainable development path through integrating environmental regulations and resource management strategies into its growth agenda.

In 2024-25, the size of the state economy is estimated to be approximately Rs. 9.5 lakh crore or $ 113 billion, and the state has been ranked 13th among 17 major states in India, in 2023-24. The sectoral shares of the state indicate the predominance of industrial sector (Table 1).

Table 1: Trend of Sectoral GSVA Shares (%) at Current Prices

Sector	1950-51	1960-61	1970-71	1980-81	1990-91	2000-01	2010-11	2020-21	2024-25
Agriculture	41.90	35.16	40.95	40.86	31.72	26.00	19.80	24.32	18.94
Industry	12.00	23.09	20.20	23.31	34.28	35.72	42.11	39.40	43.94
Services	46.10	41.74	23.31	35.83	34.00	38.27	38.09	36.28	37.11

Source: Author's calculation based on data in GoO, 2022; 2025
Note: Back Series 2011-12 Base, Figures for 2024-25 are Advance Estimates

The economy is estimated to have grown at 7.2 per cent in 2024-25 which is higher than the 6.4 per cent growth at the all-India level. In the said year, the three sectors of the state economy viz. agriculture, industry and services grew at 3.3 per cent, 6.1 per cent, and 10.0 per cent respectively. This means that high pace of growth has been evident across all sectors of the state economy (GoO, 2025). As may be seen in Table 2, Odisha's GSVA growth rate has consistently outpaced the growth rate of the Indian economy since the 2000s, reflecting strong economic momentum.

Table 2: Decadal Sectoral CAGR of Odisha

(at Constant 2011-12 Prices; in %)

Period	Odisha				India
	Agriculture	Industry	Services	GSVA	GVA
1950-51 to 1959-60	-0.61	4.84	1.58	0.86	1.52
1960-61 to 1969-70	1.99	0.22	0.99	1.35	1.39
1970-71 to 1979-80	0.39	2.57	1.33	1.19	1.40
1980-81 to 1989-90	0.83	2.88	2.37	1.78	2.23
1990-91 to 1999-00	0.62	1.85	2.43	1.63	2.49
2000-01 to 2009-10	1.66	5.02	3.72	3.78	2.85
2010-11 to 2019-20	1.12	3.19	2.94	2.75	2.80
2020-21 to 2024-25	2.51	4.31	3.97	3.91	3.35
1950-51 to 2024-25	0.72	2.30	2.05	1.66	2.10

Source: Author's calculation from data in GoO, 2022; 2025, and GoI, 2025.

3.2 Early Closeness, Worsening Gap, Reversal and Convergence in Per Capita Income (PCI)

Historically, Odisha's PCI has lagged behind the national average. Up to 1980-81, its PCI was fairly close to India's and the gap was narrowing. But the gap widened thereafter due to poor agricultural growth, underperforming industrial and services sectors and weak state management. Unlike other states, which saw growth after the 1991 economic reforms, the state continued to struggle initially. The situation reversed when it experienced a turnaround in the 21st century with improving infrastructure and ease of doing business,incoming large capital-intensive projects, particularly in the mineral sector, industry and service sectors becoming increasingly prominent contributing to strong structural change, high growth and intra-state convergence. The per capita income disparity has substantially narrowed consistently from 31.98 per cent in 2000-01 to 8.8 per cent in 2024-25. The trend is portrayed in Table 3.

Table 3: Trend of Per Capita Income in Odisha and India

(at current prices in Rs.)

Odisha/ India	1950-51	1960-61	1970-71	1980-81	1990-91	2000-01	2010-11	2020-21	2024-25
Odisha	227	341	749	1960	4411	12698	45909	103211	182548
India	265	384	806	1995	6126	18667	56971	127244	200162
Gap (%)	14.34	11.20	7.07	1.75	28.00	31.98	19.42	18.89	8.80

Source: Same as Table 2

3.3 Vision 2036 and Viksit Odisha 2047: Rhetoric and Reality

In 2024-25, the money value of Odisha's gross state domestic product (GSDP) was $ 113 billion and growth rate was 7.2 per cent (GoO, 2025). The state aspires to achieve a GSDP of $500 billion by2036 and of $1500 billion ($1.5 trillion or approximately 13-fold), by 2047 (22 years from now), raising PCI from $2200 in 2024-25 to $9000 in 2036 and $28000 in 2047 (GoO, 2025b). The Vision 2036 and Viksit Odisha 2047 Goals are presented in Table 4.

Table 4: Vision 2036 and Viksit Odisha 2047 Goals

Indicators	2024-25	2036	2047
Nominal GSDP ($ billion)	113	500	1500
Nominal PCI ($)	2200	9000	28000

Source: GoO, 2025b.

Given the GSDP figure for 2024-25 at $ 113 billion and assuming a reasonable nominal GSDP growth rate of 8 per cent per annum, Odisha's nominal GSDP may rise to [113 x $(1.08)^{11}$=] $ 263 billion in 2036 and to [113 x $(1.08)^{22}$=] $616 billion in 2047. Assuming that Odisha's population grows to 49 million in 2036 and 53 million in 2047, PCI may rise to $5367 in 2036 and $11604 in 2047. To achieve the ambitious nominal GSDP goals of $ 500 billion in 2036 and $ 1500 billion in 2047, the state economy needs to grow at CAGR of 13-14 per cent or at double the growth rate of 7.2 per cent in 2024-25, which seems aggressive and unrealistic. However, using reasonable annual growth rates, Odisha's PCI is likely to catch up with India's by 2029-30 and may reach Rs. 610868 in 2036-37, surpassing the national figure Rs. 542431 (Figure 1).

Figure 1: PCI at Current Prices: Odisha vs India Using Annual Growth Rates
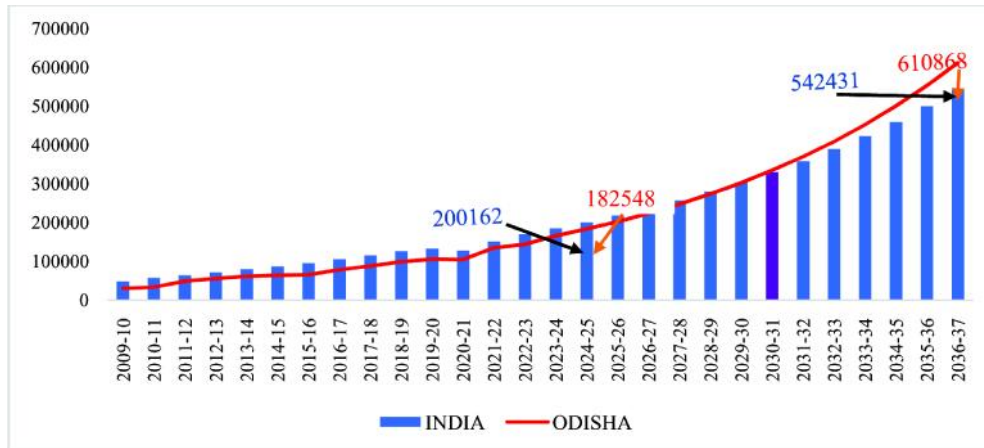
Source: Same as Table 2, and Author's projections for 2025-26 to 2035-36.

Notes: For India: 1. Data for 2021-22 are Third Revised Estimates, for 2022-23 are Second Revised Estimates and for 2023-24 are First Revised Estimates.2. Data for 2024-25 are Provisional Estimates.3. Population figures relate to mid-financial year. 4. For the years prior to 2004-05, the additivity of detailed estimates with the aggregates will not be maintained since estimates for that period at detailed and aggregate levels have been compiled by adopting the splicing method.

4 Limits to Growth

4.1 The Theory and Its Critique

The Limits to Growth (LtG) theory (Meadows et al., 1972) and its subsequent edition (Meadows et al., 1992; 2004) is a groundbreaking study using the World3 system dynamics model to explore the complex interactions among five critical factors: population growth, industrialization, pollution, food production, and resource depletion. The core argument of the thesis is widely viewed as a warning that given the planet's finite resources and its capacity to absorb pollution, if current growth trends continue unchecked, unabated growth in population, food production and industrialization will lead to resource depletion and pollution. Human action and the "business-as-usual" (BAU) trajectory will overshoot the sustainable limits to growth and result in collapse.

The LtG model and its "doomsday" alarm are a complex and highly debated idea. It is based on simplistic assumptions that can lead to forecasting errors, disproportionate outcomes, incorrect risk assessments, and potentially ineffective solutions to real-

world problems (Holling, 1973; Jantsch, 1980; Arthur, 1999; Sterman, 2000; Miller & Page, 2007; Taleb, 2007). It ignored key market mechanisms and human adaptability in incentivizing conservation for increasing resilience in the face of scarcity (Solow, 1973; Beckerman, 1992; Nordhaus, 1992; Simon, 1996). The narrative tends to oversimplify and exacerbate public fear, neglecting to promote proactive solutions such as sustainable policies and efficiency (Lomborg, 2013; Sterling, 2015).

The model overlooks the importance of technological innovations and sustainable alternatives in enhancing efficiency, reducing resource use, and mitigating environmental degradation (Simon, 1981, 1996; Ausubel, 1996; Lomborg, 2001), focusing on decoupling economic growth from environmental degradation (Geissdoerfer at al., 2017). It sidetracks the role of adoption of sustainable lifestyles (Klaniecki et al., 2018) and environmental policy interventions, such as carbon pricing, green technology incentives, and subsidies (Eastin et al., 2011), in moderating environmental impacts and promoting sustainable societies (OECD, 2018). In fact, environmental conditions are improving in many areas due to human action and policy (Lomborg, 2001), as is the Great Green Wall demonstrably restoring the degraded land in the Sahel region of Africa.

Despite valid criticisms regarding assumptions, economic factors, and model simplifications, there is no definitive research that has disproven the basic propositions and conclusions of the LTG model. The results of empirical studies and recent updates are rather broadly consistent with its projected behaviour under business-as -usual conditions (Turner, 2008), and could be related to the "economic difficulties of the global financial crisis",and "peak oil issues and analysis of net energy" (Turner, 2014). Using updated data across key variables like population, food production, industrial output, pollution, resources, ecological footprint, Herrington (2021) emphatically affirmed the validity of the original LtG postulate i.e., continued growth under the BAU scenario could lead to collapse around 2040, if major changes aren't made. Real-world indicators matched LTG's standard-run scenarioas of 2008 (Hall and Day Jr., 2009), and more so considering climate change as the outcome of too much human impact and limits to growth of energy as a critical resource (Hall, 2022). Similarly, using data through 2022, a recalibration of the World3 model underlying LTG showed a continuation of the overshoot-and-collapse pattern, with peak values slightly pushed into the future (Nebel, et al., 2023).

Limits to Growth and Odisha

The LtG theory warns of the adverse consequences of unchecked population and economic growth on the finite resources and human society. Its relevance to Odisha may be examined in the context of the state's increasing population and urbanization, growing food production, surging mineral extraction led expanding industrialization, rising pollution, and challenging resource depletion.

a. Population Growth and Urbanisation

The State's projected population growth rate at 0.6 per cent is slower than the national average of 0.9 per cent, as of 2022-23. The total fertility rate (TFR) which just equaled the replacement level (2.1) in 2011-15 is projected to decline to 1.7 in 2031-35. Odisha's population is projected to reach 49.1 million in 2036. Dependency ratio in the state consistently remained below national figures until 2011 (61.6% against India's 64.6%) and is expected to decline to 56.1 per cent in 2036 (CYSD, 2024; GoI, 2020). Odisha's youth population is one among the significant attractions for global investors. With over one in four people in 15-29 years age group, this demographic dividend offers a vast pool of potential trained and trainable workers across various industries, including technology, manufacturing, and services, fostering economic growth and increased purchasing power. The state's population trends are shown in Figure 2.

Figure 2: The State of Odisha's Population
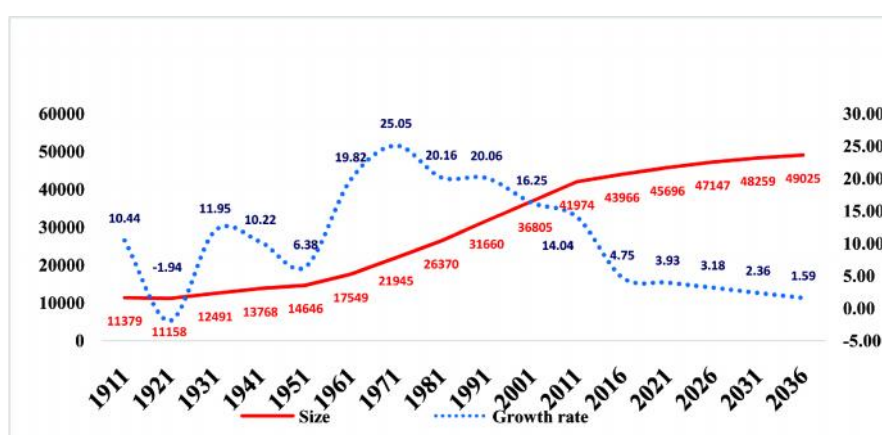
Source: Census of India figures, GoI. 2011; 2020.
Note: Population Size ('000) and Growth Rate (%);

Odisha is one of the least urbanised states in India. More than 45 per cent of the state's urban population lived in its 10 Class I cities in 2011 with more than half of this population based in the coastal areas that make up just a third of its geographical area. Between 2011 and 2024, the growth rate of urban population was among the slowest six, at about 2.3 per cent and the share of urban population was the third lowest (19%) in the country (SBI Research, 2025).The level of urbanization is projected to be around 22-23 per cent by 2036 in Odisha. It may be surmised that with slowing population growth and low level of urbanization, Odisha is far from the limits. However, they point to the imperatives of aligning population and urbanization trends with resource use and ecological balance.

b. Food Production

Odisha presents an interesting case of growth in food grains production with technological innovations and policy interventions, despite climatic constraints and natural havocs (come October, the farmers' heartbeats surge in fear of cyclones). In the state, food means rice and agriculture is synonymous with rice cultivation. Rice constitutes about 44.69% of gross cropped area (GCA) and 80.67% food grains production in 2023-24. The production of rice in 2023-24 is 115.39 lakh metric ton (MT), a three-fold jump from 37.20 lakh MT in 1970-71. Pulses are the second most important crop, accounting for 23.0% of GCA while other cereals have a low share of 6.25 per cent in 2023-24. Production of pulses and other cereals like millets are growing. Production of food grains has increased from 44.12 lakh MT in 1970-71 to 143.04 lakh MT in 2023-24. Odisha has established itself as a food grain surplus state. The trends in the food grains yield and production, and availability are shown in Tables 5 and 6. While the state has shown that despite multiple constraints food grains production could be substantially increased. However, growth may increasingly run up against diminishing returns.

Table 5: Trend of CAGR of Yield and Production of Foodgrains in Odisha

	Yield Rate (Kg./Ha.)				Production ('000tons)			
Time Period	Rice	Cereals	Pulses	Food grains	Rice	Cereals	Pulses	Food grains
1970-71 to 1979-80	0.09	-0.07	-0.83	-0.44	-0.42	-0.20	2.67	0.13
1980-81 to 1989-90	2.04	1.83	-0.18	1.39	2.23	1.74	0.62	1.55

1990-91 to 1999-00	-1.09	-0.98	-1.97	-0.83	-1.07	-1.08	-3.87	-1.42
2000-01 to 2009-10	1.86	1.99	1.58	1.64	1.84	2.02	3.46	2.16
2010-11 to 2019-20	1.12	1.14	0.67	1.06	0.79	0.73	0.38	0.69
2020-21 to 2023-24	4.02	3.83	3.45	3.67	4.82	5.08	5.23	5.09
1970-71 to 2023-24	0.94	0.96	0.04	0.78	0.86	0.83	0.44	0.78

Source: GoO, 2020; 2025.

Table 6: Per Capita (Adult Equivalent) Availability of Foodgrains in Odisha

(grams/day)

Year	Cereals	Pulses	Foodgrains
1970-71	524	47	571
2023-24	638	58	696
CAGR1970-71 to 2023-24	0.14	-0.20	0.10

Source: GoO, 2020 and Author's calculation from data in GoO, 2025a.

a. Industrial Production

Odisha boasts of a richly diverse industrial landscape - its strength lies in the vast mineral wealth and mineral based-industries, especially steel, metallurgy and aluminium. Other prominent industries relate to subsectors such as textiles, apparel, chemicals, petrochemicals, biosciences, pharmaceuticals and a wide range of handicrafts and handlooms. Tables 1 and 2 indicate that accounting for 43.9 per cent of GSVA in 2024-25 the industrial sector emerged the growth engine of the state economy since the 1990s. The share of manufacturing sub-sector in industrial GSVA increased from 42.6 per cent in 2012-13 to 52.6 per cent in 2024-25.

Even as mineral and metallurgical exports account for a staggering over three-fourths of merchandise exports (Table 7), the CAGR in exports of the state's industry sector between 2019-20 and 2023-24 stood at 52.2 per cent for textiles, 30.1 per cent for Software/Electronics, 24.5 per cent for Pharmaceuticals, 23.8 per cent for Metallurgical, 21.7 per cent for Engineering/Chemical & Allied products against 21.2 per cent for total merchandise and services exports (GoO, 2025). This suggests a gradual shifting of export potential to non-metallurgical/mineral products.The state

along with Assam added the highest value from manufacturing (Kapoor and Singh, 2023).

Table 7: Composition of Merchandise Exports from Odisha - 2023-24

Metallurgical	Mineral	Software/ Electronics	Engineering /Chemical & Allied	Marine	Other products	Total
52.3	23.1	11.6	8.7	3.5	0.9	100.0

Source: GoO, 2025

Note: *Other products include Textiles, Agriculture & Forest Products, Pharmaceuticals, Handlooms, & Handicrafts

With progressive policy measures as contained in the Odisha Industrial policy 2022 with sector-specific policies, strong infrastructure and industrial corridors, including the Bhubaneswar-Cuttack-Paradeep, Dhamra port-based industrial region and upcoming ports Odisha has the potential to emerge as the industrial hub in eastern India. Besides, the Odisha MSME Development Policy 2016 offers various incentives (capital investment and interest subsidy), stamp and electricity duty exemptions, focus on cluster development-skill building-technology upgradation, district industries centre as one-stop support institution, start-up Odisha initiative for incubation- innovation-mentorship, accessing finance through credit guarantee fund trust for micro and small enterprises etc. are working for the promotion of the micro-small-medium-enterprise sector.

The growth prospects for the industrial sector in Odisha are strong, highlighted by the Utkarsh Odisha-Make in Odisha Conclave, which attracted proposals worth Rs. 16.73 lakh crore, aiming to create 12.9 lakh jobs across 20 sectors. Key developments include the inauguration of industrial projects with a total investment of Rs. 6117 crore, expected to generate 17,286 jobs, and Rs. 5770 crore investment in new industrial estates projected to create 37,000 jobs in Haldiapada and Khordha. Additionally, strategic investments in high-tech and green industries, such as semiconductor facilities and an aircraft maintenance center, are anticipated, alongside ongoing projects like the JSW steel-POSCO integrated plant and Vedanta's aluminium and copper projects. Moreover, there is a trend towards diversification in FMCG, textiles, and food processing sectors. The state has only explored about 10% of its known mineral reserves and has utilized less than 5% (GoO, 2025; 2025b), highlighting significant untapped

resources. Factors such as the sustainability of existing minerals, skilled workforce availability, supportive institutional frameworks, developed industrial infrastructure (including ports), innovations in process efficiency, the Integrated Mines and Minerals Management System (IMMMS), and favourable policies for industries position the sector for long-term growth, countering pessimistic projections.

b. Pollution

A notable negative externality of population growth, food production, industrialisation and urbanisation has, eventually, been rising pollution - air, water, land and soil, marine, and urban areas, among others. The potential challenges these forms of pollution shall pose would be important to take into account.

5.4.1 Air Pollution and Green House Gas (GHG) Emission

The air quality index (AQI) in various cities of Odisha, including Bhubaneswar and Cuttack, is largely classified as polluted, especially during winter months. The State Pollution Control Board of Odisha (SPCBO) reported that AQI values were only satisfactory on a few days in February 2025, with most days showing moderate air quality. Stations like Talcher, Angul, and Rourkela experienced worse conditions compared to others such as Bhubaneswar and Cuttack. (SPCBO, 2025). Odisha's towns struggle to meet national air quality standards set by the Central Pollution Control Board (CPCB). Major pollution sources include power plants, construction dust, vehicle emissions, industries, brick kilns, mining, transport, biomass burning, and various household activities with prominent pollutants such as particulate matter ($PM_{2.5}$ and PM_{10}), sulfur dioxide (SO_2), and nitrogen oxides (NOx). Because of the national highways, major roads, and adjacent industrial belts, the central area of Bhubaneswar Smart City has the highest pollution emissions (Sahu et al., 2023).

Odisha's total GHG emissions have grown at a CAGR of little over 5.6% during 2012-13 to 2022-23, reached 305.2 million metric tons of CO_2 equivalent (MMT CO_2e) in 2022-23, accounting for 9.7% of the country's total emissions and by 2035–36, the state's total GHG emissions are projected to range between 493 and 782 MMT CO_2e (iFOREST, 2024). It may be 493 MMT CO_2e in a Nationally Determined Contribution (NDC)-aligned scenario with high GSDP growth at 8% and green economy initiatives resulting in a 45% lower emission intensity than the 2005 level,

665 MMT CO_2e in a BAU scenario, and 782 MMT CO_2e with 8% GSDP growth and constant emission intensity reductions. The state's per capita net GHG emissions 6.15-ton CO_2e stood much higher than India's 2.24-ton CO_2e in 2018 and the shares of Energy, Industrial Processes and Product, Agriculture- Forestry- Other Land-Use, and waste sectors in total emissions were 92%, 5%, 2% and 1%, respectively, in 2018 (GHGPI, 2022). A summary picture of energy mix in the state is given in the Table 8.

Table 8: Shares (%) of Different Sources of Energy Production in Odisha, 2021-22

Conventional sources			Non-conventional / Renewable sources				Grand Total
Thermal/ Coal-based	Hydro	Total	Solar	Small Hydro	Biomass	Total	
77.49	17.50	94.99	3.67	0.87	0.48	5.01	100.0

Source: Srivastava et al., 2025

Since energy sector is the largest emitter (92%) and the carbon-emitting coal-based thermal plants have the highest share in total energy production (77.49%) in Odisha, GHG emissions are obviously higher in the state. The Odisha Renewable Energy Policy 2022-23 aims at fostering sustainable socio-economic development with energy security by leveraging clean energy, Enhanced Energy Efficiency and mitigating environmental impacts.

5.4.2 Land Degradation and Soil Pollution

Odisha has a wide variety of impressive soil types and has serious problems with soil and land contamination and soil erosion due to mining operations (especially open cast mining), industrial waste and effluents, sewage sludge, drought occurrences, groundwater depletion, urban expansion, industrial growth and unsustainable agricultural practices i.e., overuse of pesticides and fertilizers. These also cause land degradation, nutrient depletion, soil acidification, air pollution and even surface and groundwater contamination, particularly in the mining and industrial areas of the state like Sukinda, Keonjhar, Angul, Talcher, Ib-valley, Jharsuguda, Koraput, Rayagada, Jajpur and Paradeep. People in the Sukinda valley suffer a double loss: loss of employment

because half of the mines are already shuttered due to stringent environmental laws and the remaining are operated with modern processes and machinery displacing labour and a loss of livelihood from agriculture as the land is rendered unfit for farming for which it is dubbed as the "Valley of Despair" (Mohanty et al., 2023) and the fourth most polluted place in the world (Blacksmith Institute, (2007). Land degradation is a threat to its agriculture and food security (SwitchON Foundation, 2024).

Analysing 40,265 geo-referenced soil samples from farmer's fields spread over 309 blocks in 30 districts, Dixit et al. (2020) found widespread micronutrient and nutrient imbalances, pervasive shortfalls in essential micronutrients and secondary nutrients causing alarming levels of soil pollution and land degradation across the state's farmland, especially in the mining regions. More than 80% of sample soils were acidic with many fields having a pH below 5.5 that can severely limit nutrient availability and soil uptake. About 80% of fields were deficient in boron, 51% lacked sufficient sulfur, 42% had a zinc deficiency, 28% were low in magnesium and 43% had low carbon content. In some regions, accumulation of heavy metals, and excessive as well as indiscriminate application of chemical fertilizers and pesticides furthered the decline in soil health. A study in Bolangir, Bargarh, Nuapada, Kalahandi, and Kandhamal districts in central Odisha, which have been identified as drought-affected by the Odisha State Disaster Management Authority, shows that 57% of the land in the area is challenged by very low to moderate soil erosion at a rate of 2–10 tons per hectare per year and the rest 43% faces moderate to very severe erosion at a rate of 10–25 tons per hectare per year (Dandapat et al., 2024).

5.4.3 Marine and Oceanic Pollution

Although Odisha has a 574.71 km long coastline, its marine ecosystem is unhealthy. An average amount of 258.7 ± 90.0 microplastic particles/kg of beach sediment was found in nine beach stations with twelve different types of polymers and the density of microplastic substance was found to be the highest at Swargadwara Puri followed by Chandipur, Chandrabhaga, Golden beach, Beleshwar, Gopalpur, Paradeep, Sunapur and Abhaychandpur in that order (Patchaiyappan et al., 2021). Due to tourism activities and river discharge each litter (plastic, foam, metal, rubber, and glass) is high at Puri, Gopalpur and Rushikulya beaches with adverse impact on sea turtle nesting habitat and population (Barik et al., 2024). A study by Paul et al. (2023) on 16 sites along West Bengal and Odisha coasts found them heavily contaminated with over 5 cm of

marine litter consisting of glass, rubber, wood fragments, fishing nets and floats, paper, food waste, slurry products, clothes and plastic packets posing a significant threat to the coastal environment, potentially killing marine life and affecting ocean water quality. Increase in nutrient and suspended solid concentrations in coastal waters was attributed to riverine transport of industrial effluents of high phosphorous levels as at Paradeep and higher ammonia levels carried with municipal waste as in Puri (Dixit et al., 2024).

5.4.4 Urban Wastes Pollution

Although Odisha remains one of the least urbanized states in the country, the share of urban population in total population in the state has consistently increased from 2.47% in 1911 to 16.69% in 2011 and is projected to rise to 22-23% by 2036 (GoI, 2020). Between 2001 and 2011, 37.9 per cent of the increase is attributed to new census towns and 32.8 % to rural-urban migration (Mathur et al., 2021). In 2011, 1560303 lived in slums: 812737 in recognized slums and the rest 747566 in identified slums (Yadav et al., 2021). Urban areas are struggling with improper collection, lack of segregation at source, open and legacy dumping and unscientific landfills, illegal waste burning and insufficient recycling. Table 9 indicates the enormity of the problem of managing solid waste in the State.

Table 9: Solid Waste Management in Urban Areas (tpd/2019-20)

Particulars	All ULBs	Selected 21ULBs	No. of ULBs among the selected 21, dumping unprocessed waste within 200m from
Waste generated	2208.60	1439.58	Water supply/water ponds: 21
Waste Collected	2123.30	1411.09	Religious place: 19
Waste Processed	202.40	14.00	Stadium: 20
Waste to landfill /Dump	1920.90	1397.09	Habitations: 6
% of processing	9.53	0.99	River/nullah: 10

Source: GoO, 2022a

5.4.5 Water Pollution

Odisha is facing severe water pollution and falling water tables due to rapid industrialization, mining and urbanization. Water in most of its rivers is highly

contaminated. In 2023, the numbers of habitations in the state where drinking water quality were affected by different harmful substances were: fluoride- 24, iron- 1067, salinity - 11 and nitrate- 6 (GoI, 2023). In the Sukinda valley, heavy metals such as manganese, iron, zinc, chromium and nickel in amounts ($> 5\,\mu g/L$) were found as the major contaminants in both groundwater and surface water resources (Prusty et al., 2025). Sewage, industrial effluents, and agricultural runoff are contaminating rivers and groundwater supplies, while climate change is leading to a drop in the water table in many areas. Of course, of the 19 polluted river stretches (PRS), identified in 2020 (BOD > 3mg/L), water quality was improved in 13 stretches reducing the number of PRS to 6 in June 2023 (SPCBO, 2023). Similarly, 13 of the total 129 rivers did not qualify for bathing as per the river water quality monitoring stations in June 2023. Odisha is a pioneer in formulating and implementing faecal sludge and septage management (FSSM) projects using awareness programmes, community engagement, and better treatment infrastructure across 114 ULBs and demonstrating successful urban-rural convergence in this regard for improving river water quality (NITI Aayog, 2022; NFSSM Alliance & NITI Aayog, 2021; GoO, 2023). The state bagged the Best FSSM Model (Urban) award in 2022 from India Sanitation Coalition (ISC)- Federation of Indian Chambers of Commerce & Industry (FICCI).

Groundwater quality in several towns of Odisha, including Cuttack, Berhampur, and Bhubaneswar, remains within the desirable BOD limit of less than 3 MG/L. The state operates 120 septage treatment plants with a combined capacity of 2087 kiloliters per day (SPCBO, 2023). However, contaminants have been found in groundwater at various locations across different districts as given in Table 10 (CGWB, 2024).

Table 10: District-wise Contaminants with Anomalous Values in Groundwater

Contaminants with anomalous values	Districts in 2023
Fluoride (F > 1.5 mg/L)	Angul, Balangir, Bargarh, Jharsuguda, Nayagarh, Nuapada, Puri, Sambalpur, Subarnapur, Sundargarh = 10 districts
Nitrate (NO3 >45 mg/L)	Angul, Balangir, Bargarh, Cuttack, Dhenkanal, Kendujhar, Khordha, Koraput, Mayurbhanj, Nayagarh, Nuapada, Puri, Sambalpur, Subarnapur,Sundargarh = 15 districts
Iron (Fe > 1.0 mg/L)	Angul, Balangir, Baleshwar, Bargarh, Cuttack, Dhenkanal, Gajapati, Ganjam, Jajapur, Kendrapara, Kendujhar, Khordha,

	Koraput, Malkangiri, Mayurbhanj, Nayagarh, Nuapada, Puri, Sambalpur, Subarnapur = 20 districts
Arsenic (As > 10 ppb)	Bhadrak, Cuttack, Ganjam = 3 districts
Uranium (U>30ppb)	Angul, Balangir, Bargarh = 3 districts
Residual Sodium Carbonate (RSC > 2.5)	Angul, Balangir, Bargarh, Cuttack, Dhenkanal, Khordha, Nayagarh, Nuapada, Puri, Sambalpur, Subarnapur = 11 districts

Source: Author's compilation from CGWB (2024).

Considering the need to rehaul the sewage treatment plans, Odisha government is encouraging research to understand pollution sources and develop sustainable strategies, and is implementing the Orissa Ground Water Act, 2011 for promoting conservation and management through awareness programs and training.

5.5 Resource Depletion

Globally, concerns about sufficiency of resources to support a growing human population have existed ever since the time of Malthus (1798) and in Odisha in the recent times (GoO, 2024b). The state is grappling with growing imbalance between resource availability and its use.

5.5.1 Land and Forests

Odisha is experiencing significant depletion of land and forest resources due to mining, industrialisation and urbanization which affects lives and livelihoods of people, especially of these resource dependent communities.

5.5.1.1 Reduction in Net Sown Area

Odisha is the "Hexadeltaic area" and the "Gift of Six Rivers" (Mahanadi, Brahmani, Baitarani, Budhabalanga, Subarnarekha, and Rushikulya). Its coastal plain is rich in fertile silt and the state's agriculture is irrigated by over 180 dams, from Alubani in Mayurbhanj district to Upper Suktel in Bolangir. The construction of some of these

dams, however, had led to submergence of lakhs of acres of cultivated land leading to depletion of precious land resources (Dansana, 2021). Similarly, agricultural land is being lost to river bank erosion and total cultivable land is slowly shrinking in the delta region of Kendrapara district (Kabi, 2012). The area under barren and fallow land, and culturable waste land has increased, and net sown area (NSA) has fallen (Table 11).

Table 11: Land Use Changes in Odisha

Year	Current Fallow	Barren & Unculturable Land	Culturable Waste	Net Area Sown (NAS)
1990-91	2.14	4.99	5.97	63.04
2023-24	5.88	7.20	3.73	55.92

Source: GoO, 2020; 2025a

5.5.1.2 Change in Forest Area

Odisha is a major forested state. It experienced massive decline in forest area during 1930-1970 due to human activity led deforestation for mining, industrialization, illegal timber business and agriculture. However, this trend started reversing in the late 1970s, gained momentum and later stabilized the forest area with effective government intervention, community involvement and social action. The forest cover has seen an increase in the recent years, especially since the late 1990s (Table 12).

Table 12: Forest and Mangrove Area in Odisha (km^2)

Year	1997	1999	2001	2003	2005	2007	2009	2011	2013	2015	2017	2019	2021	2023
Geog. Area							155710							
Forest Area	46941	47033	48838	48366	48374	48855	48903	50347	50460	50460	50460	51619	52156	52434
F. Area %	30.15	30.21	31.16	31.06	31.07	31.38	31.41	32.33	32.41	32.41	32.41	33.15	33.50	33.67
Mangrove	211	215	211	207	203	NA	221	222	213	231	243	251	259	259

Source: Forest Survey of India, India State of Forest Report, Various Issues

Although there is no fixed global standard for adequate mangrove coverage per km of coastline, having a 259km^2 of mangroves along a 574.71 km long coast line in Odisha can be considered inadequate, especially from the stand points of ecological

protection (from erosion, cyclones and storm surges), climate resilience, biodiversity, carbon sequestration, water quality and salinity regulation, and livelihoods.

Although 119 out of 314 blocks in Odisha have been declared as scheduled blocks constituting 44.70% of the state's geographical area as of March 2022, the Forest Rights Act is being implemented since 2005-06 and sale of land held by tribals to non-ST persons has been severely restricted, tribals have suffered remarkable land alienation due to diversion of forest land and the (concomitant) reduction in operational area held by tribals (GoO, 2024d). Substantial area of forest land has been diverted to non-forest uses such as mining, industrial projects and infrastructure development as shown in Table 13.

Table 13: Diversion of Forest Land for Non- Forest Purposes in Odisha

(as on 31.12.2024)

Under Section 2 of F(C) Act, 1980 for Development Projects		Under Section 3 (2) of Forest Rights Act 2006 for Small Development Projects		Under General Approval by State Government for Development Projects in LWE districts		Total	
No. of Projects	Area (ha.)	No. of Projects	Area (ha.)	No. of Projects	Area (ha.)	No. of Projects	Area (ha.)
627	68165.110	4545	1901.181	20	82.799	5192	70149.090

Source: PCCFO, 2025

The area of operational landholdings of the tribals in Odisha is consistently shrinking (by over 12% over a decade) despite the number of holders remaining more or less stable, suggesting significant land alienation and economic dispossession. Since most of the land losses to tribals are most likely to be in hill and forest areas, they may point to depletion of forests.

5.5.2 Marine Resource Depletion

From a long-term perspective of about four decades (1985-2023), marine fish production has increased from 0.54 LMT in 1985-86 to 2.27 LMT in 2023-24 with intermittent declines in five different years. The CAGR of marine fish production shows a fluctuating trend e.g. 4.51% during 1985-94, -0.75% during 1995-2004,-0.17% during 2005-2014, and 2.53% during 2015-2023.

Considering the current situation, the production of marine fish has nearly doubled between 2011-12 (1.14 LMT) and 2023-24 (2.27 LMT), and the CAGR of marine fish production has been estimated at 6.6% during 2019-20 to 2023-24. This growth has happened despite (i) Government of India's uniform ban on fishing in the Exclusive Economic Zone (EEZ) beyond territorial waters annually during 15 April - 14 June along the East Coast including Odisha coast since 2005 for sustaining marine fisheries, (ii) Government of Odisha's additional fishing ban for the Gahirmatha sanctuary, Devi mouth, Rushikulya mouth and Dhamara Mouth stretches every year during 1 November – 31 May for breeding and conservation of Olive Ridley turtles since 2013, and (iii) non-increase of fleet size of Mechanised Fishing Vessels since last two decades to reduce overfishing. Hence, a higher rate of marine capture (@ >2% per year) and/or liberal policy intervention would mean an early reach to the MSY level. It is, of course, another matter that Odisha bagged the "Best Marine State" award - 2020 from the Ministry of Fisheries, Animal Husbandry & Dairying, Government of India.

5.5.3 Minerals

Odisha holds a lion's share of the country's mineral reserves. The major minerals in the state, in terms of reserves and production, are bauxite, chromite, iron ore and manganese,coal and graphite (Table 14). Although production has grown, the recorded resources have also increased. The mineral situation remains unclear for the future as substantial resources are still being discovered.

Table 14: CAGR of Mineral Resources in Odisha: 2015-16 to 2024-25 (%)

CAGR	Mineral Resources					
	Bauxite	Chromite	Coal	Graphite	Iron ore	Manganese
Reserves	1.61	-0.23	1.26	1.24	1.59	-0.13
Production	2.56	-0.56	3.05	13.58	3.47	1.26

Source: Author's computation using data from Directorate of Geology, Odisha and GoO, 2025

The growing mineral resources position is indicative of significant unexplored and unexploited mineral reserves existing in the state with room for more mineral exploration, finding, and quantification. However, the increasing rate of extraction can be seen as a threat to the long-term sustainability of Odisha's rich mineral resources.

The CAG Report on abrupt and abnormal grade decline point to high quality iron ore becoming scarcer suggesting resource depletion (GoO, 2024b). Adoption of sustainable mining practices with emphasis on advanced scientific mining and limiting over extraction, mineral value addition initiatives focusing setting up of downstream industries, empowering local communities by wider mineral revenue sharing for enhancing local welfare and strengthening sectoral policy are needed for long term viability of the minerals sector.

5.5.4 Water

Odisha possesses about 11% of India's total water resources and it is considered adequate to meet the water demand by its economic sectors and domestic users.It receives 231 billion cubic metres (BCM) of rainfall. Even with a gradually reducing flow from neighbouring states through the three interstate rivers to 29.861 BCM (following flow checks like the construction of a dam in the Mahanadi River in 2015 in Chhattisgarh), the utilisable water resources (75% dependability) have been projected as 85.891BCMin 2051 (Table 15).

Table 15: Water Balance: 2001 and 2051   (BCM)

Source		Water Requirement/ Demand						Availability	Balance
	Year	Domestic	Agriculture	Industry	Environment	Others	Total		
Surface	2001	0.798	18.000	0.606	21.000	0.100	40.504	95.540	50.036
Flow	2051	1.202	40.000	1.750	21.000	0.200	64.152	85.891	21.739
Ground	2001	1.198	4.688	0.100	8.400	0.100	14.486	21.010	6.524
Water	2051	1.803	9.408	0.200	8.400	0.200	20.011	16.041	- 3.970

Source: GoO (2004, 2024a).

Note: - Environment demand has been taken as 30% for surface water and 40% of ground water.

With the current surface water flow, it is likely to create a water-scarcity like situation in 2051 as its demand is projected to increase to 64.152 BCM by then (GoO, 2004). With respect to groundwater resources, a deficit of 3.970 BCM may be predicted for 2051 with the optimistic assumption that the extractable groundwater resources of 16.041 BCM in 2024 will be maintained in 2051.

As shown in Table 16, while annual extractable groundwater resources or availability of ground water resources show year-on-year fluctuations, annual groundwater

extraction for all uses or actual use shows a consistently increasing trend. Utilisation has been steadily increasing from 7.15% in 1992 to 48.23% in 2024, although not yet at overexploitation levels (> 70%).

Table 16: Trend of Replenishable Groundwater Resource of Odisha (BCM)

Year	1992	1999	2004	2009	2011	2013	2017	2020	2022	2023	2024
AEGWR	20.00	21.01	21.01	16.69	16.69	16.69	15.57	15.71	16.34	15.93	16.04
AGWEU	1.43	3.11	3.85	4.36	4.73	5.02	6.57	6.86	7.23	7.38	7.74
%	7.15	14.79	18.31	26.14	28.33	30.07	42.18	43.65	44.25	46.33	48.23

Source: CGWB & DGWD (2024)
Notes: AEGWR= Annual Extractable Ground Water Resources or availability of ground water, AGWEU= Annual Ground Water Extraction for all Uses or actual use, % = AGWEU as % of AEGWR.

The groundwater level below the ground level (GWLGL) has fallen from 4.94 meters in 2020 to 5.47 meters in 2024 in the state. Of the 23 districts where the GWLGL has fallen significantly, the decline varied from 0.08 meter in Bolangir to 3.89 meters in Gajapati. About 80% of the recharged groundwater is extracted in the Bhubaneswar block annually and in several areas of the Smart City the groundwater level is dropping alarmingly. Table 17 depicts the water stress scenario in the state. Overall, the state's water availability condition seems comfortable in 2051.

Table 17:Per Capita Availability of Water in Districts of Odisha

(cubic meters m^3)

Scarcity (500-1000 m^3)	Stress (1000-1700 m^3)	Stress Free (>1700 m^3)
Baleshwar, Gajapati, Ganjam, Mayurbhanj, Rayagada= 5	Bargarh,Bolangir, Boudh, Cuttack, Jharsuguda, Kalahandi, Kandhamal, Khordha, Koraput, Malkangiri, Nabarangpur, Nayagarh, Nuapada, Puri, Sambalpur, Subarnapur = 16	Angul, Bhadrak, Debagarh, Dhenkanal, Jagatsinghpur, Jajpur, Kendrapara, Sundargarh = 9

Source: Author's compilation from GoO, 2025b

Sustainable Odisha: A Review of SDG Outcomes

Odisha has demonstrated notable progress in achieving the SDGs over recent years. As shown in Table 18, the state's overall score has consistently improved from 51 in 2018 to 58 in 2019, 61 in 2020 and 66 in 2023-24 elevating it from the 'Performer' to 'Front-Runner' category in 2023-24. It is also doing better than the national performance in poverty reduction (Goal-1), economic growth and decent work (Goal-8), responsible and sustainable consumption and production (Goal-12) and life on land (Goal-15).

Table 18: Odisha's SDG Index Score vis-à-vis India

Year	Serial number of Goals and Score values																Composite score	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Odisha	India
2018*	59	46	*54*	46	43	*46*	*23*	53	32	78	*34*				100	55	51	57
2019*	47	34	*61*	40	35	*85*	*50*	59	72	69	*51*	*44*	*69*	*57*	99	61	58	60
2020*	41	42	*67*	45	46	*86*	*80*	48	46	66	*70*	*73*	*70*	*82*	83	59	61	66
2023-24*	73	45	*73*	40	39	*88*	*84*	75	48	64	*74*	*85*	*64*	*70*	76	62	66	71
2023-24 **	72	52	77	61	49	89	96	68	61	65	83	78	67		75	74	71	
Percentage point improvement in Composite Score between 2018 and 2023-24																	29.41	24.56

Source: NITI Aayog SDG India Index, various years

Notes: * relates to Odisha and ** to India; bold italics indicate consistent progress while the underlined italics show improvement and then decline.

Despite progress, Odisha still carries a large burden of malnutrition and undernutrition. The percentage of pregnant women aged 15 to 49 who are anaemic increased from 47.6% to 61.8%, and the proportion of stunted children under five years rose from 29.1% to 31%. With the introduction of Women Component Plan in its budget in FY 2004–05 and launch of Gender Budget Statement in FY 2012-13, it was the first to implement gender budgeting. In 2020–21, it became the first Indian state to implement the Nutrition Budgeting. The state has a score of 40 in Quality Education (SDG 4), indicating challenges in providing quality education.

Conclusion

Odisha's recent economic trajectory presents a compelling, yet complex, narrative of economic progress and challenges. The state has achieved significant strides, marked

by a burgeoning population that provides both a demographic dividend and a growing consumer base. It has achieved robust economic growth, complemented by significant progress in food grains production ensuring food security, remarkable increase in industrial output, positioning it as a key player in the national industrial landscape, and these economic gains have translated into broad-based improvements in living standards. However, the economic surge has brought critical environmental and social costs of substantial pollution and accelerated resource depletion of its natural capital to the forefront. In the context of SDGs, Odisha has demonstrated commendable performance in certain indicators, but slow progress in reducing inequality, achieving quality health care for all and environmental sustainability. The state's future prosperity hinges on addressing these negative externalities by enhancing its ability to transition to a more inclusive and sustainable development path through integrating environmental regulations and resource management strategies into its growth agenda.

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A Note on the Functioning and Capability Approach to the Notion of Individual Well-Being

Prasanta K. Pattanaik

I am honoured and delighted to receive this award from the Odisha Economic Association. I accept it with gratitude and I thank all my colleagues in the Association for this honour. I presume that I have been given this award for my research. So, I hope that it will not be out of place if I use the time allotted to me to talk about certain problems on which I have worked in recent years. Most of my research so far has been in two areas. The first is welfare economics; I use the term, welfare economics, in a broad sense to indicate virtually the whole of normative economics. The second area includes certain types of models of individual choice and preference, which, in various ways, diverge from the frameworks conventionally used in economics; these models deal with stochastic choice, choice when preferences are vague, and choice under non-probabilistic uncertainty. In this talk, however, I shall comment on a specific conceptual development in welfare economics over the last few decades, which has come to be known as the functioning and capability approach (FCA) to the notion of individual well-being and which has its origin in some foundational contributions of Amartya Sen (1985, 1987) and Martha Nussbaum (1988, 2000).

Consider an individual who is seeking to evaluate the welfare of a society corresponding to alternative social states; for convenience, I shall call this individual E (E for evaluator of social welfare). How should she go about it? It is reasonable to propose that, in forming her social welfare judgments regarding alternative social states, E should take into account the well-being of all members of the society in the different social

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states under consideration (this, however, does not necessarily preclude the possibility of her taking into account considerations other than the well-being of the individuals in the society). But what constitutes the well-being of an individual? It is here that the FCA diverges from the dominant utilitarian tradition of conventional welfare economics.

Much of conventional welfare economics has conceived an individual's well-being as the individual's utility. An individual's utility is typically interpreted either as the individual's happiness or as the satisfaction of her desires or preferences. In particular, the preference-satisfaction view of individual well-being is widely accepted in modern welfare economics. Many thinkers, including Aristotle and the Buddha, have not subscribed to this exclusive focus on happiness or preference satisfaction as the sole index of an individual's well-being. Aristotle had a much richer conception of well-being in terms of what he called 'eudaimonia' which is sometimes translated into English as "flourishing life". The Buddha distinguished between two kinds of happiness: the kind of happiness the pursuit of which leads to increase in 'wholesome factors' and decrease in 'unwholesome factors', and the kind of happiness the pursuit of which has exactly the opposite result. Obviously, he did not regard the latter type of happiness as contributing to an individual's well-being. Many social scientists and philosophers of our time have been critical of the conception of an individual's well-being as her utility. I would not go into all their reasons, but I would like to mention one of them.

One reason for rejecting the preference-satisfaction view of individual well-being, which has often come up in the literature, involves the so called "sour-grape" phenomenon noted by social scientists and psychologists. It has been observed that people, who have been socially discriminated against for a long time and whose aspirations for a better life have been always thwarted, often decide to lower their aspirations and learn to live a contented life with whatever little they have. It has been argued that,when people stifle their own aspirations in this fashion and learn to live a fairly contented life despite physical deprivations such as malnutrition, lack of adequate housing and medical facilities, one can hardly take their contentment to be an indication that they have a reasonable level of well-being. Similar reasoning can also be used against the conception of human well-being as happiness. The functioning and capability approach argues for a very different conception of individual well-being. It argues that, in assessing the well-being of people, one needs to consider the features or aspects of life that people value positively. People value being well

nourished, being in good health, being protected from the elements, having interaction with their friends and relatives, participating in the public life of their communities, and so on. These valued attributes[1] or dimensions of life are what Sen (1985,1987) calls functionings. In the FCA, the well-being of an individual is simply the value attached to the vector or bundle of the positively valued attributes that the individual achieves. It is here that difficult issues arise.

First, the set of attributes that people value positively may vary between individuals or groups of individuals in the same society. It is not clear why E should necessarily use the same set of valued attributes to assess the well-being of all individuals in a society. If we confine ourselves to what Maslow (1943, 1971) called the physiological needs of human beings, the positively valued attributes (e.g. being well nourished, having adequate housing, being in good health, etc.) relating to those needs are likely to be the same for all people in a society. However, when we go beyond people's physiological needs, the list of positively valued attributes can be significantly different for different individuals in a society. How should E proceed if some people highly value living a strictly religious life while some others in the society attach a negative value to such a life? Similarly, participation in the life of one's community may be highly valued by some individuals, but some other individuals in the society may value living a quiet and reclusive life. Such diversity of values among individuals raises difficult questions in the FCA, and it is not clear that, if E decides to use some democratic voting procedure to choose a single set of positively valued attributes,with reference to which she would evaluate the well-being of every individual in the society, that would provide a very satisfactory response to those questions. Nor does the problem of diversity of values among individuals in a society end once E has somehow found a single set of valued attributes to be used to evaluate the well-being of every individual in the society. E has to confront similar issues again in the next step of the process of assessing the well-being of individuals. I now come to this problem.

In the rest of this note, let me make the admittedly implausible assumption that the set of positively valued attributes is the same for all individuals in the society. This would not end E's problems which arise from the diversity of values among individuals in the society. Even if the set of positively valued attributes happens to be the same for all individuals in a society, the individuals may attach different relative importance to the

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[1] For convenience, in what follows, I shall use interchangeably the terms, 'positively valued attributes' and 'valued attributes'.

different positively valued attributes. In that case, we may find that the overall value that some individuals attach to an attribute bundle, *x*, is higher than the overall value that they attach to another attribute bundle, *y*, but some other individuals may attach a higher overall value to the attribute bundle *y* than to the attribute bundle *x*. Given such divergence, how does E, the evaluator of social welfare, compare the well-being of an individual of the former type and the well-being of an individual of the latter type when such interpersonal comparisons are necessary for E's social welfare evaluation of alternative social states? Note that, utilitarians also face a similar issue. But life is easier for them in some ways. As Sen rightly observes, the notions of happiness and preference satisfaction have descriptive content and that descriptive content allows us to compare the happiness (resp. preference satisfaction) of one person with the happiness (resp. preference satisfaction) of another person. In fact, psychologists often make such interpersonal comparisons in studying the happiness or preference satisfaction of different people. The notion of the overall value that a person attaches to an attribute bundle does not have any such descriptive content. At the present state of our knowledge, we do not know how to compare the overall value that one person attaches to an attribute bundle, with the overall value that another person attaches to an attribute bundle. What can be done to overcome this problem? Given this problem, it has been suggested[2] that, when the set of positively valued attributes is the same for all individuals in the society but the individuals' rankings of alternative attribute bundles in terms of their own respective well-being differ, E can at least use the following plausible domination-based criterion to make interpersonal comparisons of the well-being of different individuals in certain circumstances.

Assumption 1. For all individuals, *A* and *B*, and all attribute bundles *x* and *y*, if the bundle *x* has more of some attributes and no less of any other attribute as compared to the bundle *y*, then E should consider *A*'s well-being from *x* to be higher than *B*'s well-being from *y*.

The intuition of Assumption 1 seems to be this. If the attribute bundle *x* has more of some valued attribute and no less of any valued attribute as compared to *y*, then *x* is an unambiguously bigger attribute bundle than *y*. In that case, there does not seem to be any intuitive reason why any difference that may be there between the relative importance that *A* attaches to the different attributes and the relative importance that *B* attaches to those attributes should matter in comparing *A*'s well-being from *x* and

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[2] See Sen (1987).

B's well-being from *y*. It would then seem plausible to say that anybody with the bigger bundle, *x,* has a higher level of well-being than anybody having the smaller bundle, *y,*. It can, however, be shown that Assumption 1, together with some other highly plausible assumptions that I shall introduce presently, leads us to a contradiction.

We observe much diversity of values among individual in most real-world societies. The following assumption postulates that, when assessing the well-being of individuals in the presence of such diversity, E should seek to accommodate such diversity at least in a minimal fashion.

Assumption 2. There exist at least two individuals, *A* and *B*, and at least two different attribute bundles *x* and *y* such that E considers *A*'s well-being from *x* to be higher than *A*'s well-being from *y* and *B*'s well-being from *y* to be higher than *B*'s well-being from *x*.

My next assumption is the counterpart of the standard continuity assumption widely used in the theory of consumers' behavior.

Assumption 3. Consider any individual and any two attribute bundles *x* and *y* such that E considers *A*'s well-being from *x* to be higher than *A*'s well-being from *y*. Then, for every attribute bundle z, if z is arbitrarily close to *x*, then E considers *A*'s well-being from z to be higher than *A*'s well-being from *y*. Also, for every attribute bundle *w*, if *w* is arbitrarily close to *y*, then E considers *A*'s well-being from *x* to be higher than *A*'s well-being from *w*.

I need to consider one more assumption. The assumption has two parts. The first part is rather trivial (though technically necessary) and the second part is a consistency requirement for E's assessment of the well-being of individuals from different attribute bundles.

Assumption 4. (i) For every individual *A* and every attribute bundle *x*, E considers *A*'s well-being from *x* to be at least as high as *A*'s well-being from *x*.

(ii) For all individuals, *A*, *B* and *C*, and for all attribute bundles *x*, *y* and z, if E considers *A*'s well-being from *x* to be higher than *B*'s well-being from *y* and *B*'s well-being from *y* to be higher than *C*'s well-being from z, then E must consider *A*'s well-being from *x* to be higher than *C*'s well-being from z.

Each of Assumptions 1, 2, 3 and 4, by itself, seems reasonable. One can, however, prove that there is no way in which E can satisfy all those four assumptions simultaneously (see Pattanaik and Xu, 2007). Given this result, one can also prove a similar negative result regarding the assessment of well-being differences of different individuals if we make certain weak assumptions linking comparisons of individual well-being differences to comparisons of individual well-being levels.[3] These results highlight some as yet unresolved conceptual problems in the FCA when, as can be expected, there is diversity of values among the individuals in the society. There is, however, one moderately bright spot in the midst of the gloom generated by the cluster of such negative results. It is possible to show that, if we weaken Assumption 1 by limiting the scope of interpersonal comparisons of individual well-being to comparisons between individuals, whose achievements are uniformly high for all attributes, and individuals, whose achievements are uniformly low for all attributes, then the weakened version of Assumption 1 and Assumptions 2, 3 and 4, together, do not necessarily run into a contradiction[4]. More research is necessary to see whether one can make further headway following such routes.

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[3] For a detailed discussion of many such negative results with alternative assumptions, see Pattanaik and Xu (2024).

[4] See Pattanaik and Xu (2024, Chapter 3).

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Paradigm Shift in Employment Pattern and Labor Market in Odisha: A Regional Analysis

Priyabrata Sahoo
Kalandi Charan Pradhan
Vinay Kumar

Abstract

The study examines shifts in employment patterns in rural and urban Odisha, India, over the past twenty years, utilizing data from the Employment Unemployment Survey (2004-05 and 2011-12) and the Periodic Labour Force Survey (2021-22). The study demonstrates that employment opportunities trend has diversified into construction, wholesale/retail trade, transport, education, and other sectors over the period. The coastal region of the state remains the most diversified and dominant economic center, while the southern region has shown signs of recovery in various emerging economic sectors in recent years. However, it is found that, in terms of quality of employment, rural areas rely more on self-employment in agriculture, while non-agricultural employment is declining. However, urban areas witness fluctuating agricultural self-employment and rising non-agricultural self-employment.

Keywords: Employment, Labor market dynamics, Labor force participation, Quality of employment, Regions of Odisha

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Introduction

The labor market plays a central role in the development process by providing stable employment, which serves as a sustainable pathway out of poverty and supports inclusive economic growth (Cazes & Verick, 2013). In India, particularly in rural areas, the labor market underwent significant transformations during the 2000s, characterized by a rapid structural shift from agricultural to non-agricultural employment. Evidence from the National Sample Survey Office (NSSO) indicates an unprecedented decline in labor force participation between 1999–2000 and 2011–12, driven largely by a sharp fall in female labor force participation. This decline has been attributed to structural transformation within the Indian economy, whereby rising household incomes and improved living standards in rural areas generated adverse income effects that reduced women's participation in the labor market.

Despite these structural changes, a growing body of literature highlights a worrying slowdown in the Indian economy's capacity to generate employment. Studies by Himanshu (2011), Abraham (2013), Chand and Srivastava (2014), Ghose (2016), Mehrotra and Parida (2017), and Kannan and Raveendran (2019) collectively document a persistent decline in employment absorption, particularly during the period from 2011–12 to 2017–18. This phase has been widely recognized as one marked by simultaneous job creation and job destruction, reflecting increasing labor market volatility. Importantly, these dynamics are not confined to the national level but are equally pronounced across sub-national and regional contexts in India.

Odisha, a predominantly agrarian state in eastern India, presents a particularly compelling case. The state ranks among the poorest in the country, trailing only states such as Chhattisgarh, Jharkhand, Manipur, Arunachal Pradesh, and Bihar. Mondal et al. (2023) further identify Odisha as one of the most deprived states in India, ranking poorly in terms of basic amenities as well as social and material deprivation. Labor migration from Odisha to relatively high-income states such as Gujarat, Tamil Nadu, Maharashtra, and Andhra Pradesh—is widespread, with migrants largely absorbed into informal and low-paid employment (Sahoo et al., 2025; Saha & Roychowdhury, 2021). Gender disparities further characterize the labor market, as women consistently receive lower wages than men for comparable agricultural work (Das et al., 2021). The gender wage gap in rural Odisha increased from 34.4% in 2019–20 to 38.9% in 2020–21, mirroring trends observed across rural India (Bajpai, 2023). Paradoxically,

this widening gap coexists with an expanding female agricultural workforce, while Odisha continues to record the lowest agricultural wage rates for both men and women (Swain et al., 2018).

Odisha's labour market transition broadly reflects national trends. Both Odisha and India experienced rising unemployment rates for men and women between 1972 and 2011 *(Odisha Economic Survey, 2011–12)*. Although Odisha historically maintained a higher worker population ratio (WPR) than the national average, WPR and labor force participation rates declined for both sexes, with a sharper fall among women (Swain et al., 2018). The period between 1999–2000 and 2004–05 witnessed a contraction in casual labor alongside a modest rise in regular employment, indicating a reconfiguration of employment structures (Behera, 2016). Meanwhile, limited employment generation in agriculture and declining employment in manufacturing intensified seasonal migration and agrarian distress (Padhi & Panda, 2021).

Between 2004–05 and 2011–12, nearly one million workers transitioned from agriculture to construction and services in Odisha, while employment in manufacturing continued to decline (Behera, 2016; Thomas & Jayesh, 2016; Pattayat & Parida, 2017). These shifts pose significant challenges for youth employment and long-term economic development.

Against this backdrop, the present study examines changes in rural and urban labor markets in Odisha, with particular emphasis on employment patterns, job quality, and living conditions. It also explores the multiple economic and social factors shaping labor market outcomes in the state. The paper is organized as follows: Section 2 describes the data sources and methodology; Section 3 analyzes employment patterns; Section 4 assesses the quality of employment across regions; and Section 5 concludes.

Data and Methods

The study relies on secondary data from the NSSO Employment–Unemployment Surveys (2004–05 and 2011–12) and the Periodic Labour Force Survey (PLFS) 2021–22. The analysis primarily focuses on PLFS 2021–22, the most recent dataset available with comprehensive gender- and sector-wise disaggregated estimates at the time of the study. To ensure comparability across survey rounds, major economic activities

are analyzed using the one-digit NIC-2004 classification. Key labor market indicators - unemployment rate, labor force participation rate, and workforce participation rate are derived from usual principal and subsidiary activity status. For regional analysis, Odisha is classified into Coastal, Northern, and Southern regions following NSS classifications.

Figure 1: Location Map of Study Region

NSS Regions of Odisha
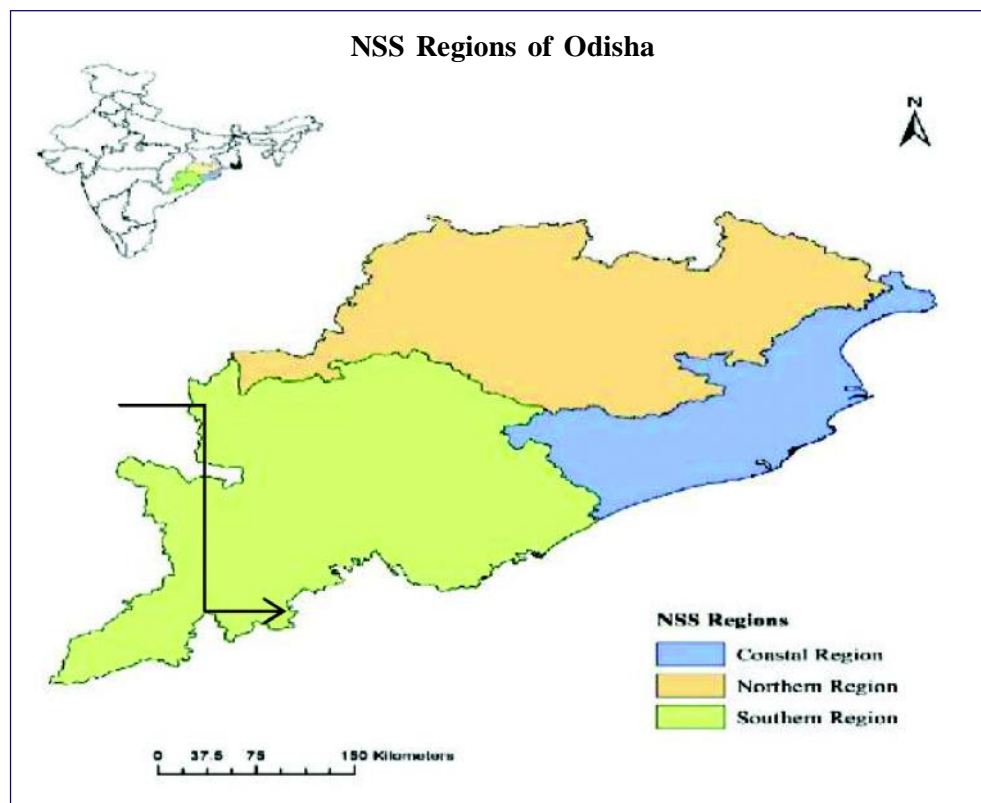
Results and Discussions

Employment Pattern in Odisha

To explore how employment pattern has changed in rural and urban Odisha from 2004-05 to 2021-22, the present section considers different aspects like proportion of workers engaged in different activities, gender wise trend of economic activity, region wise trend in employment in Odisha, trend in LFPR (Labor Force Participation Rate), WFPR (Work Force Participation Rate), and UR (Unemployment Rate).

Table 1: Employment Pattern in Odisha (LFPR, WFPR, and UR)

Odisha	Total			Rural			Urban		
	2004-05	2011-12	2021-22	2004-05	2011-12	2021-22	2004-05	2011-12	2021-22
UR	5.95	2.38	6.02	5.01	2.20	5.35	13.38	3.53	10.48
UR	5.95	2.38	6.02	5.01	2.20	5.35	13.38	3.53	10.48
LFPR	46.40	42.20	42.10	47.60	42.70	42.60	38.60	39.50	39.00
WFPR	43.60	41.20	39.50	45.20	41.70	40.30	33.40	38.10	34.90
India		Total			Rural			Urban	
UR	2.31	2.19	4.05	1.67	1.73	3.25	4.49	3.45	6.27
LFPR	43.00	39.50	41.30	44.60	40.60	42.20	38.20	36.70	39.00
WFPR	42.00	38.60	39.60	43.90	39.90	40.80	36.50	35.50	36.60

Source: Authors' estimation based on EUS 61st, 68th and PLFS 2021-22 round unit level data
Note: LFPR, WFPR, and UR indicate Labor Force Participation Rate (LFPR), Workforce Participation Rate (WFPR), and Unemployment Rate (UR)

Table 1 highlights pronounced rural–urban disparities in labor market indicators in Odisha, particularly in labor force participation rate (LFPR) and unemployment rate (UR). Urban areas consistently record lower LFPRs and substantially higher URs than rural areas. Overall LFPR declined from 46.4% in 2004–05 to 42.1% in 2021–22, while workforce participation rate (WFPR) fell from 43.6% to 39.5% during the same period. The decline in WFPR was especially marked in rural Odisha, decreasing from 45.2% to 40.3%. Throughout the period, urban WFPR remained lower than rural WFPR, indicating weaker workforce engagement in urban areas. In contrast, urban UR, though fluctuating, remained consistently higher than rural UR, reflecting greater joblessness among urban residents. These patterns highlight the complex interplay between economic and socio-cultural factors shaping labor market outcomes. Beyond job availability and sectoral composition, labor force participation and employment are influenced by gender norms, social stratification, migration, and household responsibilities. Existing studies emphasize that such socio-cultural constraints disproportionately affect women and marginalized groups, thereby reinforcing observed rural–urban labor market inequalities (Klasen & Pieters, 2015; Chatterjee & Vanneman, 2022). A comparable rural–urban divide is evident at the national level. India's LFPR declined from 43.0% in 2004–05 to 41.3% in 2021–22,

with rural participation consistently exceeding urban levels. WFPR also fell from 42.0% to 39.6%, again with lower rates in urban areas. Although the rise in urban UR has been slower than in rural areas, this may reflect both relatively greater economic diversification in cities and persistent challenges in generating adequate employment for a growing urban workforce.

Gender-wise Pattern

Employment patterns in Odisha between 2004–05 and 2021–22 reveal persistent gender disparities and marked rural–urban contrasts (Table 2). In rural Odisha, unemployment rates initially declined for men and women between 2004–05 and 2011–12 but rose sharply by 2021–22, indicating growing employment stress in recent years. Male rural UR increased to 6.41% in 2021–22, while female UR rose to 2.99%, reflecting limited resilience of rural labor markets. Rural LFPR show a modest decline for men but a pronounced and continuous decline for women, falling from 35.1% to 26.36%. Correspondingly, WPR remained relatively stable for rural men but declined substantially for rural women, reinforcing enduring gender gaps in rural employment.

Table 2: Gender-wise Employment Pattern Within Rural and Urban Areas in Odisha

	Rural						Urban					
	Male			Female			Male			Female		
	2004 -05	2011 -12	2021 -22	2004 -05	2011 -12	2021 -22	2004 -05	2011 -12	2021 -22	2004 -05	2011 -12	2021 -22
Odisha												
UR	3.06	2.3	6.41	8.31	1.96	2.99	8.97	3.88	8.57	26.59	2.00	17.13
LFPR	60.42	60.59	58.68	35.1	25.07	26.36	55.32	60.30	59.30	20.20	15.84	17.81
WFPR	58.57	59.2	54.92	32.18	24.58	25.57	50.36	57.96	54.22	14.83	15.52	14.76
India												
UR	1.60	1.75	3.77	1.79	1.68	2.13	3.81	3.00	5.79	6.88	5.24	7.85
LFPR	55.52	55.32	56.86	33.31	25.26	27.17	57.02	56.33	58.33	17.82	15.48	18.76
WFPR	54.63	54.35	54.71	32.71	24.83	26.59	54.85	54.64	54.95	16.59	14.67	17.29

Source: Authors' estimation based on EUS 61st, 68th and PLFS 2021-22 round unit level data

Urban labor markets exhibit a different but equally unequal pattern. Urban male UR

remained relatively high and stable, while female UR, though declining from extremely high levels, continued to exceed male unemployment by a wide margin. Urban male LFPR increased slightly over time, whereas female LFPR declined further, remaining below 20%. Workforce participation among urban men improved modestly, but urban female WPR stagnated at very low levels.

Types of Economic Sctivity in Rural and Urban Odisha

Figure 2 depicts the changing structure of economic activities in Odisha during 2004–05, 2011–12, and 2021–22, highlighting a clear shift away from agriculture toward non-farm sectors. Although agriculture and fishing have historically dominated the state's workforce, their share declined substantially over time. At the aggregate level, the proportion of workers engaged in agriculture and fishing fell from 63.32% in 2004–05 to 45.6% in 2021–22. In contrast, construction and wholesale/retail trade expanded markedly. Employment in construction increased from 6.01% to 18.01%, while engagement in wholesale and retail trade rose from 7.35% to 10.47% during the same period.

In rural Odisha, agriculture and fishing remained the primary source of employment but experienced a sharp contraction, declining from 69.04% in 2004–05 to 51.04% in 2021–22. Manufacturing employment in rural areas fell from 11.08% to 6.59%, indicating limited industrial absorption. Conversely, construction emerged as the most dynamic sector, with rural employment increasing from 5.49% to 18.32%, reflecting infrastructure expansion and non-farm livelihood diversification. Wholesale and retail trade also gained importance, rising from 5.81% to 9.16%, alongside modest growth in public administration and education.

Figure 2: Types of Economic Activity in Rural and Urban Odisha
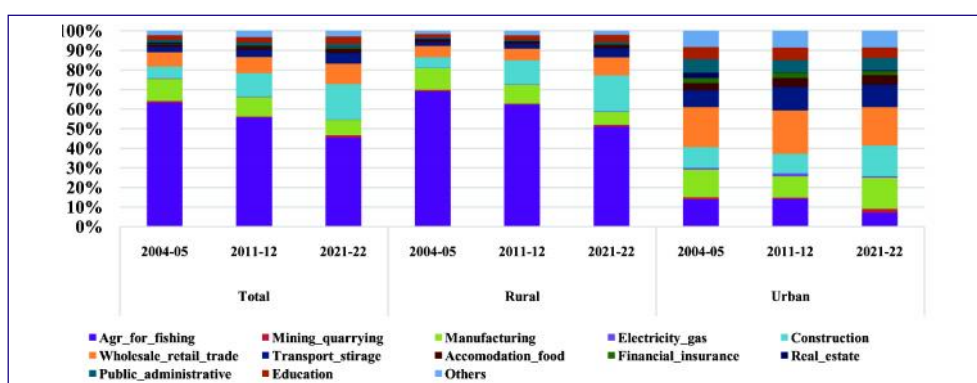
Source: Authors' estimation based on EUS 61st, 68th and PLFS 2021-22 round unit level data

Urban employment patterns display greater sectoral diversification. The share of urban workers in agriculture and fishing declined from 13.92% in 2004–05 to 7.12% in 2021–22. Manufacturing employment increased overall despite interim fluctuations, while construction expanded steadily from 10.48% to 15.81%. Wholesale and retail trade remained a major urban employer, though its share declined slightly in recent years. Employment in transport and storage increased consistently, whereas real estate activities contracted sharply after 2004–05. Overall, these trends reflect an on-going structural transformation in Odisha's rural and urban economies, characterized by declining agricultural dependence and rising non-farm employment.

Gender-wise Trend of Employment in Rural Odisha

Table 3 reveals significant shifts in the gendered structure of rural employment in Odisha between 2004–05 and 2021–22, reflecting gradual rural transformation alongside persistent sectoral rigidities. Agriculture, forestry, and fishing, traditionally the backbone of rural employment, accounted for 69.04% of total rural employment in 2004–05 but declined steadily to 51.04% by 2021–22. Despite this decline, more than half of the rural workforce remains dependent on agriculture, highlighting its continued dominance amid low productivity and income vulnerability.

Construction has emerged as the most dynamic non-farm sector, with employment rising sharply from 5.49% to 18.32% over the study period. This expansion points to growing informalization and distress-driven employment, particularly in low-skilled rural labour markets. Wholesale and retail trade and transport and storage also expanded moderately, indicating a gradual shift toward service-oriented activities. In contrast, manufacturing employment declined from 11.08% to 6.59%, signaling stagnation or deindustrialization in rural areas. Other sectors, including education and public administration, showed modest growth, while mining, accommodation, and financial services remained marginal.

Table 3: Gender-wise Trend of Employment in Rural Odisha

Rural Odisha	Male			Female			Total		
Activity	2004-05	2011-12	2021-22	2004-05	2011-12	2021-22	2004-05	2011-12	2021-22
Agriculture for fishing	65.93	59.26	43.23	74.59	69.31	67.94	69.04	62.25	51.04

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Mining quarrying	0.82	0.42	1.23	0.65	0.69	0.43	0.76	0.50	0.97
Manufac-turing	9.00	8.00	5.00	16.00	15.00	10.00	11.08	9.61	6.59
Electricity gas	0.23	0.31	0.35	0.00	0.00	0.05	0.15	0.21	0.26
Constru-ction	6.69	14.23	22.71	3.35	7.77	8.83	5.49	12.31	18.32
Wholesale retail trade	8.06	7.62	11.51	1.79	2.07	4.08	5.81	5.97	9.16
Transport strigae	3.03	3.24	7.06	0.14	0.57	0.09	2.00	2.45	4.86
Accommo-dation food	1.02	1.48	1.91	0.75	0.26	0.72	0.92	1.12	1.54
Financial insurance	0.28	0.31	0.52	0.00	0.01	0.01	0.18	0.22	0.36
Real estate	0.36	0.02	0.03	0.00	0.00	0.00	0.23	0.01	0.02
Public adminis-trative	1.02	1.01	1.53	0.29	0.12	0.26	0.76	0.74	1.12
Education	2.17	2.11	2.33	1.70	2.49	6.28	2.00	2.22	3.58
Others	1.87	2.45	2.48	1.08	2.21	1.50	1.58	2.38	2.17

Source: Authors' estimation based on EUS 61st, 68th and PLFS 2021-22 round unit level data

Gender-wise patterns reveal notable disparities. Male employment in agriculture declined sharply from 65.93% to 43.23%, while female participation fell more gradually from 74.59% to 67.94%, underscoring women's continued concentration in agriculture. Manufacturing employment declined for both genders, from 9% to 5% for men and from 16% to 10% for women. Construction absorbed an increasing share of both male and female workers, with male participation rising to 22.71% and female participation to 8.83% by 2021–22. Employment in wholesale and retail trade increased for both genders, while real estate activities remained negligible, especially for women. Notably, female employment in education increased substantially, reaching 6.28% in 2021–22, reflecting expanding opportunities for women in social sector services.

Gender-wise Trend of Employment in Urban Odisha

Table 4 presents sectoral and gender-wise employment trends in urban Odisha from

2004–05 to 2021–22, reflecting structural shifts driven by urbanization and economic transformation. Employment in agriculture, forestry, and fishing declined sharply from 13.92% in 2004–05 to 7.12% in 2021–22, indicating a gradual disengagement of urban livelihoods from primary-sector activities. Manufacturing employment, after declining in 2011–12, rebounded strongly to 15.92% by 2021–22, suggesting renewed growth of small-scale and informal industrial activities alongside expanding urban infrastructure. Construction also emerged as a major employment generator, increasing from 10.48% to 15.81%, reflecting intensified urban development. In contrast, employment in utilities such as electricity, gas, and water supply declined, pointing to limited job creation in formal public sectors. Wholesale and retail trade remained a key employer, though its share declined slightly in recent years, possibly due to the expansion of organized retail and digital platforms. Transport and storage expanded steadily, while accommodation, food services, and financial activities recorded modest growth. Employment in education showed a marginal decline, indicating limited expansion in public and institutional employment.

Table 4: Gender-wise Trend of Employment in Urban Odisha

Urban Odisha	Male			Female			Total		
Activity	2004-05	2011-12	2021-22	2004-05	2011-12	2021-22	2004-05	2011-12	2021-22
Agriculture for fishing	10.08	12.07	5.26	28.23	22.73	14.26	13.92	14.1	7.12
Mining quarrying	1.12	1.03	2.25	0.71	0.00	0.85	1.04	0.84	1.96
Manufacturing	15.00	9.00	16.00	8.92	16.00	16.00	14.01	10.64	15.92
Electricity gas	1.34	1.94	0.79	0.27	0.27	0.00	1.11	1.62	0.63
Construction	10.85	9.92	16.06	9.08	10.36	14.83	10.48	10.01	15.81
Wholesale retail trade	24.13	23.33	20.62	7.57	16.73	16.13	20.62	22.07	19.69
Transport strigae	10.85	14.59	13.98	0.16	1.27	1.04	8.58	12.05	11.31
Accommodation food	3.64	4.38	5.76	2.44	5.29	2.20	3.39	4.55	5.02

Financial insurance	2.29	3.29	2.24	4.34	0.93	1.57	2.72	2.84	2.1
Real estate	3.27	0.28	0.36	0.63	0.00	0.00	2.71	0.23	0.28
Public adm-instrative	7.72	7.18	6.97	3.88	0.95	3.33	6.91	5.99	6.22
Education	3.62	4.61	3.44	15.96	14.42	13.32	6.23	6.48	5.48
Others	5.71	8.09	6.47	17.81	10.68	16.12	8.27	8.59	8.46

Source: Authors' estimation based on EUS 61[st,] 68th and PLFS 2021-22 round unit level data

Gender-wise trends reveal distinct patterns. Male participation in agriculture declined markedly after 2011–12, while female participation fell sharply over the entire period, highlighting women's faster withdrawal from urban primary-sector employment. Manufacturing and construction absorbed a growing share of male workers, with increasing female participation in construction as well. Wholesale and retail trade remained male-dominated, but female participation rose significantly by 2021–22. Both male and female employment increased in education and accommodation services, reflecting expanding service-sector opportunities. Female participation in public administration and education also improved, indicating gradual shifts in gender roles within urban formal employment. Overall, urban Odisha's labor market shows increasing sectoral diversification, accompanied by evolving but still uneven gender integration across economic activities.

3.6. Region-wise Trend in Employment in Odisha

Table 5 highlights pronounced regional disparities in employment structure across Odisha's coastal, southern, and northern regions between 2004–05 and 2021–22, reflecting uneven patterns of structural transformation. Agriculture and fishing, traditionally dominant across all regions, experienced a substantial decline. The coastal region witnessed the sharpest contraction, with employment in agriculture falling from 58.97% to 36.43%, indicating rapid diversification away from primary activities. The southern region also remained heavily agrarian, though its agricultural workforce declined more gradually from 73.47% to 62.69%. In contrast, the northern region, which had relatively lower dependence on agriculture, experienced a decline from 62.61% to 43.94%, suggesting faster structural change compared to the south.

Table 5: Region-wise Trend in Employment in Odisha

Activity	Coastal			Southern			Northern		
	2004 -05	2011 -12	2021 -22	2004 -05	2011 -12	2021 -22	2004 -05	2011 -12	2021 -22
Agriculture & fishing	58.97	51.91	36.43	73.47	61.64	62.69	62.61	57.34	43.94
Mining & quarrying	0.24	0.38	0.67	0.07	0.02	1.72	1.70	0.94	1.12
Manufac- turing	10.09	8.21	7.47	6.31	4.08	4.83	15.26	13.65	9.86
Electricity & gas	0.28	0.50	0.36	0.15	0.43	0.15	0.26	0.30	0.34
Constru- ction	6.64	12.33	18.41	7.04	16.72	15.75	4.86	9.75	19.04
Wholesale & retail trade	10.06	10.54	14.98	6.33	6.73	5.03	5.11	6.20	9.41
Transport & storage	3.29	4.50	6.09	1.49	2.87	3.46	2.66	3.31	6.61
Accommo- dation & food	1.81	1.62	2.86	0.69	1.40	0.38	0.78	1.62	2.08
Financial insurance	0.81	0.72	0.98	0.08	0.07	0.17	0.25	0.63	0.42
Real estate	0.59	0.09	0.12	0.17	0.00	0.00	0.55	0.00	0.02
Public admi- nistrative	1.60	1.39	2.61	1.20	1.21	0.81	1.29	1.63	1.50
Education	2.88	3.72	4.39	1.84	1.98	3.43	2.30	2.15	3.49
Others	2.74	4.07	4.62	1.16	2.83	1.58	2.37	2.48	2.15

Source: Authors' estimation based on EUS 61[st,] 68th and PLFS 2021-22 round unit level data

Mining and quarrying showed modest expansion in the coastal and northern regions, reflecting the concentration of mineral resources and extractive activities, while remaining marginal in the southern region. Manufacturing employment declined across all regions, signaling limited industrial absorption. The coastal region's manufacturing share fell from 10.09% to 7.47%, while the southern region recorded persistently low participation. Although the northern region maintained the highest manufacturing share,

it declined sharply from 15.26% to 9.86%, indicating stagnation or relocation of industrial activity. Construction emerged as the most dynamic sector across regions, underscoring its role as a key employment absorber amid limited growth in productive sectors. The coastal region's construction employment rose from 6.64% to 18.41%, while the southern region experienced rapid expansion until 2011–12 before stabilizing. The northern region recorded the fastest growth, increasing from 4.86% to 19.04% by 2021–22, reflecting large-scale infrastructure investments and urban expansion. However, the dominance of construction also points to increasing informalization and vulnerability in regional labor markets. Wholesale and retail trade remained most prominent in the coastal region but showed recent stagnation. The northern region experienced steady growth in this sector, while the southern region recorded a decline by 2021–22. Transport and storage expanded across all regions, with the strongest growth in the northern region, reflecting rising mobility and logistics demand. Accommodation and food services grew modestly across regions, driven by tourism and urban consumption. Social and service sectors also expanded unevenly. Public administration employment increased in the coastal and southern regions but remained relatively stagnant in the north. Education employment rose steadily across all regions, with the coastal region maintaining the highest share, reflecting better institutional infrastructure and growing emphasis on human capital. Overall, the findings reveal regionally differentiated labor market trajectories in Odisha, characterized by declining agricultural dependence, limited industrialization, and increasing reliance on construction and service-sector employment.

Quality of Employment

4.1. Trends in Quality of Employment in Rural Odisha

Figure 3 highlights significant shifts in the composition and quality of rural employment in Odisha from 2004–05 to 2021–22, revealing structural transformation alongside persistent informality and gender disparities. Self-employment in agriculture, historically the dominant form of work, accounted for 33.41% of rural employment in 2004–05, increased modestly to 37.19% in 2011–12, and declined to 34.42% in 2021–22. Self-employment in non-agricultural sectors remained relatively stable, rising slightly from 20.1% to 21.51% over the same period. Notably, casual labor in agriculture witnessed a steep decline from 27.2% to 4.22%, while casual labor in non-agricultural activities increased from 9.82% to 21.51%, signaling a shift toward informal employment in emerging sectors such as construction, trade, and services. The "Others" category also grew from 12.12% in 2011–12 to 18.34% in 2021–22, reflecting diversification into less traditional, often precarious occupations.

Figure 3: Trends in Quality of Employment in Rural Odisha
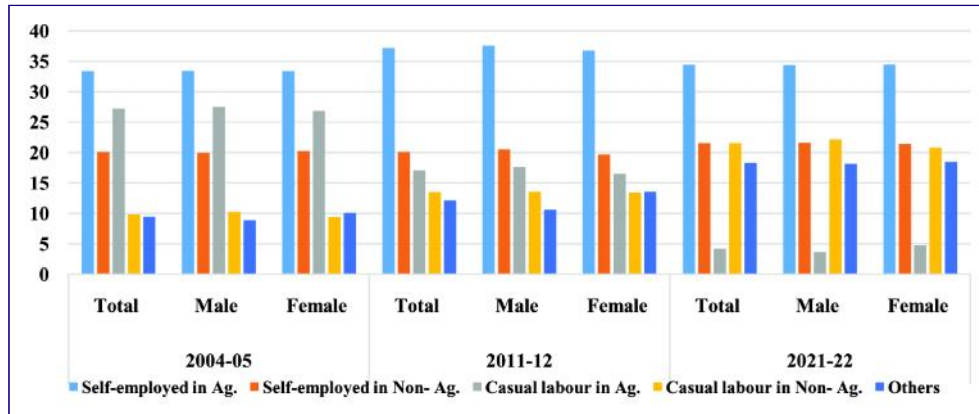
Source: Authors' estimation based on EUS 61st, 68th and PLFS 2021-22 round unit level data

Gender-wise analysis indicates nuanced differences in employment patterns. In 2004–05, males and females had comparable levels of agricultural self-employment (33.43% and 33.38%), while females had a slightly higher share in non-agricultural self-employment (20.25% vs. 19.95%). Casual agricultural labor involved both genders extensively, with males slightly higher in non-agricultural casual work (10.2% vs. 9.44%). By 2011–12, males dominated both agricultural (37.62%) and non-agricultural self-employment (20.52%), though females remained significant in casual labor and the "Others" category, reflecting persistent gendered segmentation of employment opportunities.

By 2021–22, self-employment in agriculture remained comparable between males (34.37%) and females (34.48%), while non-agricultural self-employment was also nearly equal (21.63% and 21.39%). Females exhibited higher participation in casual agricultural labor (4.79% vs. 3.65%), whereas males dominated non-agricultural casual labor (22.17% vs. 20.84%). These patterns underscore the enduring prominence of informal, insecure work in rural Odisha, particularly in non-agricultural sectors, despite modest structural shifts.

4.2. Trends in Quality of Employment in Urban Odisha

Figure 4 highlights evolving patterns and gender disparities in urban employment in Odisha from 2004–05 to 2021–22. Self-employment accounted for nearly 40% of urban employment in 2004–05, slightly higher among males (40.3%) than females

(39.41%). The share of self-employment increased to 46.69% in 2011–12 but declined to 39.1% in 2021–22, with females (39.91%) slightly exceeding males (38.31%). This shift reflects urban industrialization, service sector expansion, and changing economic structures, with women increasingly participating in informal, often home-based or small-scale self-employment activities influenced by socio-cultural norms.

Figure 4: Trends in Quality of Employment in Urban Odisha
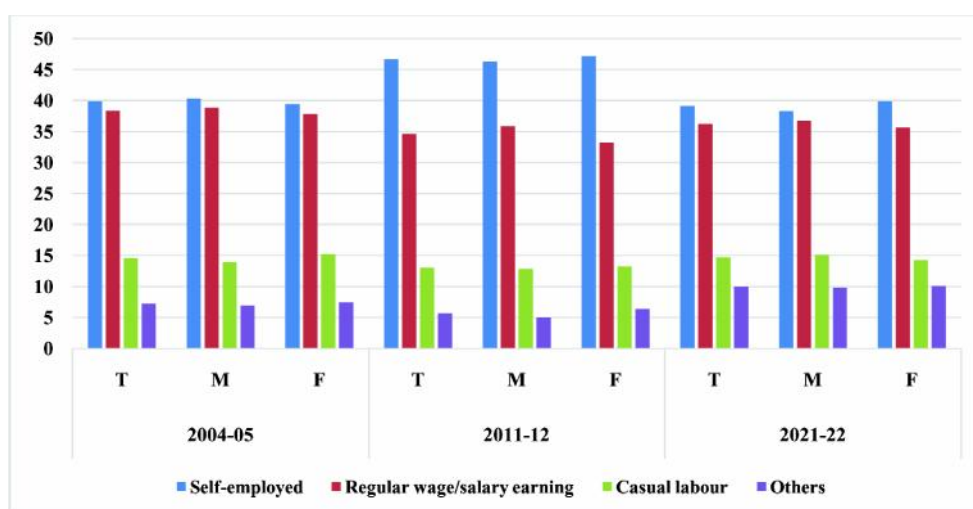
Source: Authors' estimation from EUS 61st, 68th and PLFS 2021-22 round unit level data

Regular salaried employment, indicative of more formal and stable work, engaged 38.36% of the urban workforce in 2004–05, with males slightly ahead (38.82%) of females (37.86%). Participation declined to 34.65% in 2011–12 but rose to 36.22% in 2021–22, with males (36.73%) maintaining a higher share than females (35.68%). This trend suggests gradual expansion of formal wage employment, though gender gaps persist, particularly in access to secure jobs.

Casual labour, reflecting informal and precarious employment, accounted for 14.57% of urban workers in 2004–05, higher among females (15.25%) than males (13.95%). After a brief decline in 2011–12 (13%), the share increased to 14.71% in 2021–22, indicating sustained reliance on informal jobs despite urban economic growth. The "Others" category, encompassing diverse informal or emerging employment, initially involved 7.19% of urban workers, declining to 5.66% in 2011–12 before rising sharply to 9.97% in 2021–22, with females (10.13%) slightly outnumbering males (9.82%). Overall, urban Odisha demonstrates a gradual shift toward formal employment, particularly in salaried jobs, alongside persistent informal work and pronounced gender disparities. Women remain concentrated in self-employment and casual work,

highlighting the need for targeted interventions to enhance formal job access, job security, and workforce participation (Padhi & Panda, 2021; Sahoo & Nayak, 2019).

4.3. Trends in Quality of Employment in Rural Odisha Across Sectors

Figure 5 highlights sector-wise shifts in rural employment in Odisha from 2004–05 to 2021–22. In the primary sector, self-employment in agriculture remained dominant, rising from 47.59% in 2004–05 to 60.96% in 2011–12 and 68.21% in 2021–22, reflecting continued heavy reliance on agriculture for livelihoods. In contrast, casual labor in agriculture declined sharply from 42.15% to 26.47% in 2011–12 and further to 7.95% in 2021–22, signaling a move away from seasonal, low-security agricultural work.

In the secondary sector, self-employment in non-agricultural activities fell significantly from 49.91% in 2004–05 to 37.97% in 2011–12 and 20.52% in 2021–22, indicating a reduction in independent non-farm enterprises. Conversely, casual labor in this sector increased markedly from 33.46% to 45.12% in 2011–12 and 62% in 2021–22, highlighting the growth of informal, precarious employment in rural manufacturing, construction, and trade. In the tertiary sector, self-employment in non-agricultural activities rose from 52.81% in 2004–05 to 58.65% in 2011–12 before declining to 53.38% in 2021–22, reflecting fluctuating engagement in service-based work. Employment in "other activities" within the tertiary sector exhibited sustained growth, increasing from 23.94% to 30.96%, suggesting rising diversification into emerging service occupations.

Figure 5: Trends in Quality of Employment in Rural Odisha Across Sectors
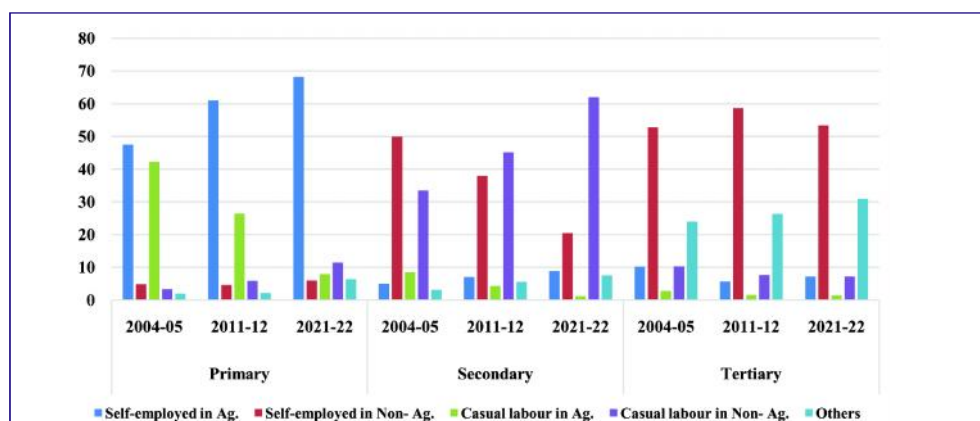
Source: Authors' estimation based on EUS 61st, 68th and PLFS 2021-22 round unit level data

Overall, rural Odisha demonstrates a dual trend: increasing dependence on agricultural self-employment alongside a marked expansion of informal and casual work in secondary and tertiary sectors, highlighting the precarious nature of rural employment and structural imbalances across sectors.

4.4. Trends in Quality of Employment in Urban Odisha Across Sectors

Figure 6 depicts sector-wise employment trends in urban Odisha from 2004–05 to 2021–22. In the primary sector, self-employment declined slightly from 54.71% to 51.69%, while casual labor in other activities dropped sharply from 10.47% to zero, reflecting reduced reliance on traditional occupations.

Figure 6: Trends in Quality of Employment in Urban Odisha Across Sectors
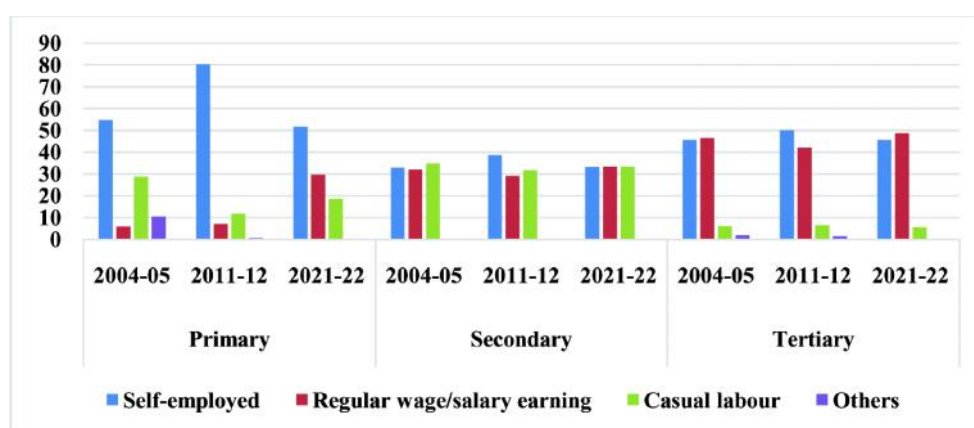
Source: Authors' estimation based on EUS 61st, 68th and PLFS 2021-22 round unit level data

In the secondary sector, self-employment fluctuated, rising modestly from 32.02% to 33.51%, whereas casual labor initially fell from 34.90% to 31.78% before increasing to 33.30%, indicating persistent informal work. In the tertiary sector, regular wage/ salary employment declined from 46.46% to 42.09% by 2011–12 but rebounded to 48.76% in 2021–22, reflecting cyclical patterns in formal urban jobs and gradual expansion of salaried opportunities.

4.5. Trends in Quality of Employment in Rural Odisha Across Regions

Figure 7 highlights the regional variations in rural employment quality across Odisha from 2004–05 to 2021–22, revealing marked shifts in sectoral engagement and

informalization trends. In coastal Odisha, self-employment in agriculture declined modestly from 34.3% to 27.3%, while self-employment in non-agricultural activities remained relatively stable, rising from 22.78% to 26.95% by 2021–22. Employment in "other activities," indicative of more formal or diversified jobs, grew from 12.03% to 23.03%, signaling an expansion of formal sector opportunities. Casual agricultural labor declined sharply from 21.2% to 2.64%, whereas casual labor in non-agricultural activities increased from 8.54% to 20.09%, reflecting a clear shift toward informal employment in secondary sectors.

Figure 7: Trends in Quality of Employment in Rural Odisha Across Regions
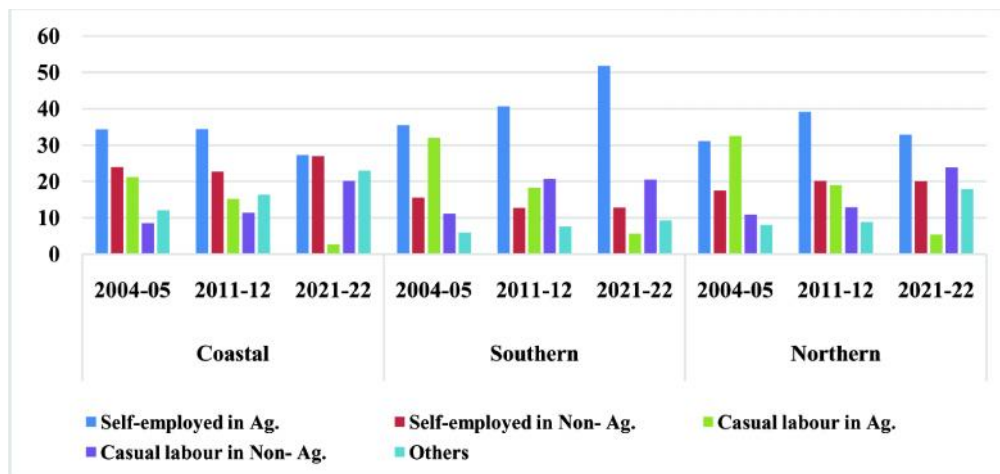
Source: Authors' estimation based on EUS 61[st,] 68th and PLFS 2021-22 round unit level data

In the southern region, self-employment in agriculture increased substantially from 35.44% to 51.72%, underscoring the continued dependence on primary sector livelihoods. Non-agricultural self-employment remained low and stable around 12–13%, while casual agricultural labor decreased from 32.03% to 5.59%. Concurrently, casual labor in non-agricultural sectors rose from 11.16% to 20.52%, highlighting informalization in secondary activities. Employment in other sectors remained marginally stable, indicating slow growth in formal jobs.

The northern region displayed cyclical patterns in agricultural self-employment, rising from 31.11% to 39.14% in 2011–12 before falling to 32.91% in 2021–22. Self-employment in non-agricultural activities stabilized around 20%, while "other activities"

grew sharply from 8.04% to 17.92%, reflecting increasing formal sector engagement. Casual agricultural labor declined dramatically from 32.55% to 5.35%, whereas casual non-agricultural labor nearly doubled from 10.8% to 23.85%, demonstrating a structural shift toward informal employment in secondary sectors.

Overall, the regional analysis highlights a pronounced transition from casual agricultural labor to non-agricultural informal and formal employment, with coastal and northern regions showing strong growth in formal activities, while southern Odisha remains heavily reliant on agriculture.

4.6. Trends in Quality of Employment in Urban Odisha Across Regions

Table 6 highlights regional variations in urban employment quality in Odisha from 2004–05 to 2021–22, revealing dynamic shifts in sectoral engagement. In the coastal urban region, self-employment initially rose from 45.58% to 54.55% by 2011–12, reflecting growing reliance on informal and small-scale enterprises, but declined sharply to 37.12% in 2021–22, indicating a transition toward more formal wage-based employment. Regular salaried jobs followed a U-shaped trend, falling from 32.8% to 29.35% before rising to 36.81%, while casual labor remained relatively stable. Employment in "other activities" fluctuated, declining to 4.75% in 2011–12 before increasing to 14.17% by 2021–22, signaling gradual diversification into emerging urban occupations.

Table 6: Trends in Quality of Employment in Urban Odisha Across Regions

	Coastal			Southern			Northern		
Urban	2004 -05	2011 -12	2021 -22	2004 -05	2011 -12	2021 -22	2004 -05	2011 -12	2021 -22
Self-employed	45.58	54.55	37.12	35.02	44.13	36.51	35.06	35.6	41.96
Regular wage/salary	32.8	29.35	36.81	39.19	26.64	43.27	44.06	44.54	33.9
Casual labor	11.53	11.36	11.9	18.08	16.06	17.74	16.9	14.71	17.23
Others	10.09	4.75	14.17	7.71	13.16	2.48	3.98	5.16	6.92

Source: Authors' estimation based on EUS 61st, 68th and PLFS 2021-22 round unit level data

In the southern urban region, self-employment exhibited a similar pattern, rising from 35.02% to 44.13% and then decreasing to 36.51%. Regular salaried employment, after a sharp dip to 26.64%, rebounded strongly to 43.27%, highlighting expanding formal employment opportunities. Casual labor remained stable at around 18%, while "other activities" experienced volatility, peaking at 13.16% in 2011–12 before falling to 2.48%, indicating uneven growth in tertiary and service-based employment. The northern urban region showed a steady increase in self-employment from 35.06% to 41.96%, reflecting entrepreneurial expansion and supportive policy measures. Regular salaried employment decreased from 44.06% to 33.9%, while casual labor remained largely stable. Employment in other activities increased moderately from 3.98% to 6.92%, suggesting diversification in emerging sectors.

Overall, urban Odisha exhibits a dynamic and evolving labor landscape, characterized by growth in self-employment, fluctuating regular wage jobs, and stable casual labor. Coastal and southern regions reflect transitional patterns toward formalization, whereas the northern region shows sustained self-employment growth.

Conclusion

This study examines changes in employment patterns and the labor market in Odisha over the past three decades, drawing on data from the Employment-Unemployment Surveys (2004-05 and 2011-12) and the Periodic Labour Force Survey (PLFS) 2021-22. The analysis highlights several key trends in the state's employment landscape. In rural Odisha, employment has shifted considerably away from traditional sectors such as agriculture and manufacturing. While agriculture remains a significant source of livelihood, the construction and wholesale/retail trade sectors have recorded notable growth, providing employment opportunities for both men and women. The education sector has emerged as an important source of employment for women, reflecting broader social and economic changes, whereas sectors such as real estate and financial services continue to employ a relatively small share of the workforce. A closer examination of employment quality in rural areas indicates a rising reliance on self-employment in agriculture, a decline in self-employment in non-agricultural activities, and a substantial reduction in casual agricultural labor. In contrast, casual labor in secondary sector activities has grown significantly, accompanied by emerging opportunities in formal wage or salary jobs within the tertiary sector. These shifts suggest an evolving rural labor market marked by diversification and changing

employment quality. In urban Odisha, employment trends reveal a declining reliance on agriculture and fishing, particularly among women. The manufacturing sector has experienced considerable fluctuations, while education continues to be a significant source of female employment. The construction and wholesale/retail trade sectors have expanded steadily for both genders. Male participation in the financial and insurance sector has increased, whereas engagement in real estate, transport, and storage remains limited. Public administration has seen a modest rise in female employment, reflecting broader structural changes in the urban labor market. Regionally, there is a clear shift away from traditional employment sectors toward construction and service-oriented industries. The coastal region remains the most diversified and economically dominant, while the southern region has shown signs of recovery across multiple sectors in recent years.

Based on these findings, the study emphasizes the need for targeted policy interventions. Prioritizing the up skilling of the workforce is critical to improving employment quality and productivity. A balanced and cautious approach to labor market flexibility should also be pursued to safeguard workers' rights while encouraging economic growth. Finally, implementing a comprehensive National Employment Policy is essential to provide a cohesive framework for labor market development, enhance workforce capabilities, and support inclusive economic opportunities across the state.

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State-District Dichotomy in Childhood Vaccine-Preventable Diseases in India: A Multilevel and Cluster-Based Analysis

Tulika Tripathi

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Abstract

This paper explores factors responsible for the observed variations in childhood vaccine-preventable diseases(CVPDs) across districts in India. The paper examines how state-level programmatic factors and specific district-level characteristics influence CVPD burdens by using multilevel mixed-effects regression and cluster analysis on health and demographic data from NFHS-5 and HMIS 2019-20. The findings reveal considerable differences between states, as indicated by an intraclass correlation coefficient (ICC) of 0.46. Key district-level factors, such as the average number of children per woman, antenatal care coverage, and the percentage Scheduled Castes (SCs) or Scheduled Tribes (STs) population, significantly impact CVPD rates. Furthermore, the cluster analysis identifies four distinct types of districts based on their CVPD burdens, which has a critical policy suggestion for formulating locally tailored interventions to improve full coverage of child vaccination.

Keywords: Vaccine Preventable Diseases (VPDs), Childhood Vaccine Preventable Diseases (CVPDs), Multi-level Modelling, India

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Introduction

India has witnessed substantial improvements in immunization coverage over the past two decades. However, childhood vaccine-preventable diseases (CVPDs) continue to cause substantial morbidity, with significant disparities across regions. Despite national-level convergence, district heterogeneity in vaccine-preventable diseases (VPD) outcomes, particularly the presence of pockets of zero-dose children, can lead to an outbreak/endemic at any time.Though there are national immunization programs like UIP and Mission Indradhanush (MI) launched in 2014 and intensified Mission Indradhanush (IMI) in subsequent years, with an initial prioritisation of 201 low coverage districts, CVPDs continue to pose a challenge in India (Dhawan et. al. 2023). Wherever immunization is patchy, outbreaks of CVPDs tend to cluster. Dhalaria et al. (2024) utilized district data to demonstrate that measles was inversely correlated with measles vaccine coverage and clustered in states with weaker healthcare systems.

Advanced geospatial analyses have mapped immunization coverage and CVPD risk clusters in India. Khan et al. (2018) found significant spatial autocorrelation in district-level vaccination rates in the National Family Health Survey (NFHS) -4 data. Their univariate LISA (Local Indicators of Spatial Association) cluster maps identified contiguous low-coverage regions (notably in central India and parts of the northeast), signifying that neighbouring districts often share similar immunization performance. Similarly, Panda et al. (2020) identified apparent spatial clustering of 99 hotspot districts with a high immunization gap (mostly overlapping state borders in north-central India) and 111 coldspot districts (many in the south and west) with significantly lower coverage.

While much of the research and policy discussion has focused on improving immunization coverage, there is relatively little empirical investigation into the identification of low uptake of CVPD districts. This paper addresses this gap by applying multilevel regression and an unsupervised clustering strategy to analyse the predictors of CVPDs incidence across 707 districts in India, with states treated as higher-level clusters. The goal is to identify service-led and socio-demographic factors that contribute to CPVDs' vulnerability at the district level,which remain hidden under aggregate analyses.In this context the paper addresses the following three questions:

1 What is the burden of CVPDs across Indian states and districts?

2 What is the relative contribution of state- versus district-level factors in shaping the CVPD burden?

3 What arethe typologies of districts based on key health and demographic predictors?

Review of Literature

Childhood immunization rates in India vary widely by state, ranging from 33.9% full vaccination coverage in Arunachal Pradesh to 91.3% in Punjab in 2016 (Goodman, 2023). Such gaps persist: NFHS-5 (2019-21) reported immunization rates as high as 90% in Odisha and Tamil Nadu and as low as 57% in Nagaland. Shrivastwa et al. (2019) examined state-level determinants of vaccination and found states with mid-level poverty had significantly lower odds of complete vaccination compared to both poorer and richer states. Further studies have also suggested that, controlling for socioeconomic and health system variables, districts with larger Muslim populations exhibited lower vaccination coverage (Ali et al., 2022; Hussain et al., 2015). Another comparative study of select northern states found that urban-rural differences in coverage varied by state, and overall vaccination inequality was paradoxically higher in better-off states, such as Maharashtra, than in poorer states, like Bihar (Shrivastwa et al., 2019). These studies highlight that each state's unique context influences immunization outcomes.

Recent worksbased on NFHS-5 (2019-21) demonstrate that most of the geographic variance in under-vaccination observed at the state level is actually better captured at the district level. The small-area "cluster" effect accounts for over half of the total variation in key indicators, including zero-dose status, incomplete basic schedule, and non-receipt of measles-rubella doses. It reframes the classic "state vs district" problem as a multi-level one where cluster-level heterogeneity within districts is catalytic for program design (Johri et al., 2024; Rajpal et al., 2023). Several studies have performed district-level analyses highlighting that even high-performing states have poorly immunized districts, and vice versa. Rammohan and Awofeso (2015) conducted a multilevel analysis of district-level disparities using data from 549 districts, based on the DLHS-3, 2008, and found wide heterogeneity in measles and Diphtheria coverage across districts. Importantly, they showed that district-level socioeconomic development and health infrastructure strongly predict immunization uptake.

Given the hierarchical nature of immunization outcomes, multilevel models have been widely applied to disentangle contextual effects. Saikia et al. (2023) found a modest but significant district-level influence beyond individual factors, while Johri et al. (2024), using a four-level model (state–district–cluster–child), showed that 68% of the variance in zero-dose status occurred at the cluster level, indicating strong community-level clustering. Their study further revealed that districts with high under-vaccination also exhibited greater within-district heterogeneity. Multilevel and decomposition analyses consistently attribute inequalities primarily to maternal education, ANC contact, and household wealth, with additional geographic contributions (Wahl et al., 2021; Bettampadi et al., 2021; Sharma et al., 2021).

While India's immunization programme has been well examined, the fine-scale geography of VPDs remains underexplored. Existing studies treat immunization as a binary indicator, neglecting the actual incidence of CVPDs and the linkage between service delivery and disease burden. This study addresses this gap by analyzing district-level CVPD incidence through multilevel modelling to separate state and district effects, and by applying k-means clustering to identify sociodemographic typologies of districts, thereby offering insights for locally tailored public health policy.

Data and Methodology

We have analyzed averages of 707 districts in India using data from the NFHS-5 and the Health Management Information System (HMIS) for the period 2019-2020. The primary variable used in the study is the CVPD, its absolute number for five diseases across districts aretaken from HMIS data (Table 1). The analysis also includes several independent variables, such as the sex ratio at birth, mean age at first birth, mean number of children ever born, percentage of the population belonging to SC or ST, percentage of women with more than 10 years of schooling, and antenatal care coverage estimated from NFHS 5. Furthermore, the percentage of the population living in urban areas and the percentage of households living in poverty are taken from MOSPI. The data were cleaned and merged using district names and codes for analysis.

To estimate the CVPD rate, this study used a standard method of calculating the number of children infected with CVPDs per 100,000 children, based on data from HIMS.

$$CVPDs_{Rdistrict} = \frac{\text{Number of children infected with VPDs in the district}}{\text{number of children in the district}} \times 100{,}000$$

Where CVPDs are defined by aggregating seven infectious diseases: pneumonia, diphtheria, pertussis, tetanus, tuberculosis (TB), measles, and diarrhoea.

Model 1: Multilevel Mixed-Effects Regression

The literature review shows that the steady national gains and narrowing state inequalities, persisting between-district clustering and the hierarchical nature of vaccine coverage, needed a multilevel, cluster design. It can identify "hotspot" clusters even within better-performing states and links cluster-level risk to modifiable service-led factors (e.g., outreach density, vaccination outreach), thereby showing the state-district dichotomy that often blurs the hotspots for CVPD outbreaks. Therefore, we estimated multilevel mixed-effect to examine the predictors of childhood VPD incidence:

$$CVPDsR_{ij} = \beta_0 + \beta_1 X_{1ij} + \beta_2 X_{2ij} + \cdots + \beta_k X_{kij} + u_j + \epsilon_{ij}$$

Where:

i indexes districts, j indexes states

X_{kij} are district-level predictors

$u_j \sim N(0,\ \sigma^2_u)$ is the state-level random intercept

$\epsilon_{ij} \sim N(0,\ \sigma^2)$ is the district-level residual

Model 2: Fixed-Effects Regression (Absorbing State Effects)

Secondly weused multi-level fixed- effects model to control for unobserved state-level heterogeneity by absorbing state-specific intercepts and to identify district-level determinants.

$$Y_{ij} = \beta_0 + \beta_1 X_{1ij} + \beta_2 X_{2ij} + \cdots + \beta_k X_{kij} + \alpha_j + \varepsilon_{ij}$$

Where α_j are state fixed effects and other terms are as defined above.

Model 3: K-means Clustering

This model is used to identify latent groups of districts with similar demographic and health characteristics, as well as geographic hotspots and cold spots of CVPDs.

Algorithm: Minimize the within-cluster sum of squares:

$$\sum_{k-1}^{K}\sum_{i \in C_k} ||x_i - \mu_k||^2$$

Where K is the number of clusters, xi is the feature vector for district i, and μk is the centroid of cluster k.

First, we analysed the spatial distribution of CVPDs across states and districts in India to understand the clustering of CVPDs within these regions. Furthermore, we created a correlation heat map with the predictor variables. Based on the analysis of the heatmap, we employed multilevel mixed-effects and multilevel fixed-effects models to understand state-level variation and district-level predictors. We used K-means cluster analysis to identify the hot and cold spots of CVPDs across 707 districts in India, along with their corresponding socio-demographic characteristics.

4. Results

4.1. Childhood Vaccine-Preventable Diseases Across the State and District

Table1 presents the state-wise distribution of disease burden for seven vaccine-preventable diseases affecting children in India. These include measles, diarrhoea, tetanus, pneumonia, diphtheria, pertussis, and TB. Of the total CVPDs burden, diarrhoea is highest at the all-India level, followed by pneumonia, TB, and measles, while tetanus is the least burdened, followed by pertussis and diphtheria.

Table 1: Current Burden of Child Vaccine-Preventable Diseases Across India States

States	Pneumonia	Diphtheria	Pertussis	Tetanus	Tuberculosis	Measles	Diarrhoea
A & N	4	0	0	0	3	1	1442
Andhra Pradesh	9036	7	9	1	572	131	38668
Arunachal Pradesh	187	5	5	0	30	4	6388
Assam	9152	17	14	12	456	913	83290
Bihar	7550	588	21	7	1357	405	62694
Chandigarh	3576	16	8	3	15	18	8504
Chhattisgarh	3939	40	6	2	182	128	92260
Dadra & Nagar Haveli	35	0	0	0	3	13	2406
Daman & Diu	26	0	0	0	1	0	901
Delhi	21875	107	35	9	908	200	154044

Goa	518	0	0	0	26	11	2980
Gujarat	5998	387	11	30	1028	254	231672
Haryana	3334	10	2	2	312	98	30890
Himachal Pradesh	2608	0	0	0	42	13	13203
Jammu & Kashmir	3630	7	138	1	58	188	44928
Jharkhand	1563	20	3	3	303	408	21796
Karnataka	28536	74	10	4	1047	313	180616
Kerala	12145	17	37	2	94	159	58288
Lakshadweep	34	0	0	0	1	0	1178
Madhya Pradesh	32390	93	10	44	2362	554	223429
Maharashtra	12407	10	3	0	1218	402	74066
Manipur	892	0	0	0	5	58	8278
Meghalaya	3788	1	2	6	194	113	52204
Mizoram	1165	0	0	0	68	114	7663
Nagaland	378	0	0	0	57	20	3520
Odisha	14753	0	0	0	476	133	132831
Puducherry	1125	50	4	0	42	13	7894
Punjab	5790	6	0	1	266	43	36572
Rajasthan	58172	400	462	49	1680	880	265372
Sikkim	187	0	0	0	6	9	2797
Tamil Nadu	4889	37	0	0	148	595	500933
Telangana	3943	112	22	16	279	316	40089
Tripura	743	0	0	0	9	27	8175
Uttar Pradesh	94938	2395	598	458	5042	3185	394749
Uttarakhand	2151	11	4	0	89	88	13734
West Bengal	13382	9	4	2	765	3433	234159
India	364839	4419	1408	652	19144	13240	3042613

Source: Authors' calculation from HMIS, 2019-20

Developing states, such as Uttar Pradesh, Madhya Pradesh, Rajasthan, and Bihar, show the poorest performance in most CVPDs. Developed and better-managed states, such as Kerala, Tamil Nadu, Maharashtra, Punjab, Odisha, and Jharkhand, show better performance in the management of CVPDs. For example, the prevalence of childhood pneumonia is highest in Uttar Pradesh, followed by Rajasthan and Madhya

Pradesh, while Jharkhand shows the lowest share. The incidence of diphtheria among children is again high in Uttar Pradesh, Bihar, and Rajasthan, whereas Odisha has no reported cases.

The incidence of childhood pertussis is highest in Uttar Pradesh, followed by Rajasthan and Kerala, whereas Tamil Nadu, Punjab, and Odisha report no instances. Similarly, Uttar Pradesh, Rajasthan, and Madhya Pradesh are the worst-performing states in childhood tetanus, while Tamil Nadu, Maharashtra, and Odisha are the best-performing states with no instances.

Childhood TB is a significant concern in Uttar Pradesh, Madhya Pradesh, and Rajasthan, while Kerala is the best performer in India. Childhood measles ismore common in West Bengal, Uttar Pradesh, and Rajasthan, whereas Punjab has the lowest prevalence. However, in terms of childhood diarrhoea, Tamil Nadu, Uttar Pradesh, and Rajasthan are the poorest performing states in India, while Jharkhand is the best performer.

Often, state averages hide district-level variation; therefore, we analysed the combined CVPDs at the district level to identify clusters of higher incidence of CVPDs across districts. We mapped the distribution of CVPDs across the states and districts of India (Figures 1 and 2) to understand their spatial pattern. According to the spatial distribution analysis, large geographical disparities in CVPDs exist among the 29 states and 7 union territories in India.

Figure 1: Childhood Vaccine-Preventable Diseases in Indian States
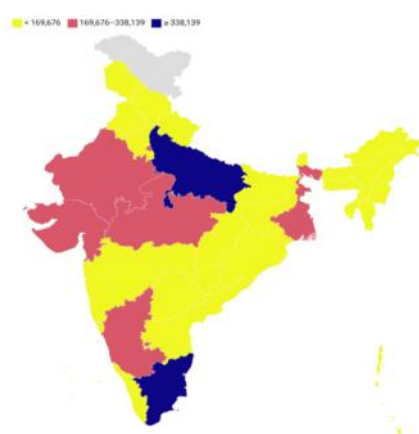
Source: Authors' calculation based on HMIS, 2019-20.

Figures 2: Childhood Vaccine-Preventable Diseases in Indian Districts
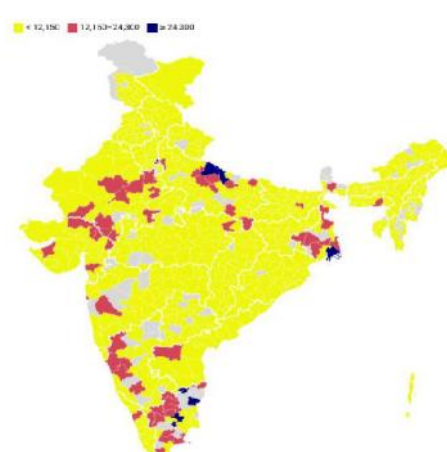
Source: Authors' calculation based on HMIS, 2019-20.

Figure 3:   Childhood Vaccine-Preventable Diseases in Indian Districts
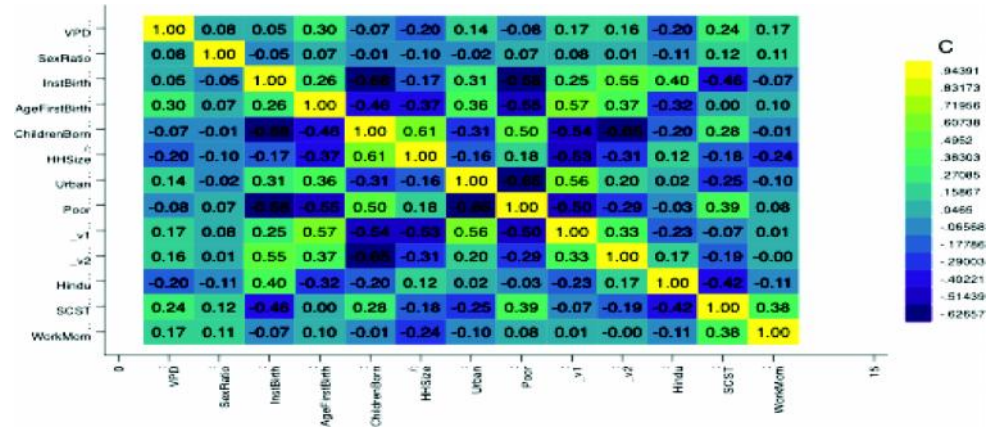
Source: Authors' calculation

A district-level analysis of pairwise correlations between socio-demographic indicators and CVPD rates reveals a moderate positive correlation between the mean age at first birth and CVPD rates (r = 0.296), suggesting that districts with delayed childbearing are often associated with urbanization or higher socio-economic status and may report more CVPDs (Figure 3). This could reflect either better disease surveillance in urban areas or increased health-seeking behaviour, which tends to bias disease reporting upward (Wahlet al., 2021). Similarly, maternal schooling beyond 10 years (r = 0.170) and antenatal care utilization (r = 0.156) are positively associated with CVPD rates (Figure 3). These findings may appear counterintuitive but likely reflect greater awareness and institutional contact in districts with stronger health systems. The share of working mothers also shows a modest positive correlation (r = 0.168), possibly due to increased exposure to daycare or crowded settings, or reduced parental supervision.

Districts with higher proportions of SCs and STs show a stronger positive correlation with CVPD burden (r =0.243), consistent with literature on systemic marginalization and health access barriers faced by these communities. On the other hand, variables such as the sex ratio at birth (r = 0.076), institutional birth rate (r = 0.047), and urban population share (r = 0.143) display weak or negligible correlations with CVPD burden, indicating limited predictive value at the aggregate district level.

Interestingly, several negative associations emerge, including the mean number of children ever born (r = -0.069), average household size (r = -0.202), and the proportion

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of the Hindu population (r = -0.203). These may indicate underreporting in high-fertility or larger households, possibly due to lower health system engagement, and may also reflect underlying regional and cultural heterogeneities, particularly where Muslim-majority populations are concentrated in socio-economically disadvantaged areas. Based on the results of this analysis, we further ran multilevel mixed-effects and fixed-effects regression to decipher the role of state and district-level factors.

Results of Multilevel Mixed-Effects Regression

To disentangle the hierarchical structure of vaccine-preventable disease, we estimated a two-level mixed-effects model with random intercepts at the state level (Table 3). The model yields an intraclass correlation coefficient (ICC) of 0.46, indicating that nearly 46% of the unexplained variance in the log-transformed CVPD rate is attributable to differences between states. This finding highlights the importance of state-level institutional and policy environments in shaping public health outcomes.

Table 3: Mixed-Effects Model Results (with Random Intercepts for State)

| Variable	Coef	Std. Err.	P>|z|	Sig.
Sex Ratio at Birth	0.0002	0.00029	0.5	
Institutional Births	0.01089	0.00593	0.066	+
Age at First Birth	0.07857	0.04828	0.104	
Children Ever Born	0.49723	0.18707	0.008	**
Urban Population	0.00163	0.00288	0.571	
Poor Households	0.00623	0.00344	0.07	+
Working Mothers	0.00114	0.02108	0.957	
SC/ST Population	0.00883	0.00254	0.001	**
Schooling >10 Years	0.00503	0.00535	0.347	
Antenatal Care	0.01365	0.00543	0.012	*

Source: Authors' calculation

Among the district-level covariates, the mean number of children ever born ($\hat{a} = 0.497$, $p < 0.01$), the percentage of SC/ST population ($\hat{a} = 0.0088$, $p < 0.01$), and antenatal care coverage ($\hat{a} = 0.0137$, $p < 0.05$) emerged as significant predictors of the CVPD burden. The statistically robust coefficient on SC/ST population signals

persistent inequities in healthcare access among historically marginalized communities, consistent with prior studies on caste-based health disparities in India (Subramanian et al., 2006).

Antenatal care, often seen as a proxy for maternal engagement with health systems, is also positively associated with reported CVPD rates. While counterintuitive, this may indicate surveillance bias: districts with better antenatal coverage may also have stronger disease monitoring and reporting infrastructures. This explanation aligns with epidemiological insights on detection bias in health system assessments (Boerma & Stansfield, 2007).Other covariates, including the proportion of institutional deliveries (p = 0.066) and households in poverty (p = 0.07) with CVPDs, show positive and consistent results, aligning with findings from other studies. Interestingly, urbanization, sex ratio at birth, working mothers, and maternal schooling beyond 10 years do not appear to be significant explanatory variables of the CVPD variation across districts if state-level random effects are controlled for.

Since the percentage of the SC/ST population at the district level emerges as a significant determinant, we further analyzed the predicted CVPD rate by SC/ST population share based on the mixed-effects regression results. Figure 4 illustrates the predicted values of childhood vaccine-preventable disease rates across varying levels of SC/ST population share, accompanied by 95% confidence intervals. The results reveal a strong and positive linear association. As the percentage of the SC/ST population increases from 10% to 90%, the predicted CVPD rate rises steadily from approximately 1.7 to over 3.0. This gradient persists across the entire distribution, the slope and confidence bands indicating statistical reliability, particularly at moderate population shares (30-70%).

This pattern shows the structural disadvantage faced by SCs and STs in accessing routine immunization services, even after controlling for other covariates in the regression model. The higher predicted CVPD burden in SC/ST-dominant districts likely reflects a combination of long-standing barriers, including geographic marginality (e.g., tribal settlements in forested or remote areas) and service delivery gaps (Kumar & Tripathi, 2024; Singh et al., 2013). What is particularly notable in this graph is the linear nature of the predicted increase, which implies that inequities scale with social disadvantage. Unlike threshold effects, where disparities emerge only beyond a specific cutoff, the risk of CVPDs appears to rise consistently with each decile increase in SC/ST share.

Figure 4: Predicted CVPD Rate by SC/ST Share
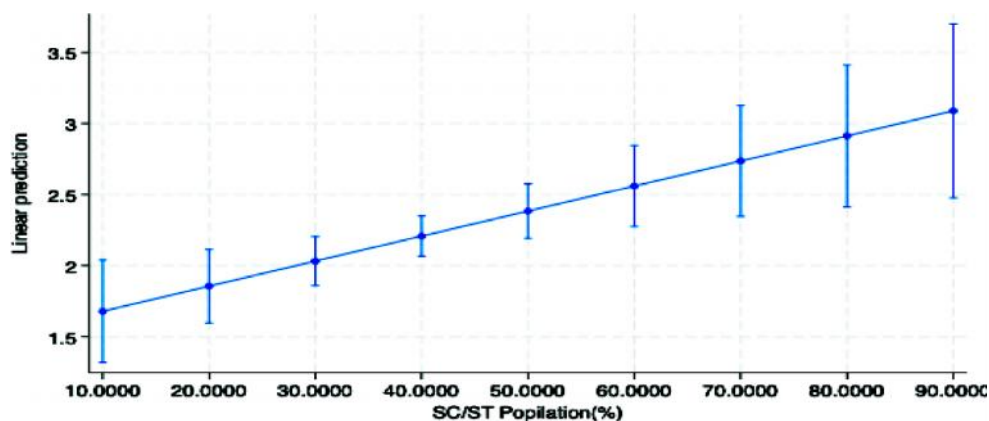
Source:Authors' calculation

The widening of confidence intervals at the extremes (i.e., districts with very low or very high SC/ST populations) reflects greater heterogeneity or smaller sample sizes at these margins.

Fixed-Effects Regression

To test the robustness of these associations, we applied a fixed-effects model, which non-parametrically controls for unobserved, time-invariant state-level heterogeneity (Table 4). The key predictors, children ever born, SC/ST population, and antenatal care coverage, maintain the direction and significance (Tables 3 and 4), reinforcing more substantial confidence in their role as structural correlates of CVPD burden. The model gives an adjusted R² of 0.48, indicating that nearly half of the variance in district-level CVPD outcomes is explained once fixed state effects are taken into account. Therefore, the persisting findings under both random and fixed-effects frameworks support their interpretive reliability and strengthen causal inferences within the bounds of cross-sectional analysis.

Table 4: Fixed-Effects Model Results (State Absorbed)

Variable	Coef	Std. Err.	P>|z|	Sig.
Sex Ratio at Birth	-0.00015	0.00065	0.822	
Institutional Births	0.01219	0.01376	0.376	
Age at First Birth	0.19998	0.11256	0.076	+

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Children Ever Born	1.21878	0.42951	0.005	**
Urban Population	-0.0091	0.00663	0.17	
Poor Households	0.00161	0.00804	0.841	
Working Mothers	-0.03767	0.04731	0.426	
SC/ST Population	0.01762	0.0059	0.003	**
Schooling >10 Years	0.00584	0.01255	0.642	
Antenatal Care	0.04001	0.01228	0.001	**

Source: Authors' calculation.

Note: *** $p < 0.00$, ** $p < 0.01$, * $p < 0.0$, + $p < 0.1$

Together, these results (Tables 3 and 4) point towards a dual structure of determinants. While state-level governance and infrastructural capacity account for a substantial share of the variation, district-level reproductive behavior, social disadvantage, and service access remain critical factors for reducing CVPDs in India. As mentioned, the district-level factors emerged as critical factors to reduce CVPDs. We further applied cluster analysis to identify districts with a greater need for policy change and focus from the state and national governments.

Cluster Analysis

Based on the results of the previous section, which showed the varying roles of different factors in explaining CVPDs and the diverse burden of CVPDs across districts, we applied k-means clustering to the standardized values of key demographic and health predictors. This unsupervised classification yielded four distinct district clusters, each exhibiting a distinct characteristic of CVPD burden. The mean predicted CVPD rate varied substantially across clusters (Figure 5).

Figure 5: Mean Childhood VPD Rate
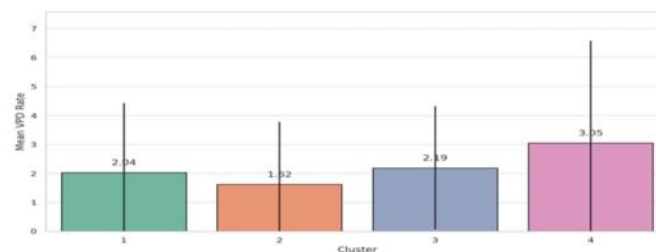
Source: Authors' calculation

High burden clusters (4 and 5) are characterized by higher fertility, lower antenatal care coverage, and a greater share of socio-economically disadvantaged populations. In contrast, lower-burden clusters tend to coincide with better maternal health indicators and stronger institutional engagement. Cluster 2 had the lowest average rate (1.62), suggesting relatively favourable health and demographic conditions. Districts in Cluster 4 are the priority districts for intensified immunization outreach, infrastructure strengthening, and program delivery, with a focus on marginalized communities. We mapped the districts in Cluster 4 to further explore the granularity for spatial targeting and inter-district comparisons.

Figure 6 highlights the geographic distribution of the districts of Cluster 4, which is characterized by the highest average rate of CVPDs. These districts are scattered across India, but with distinct spatial patterns. First, a notable concentration of high-burden districts is observed in the southern states, particularly Tamil Nadu (e.g., Thoothukudi, Tiruppur), Karnataka (e.g., Tumkur, Dharwad), and parts of Maharashtra (e.g., Amravati, Pune). And these were the states performing very well in terms of a lower CVPD burden.

Despite their overall stronger health infrastructure, these states have pockets of higher CVPD incidence, which is likely a reflection of urban-rural disparities, underserved subpopulations, or reporting effects linked to better surveillance systems. The presence of Leh, Hoshiarpur, and Nainital in the north and northwest of Cluster 4 suggests that terrain-related service delivery challenges and seasonal inaccessibility may play a role. These are hilly or high-altitude districts where immunization outreach can be logistically constrained, particularly during winter months.

The map (Figure 6) also reveals eastern and northeastern districts, such as Kohima, Darjeeling, and North 24 Parganas, among the highest CVPD burden clusters. These areas are known for social diversity, minority populations, and in some cases, high migration or border-related health system gaps, which could contribute to immunization disruption or exclusion. Interestingly, urban-industrial districts such as Rajkot (Gujarat), Kanpur Nagar (Uttar Pradesh), and Yaman (Puducherry) also appear in Cluster 4. The spatial heterogeneity of Cluster 4 thus reveals that high CVPD burden is not confined to historically poor or tribal regions, but also occurs in more developed districts.

Figure 6: Districts with the Highest Rate of CVPDs
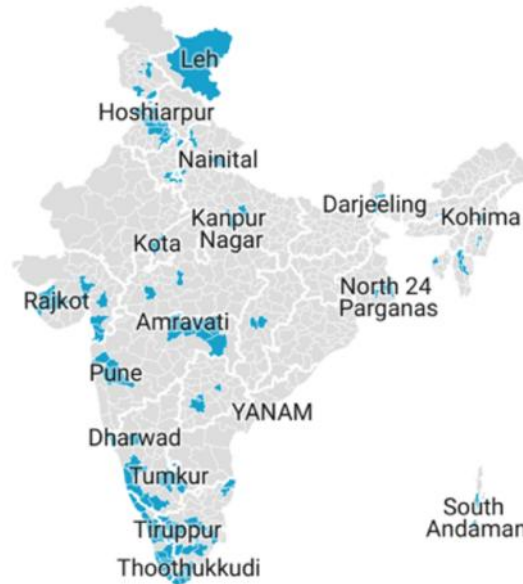
Source: Authors' calculation

Predictors Across CVPD District Clusters

Figure 7 presents the cluster-wise standardized means of five key predictors associated with childhood vaccine-preventable disease rates: antenatal care, share of SC/ST population, number of children ever born, mean age at first birth, and institutional births. These indicators are normalized (z-scores), allowing for comparative interpretation across clusters, regardless of the original units of measurement. The results highlight distinct compositional characteristics of each cluster, reinforcing the heterogeneity in demographic and service access profiles that underlie CVPD disparities. Clusters 3 and 4, which have the highest average CVPD burden, are characterized by the lowest standardized values for antenatal care, age at first birth, and institutional births, alongside the highest number of children ever born and an above-average share of the SC/ST population.

Further, Cluster 1 shows high levels of antenatal care, institutional deliveries, and delayed childbearing, suggesting better maternal health services. However, a moderately high SC/ST share and fertility levels suggest potential disparities that may be masked within the average service utilization. Similarly, Cluster 2, which has the

lowest mean CVPD rate, is characterized by a low SC/ST population share and lower fertility, despite slightly below-average antenatal care and institutional births, which reflect better programmatic results, health infrastructure, and service delivery.

Figure 7: Predictors by CVPD Cluster
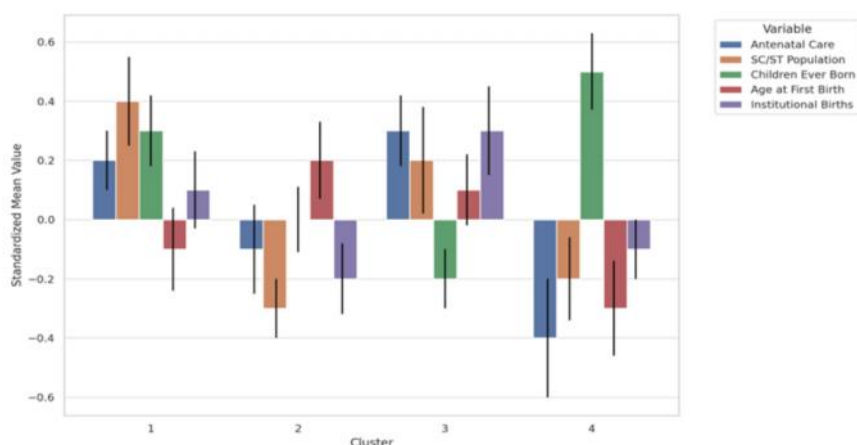
Source: Authors' calculation

The above analysis reveals that while the high CVPD burden (Cluster 4) coexists with socio-demographic disadvantages, particularly high fertility rates and caste/tribe marginalization, low-burden clusters (e.g., Cluster 2) benefit from both demographic transition and social advantages.

Discussion

Our analysis reveals significant socio-spatial disparities in the distribution of vaccine-preventable diseases across Indian districts. Multilevel modelling results indicate that nearly half of the unexplained variation in CVPD rates is attributable to differences between states, highlighting the significance of programmatic and service-led factors in shaping CVPD outcomes through immunisation. However, the remaining 50 per cent variation is explained by key district-level predictors, such as the mean number of children ever born to a woman, the share of SC/ST population, and antenatal care coverage, drawing attention to persistent intra-state disparities. Our findings are consistent with other studies that link lower antenatal care and higher fertility to lower immunization coverage (Shrivastwa et al., 2019). Districts with limited antenatal care not only have lower immunization uptake but may also have underreporting in health reporting systems.

Similarly, the positive association between SC/ST population share and CVPD burden supports longstanding evidence that caste-based exclusion continues to shape access to preventive health services (Borooah, 2004; Subramanian et al., 2006), or the community might have vaccine hesitancy due to lack of education or traditional norms. Further high migration rates in traditionally marginalised caste groups lead to vaccine discontinuity, leading to a high risk of CVPDs in children. Saikia et al. (2023) found that the single most differentiating factor was whether the child had the vaccination card/health card.Chhabra et al. (2007) analyse immunization coverage in urbanized villages of Delhi and show that urban residence alone does not guarantee full immunization, particularly once socio demographic covariates are controlled.

The cluster analysis further reinforces the conclusion that districts with high CVPD burden cluster together based on similar socio-demographic constraints - remarkably low maternal service use and high fertility - regardless of geographic location or average poverty rates. The results of the study suggest that centralized policies, such as Mission Indradhanush, must allow for district-specific flexibility that recognizes demographic, social, and structural barriers beyond a mere targeting approach. Moreover, our analysis suggests the potential utility of multi-level modeling and clustering approaches to inform such targeting at the micro level, for better outcomes in a cost-effective manner.

Conclusion

This paper provides critical evidence that the burden of childhood vaccine-preventable diseases is not uniformly distributed; it is shaped by the intersection of demographics, population share of SC/ST, and health system capacity at both district and state levels. Two broad insights emerge from this analysis. First, while national averages may suggest gradual progress, the variance in CVPD's burden is predominantly at the district level. Our multilevel model indicates that nearly half of the unexplained variation in CVPD rates is attributable to differences between states. However, even within relatively well-managed states, districts diverge in performance. Clusters of high-burden districts (Cluster 4) are not always the poorest, but are often characterized by high fertility rates, lower maternal service uptake, and a high proportionof SC and ST populations.

Second, districts with higher numbers of children ever born might reflect lower levels of female agency and limited contraceptive access, and face greater challenges in

ensuring timely and complete immunization. Third, while states account for almost half of the CVPD variation in shaping CVPD outcomes, a 'one-size-fits-all' approach is unsustainable in achieving closer proximity to targets, particularly in the final stages. States differ widely in their institutional capacity, prioritization, and health governance models. For instance, Kerala and Tamil Nadu exhibit high coverage and low CVPD prevalence, while large states like Uttar Pradesh, Madhya Pradesh, and Bihar continue to face endemic challenges.However, the low CVPD prevalence states, such as Tamil Nadu and Karnataka, have pockets of a very high burden of CVPD districts.

Overall, multilevel evidence suggests that improving childhood vaccination in India requires addressing both compositional factors (such as household poverty, parental education, and family size) and contextual factors (including community healthcare access, public infrastructure, and social norms). Hence, the full immunisation policies should include investment in district-level capacity, particularly in high-burden clusters, programs to prioritize SC/ST-majority districts explicitly, and better coordination among municipal/PRIs, state, and central institutions to allow for a flexible implementation model, tailored to local realities, of national programs like Mission Indradhanush.

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Annexure

Table 1: Description of the Study Variables

Variable	Definition	Data source
Childhood VPDs Rate	Children who are affected by VPDs account for 100000 children under five years old.	Author's calculation from HMIS,2019-20
Institutional Birth	Percentage of Institutional childbirths from total child births	Author's calculation from NFHS-5
Mean age at first birth	Age at first birth as reported by women in years	Author's calculation from NFHS-5
Mean children ever born	Mean number of children ever born per woman	Author's calculation from NFHS-5
Average Household Size	The average number of persons living in a household	Author's calculation from NFHS-5
Hindu Population	Share of the Hindu population in a district	Author's calculation from NFHS-5
Working mother	Share of working mothers in a district from NFHS-5	Author's calculation
Received antenatal care for pregnancy	Proportion of mothers who received antenatal care for pregnancy	Author's calculation from NFHS-5
HII	Health Infrastructure Index (HII) is made by taking district-wise sub-centres, PHCs, CHCs, Sub-Divisional Hospital, and District Hospital, then divided by five from its normalised value.	Author's calculation from the Government of India, Ministry of Health and Family Welfare, Rural Health Statistics,2020-21
Poverty Headcount Ratio	The number of people below the poverty line from the total population	Author's calculation from India-National-Multidimensional-Poverty-Index: A Progress Review 2023(Based on NFHS-5)

Determinants of Daily Earnings of Informal Construction Labourers: A Study in Two Districts of West Bengal

Neeloy Gupta
Archita Ghosh

Abstract

The informal construction sector in India, particularly in West Bengal, plays a crucial role in meeting the demand for affordable housing and public projects, employing millions of informal labourers and contributing significantly to the economy's gross value added (GVA). However, as found in various studies, informal employment often fails to provide proper returns to labourers in terms of earnings and working conditions. This study, based on a primary survey in the districts of Cooch Behar and North 24 Parganas in West Bengal, analyzes the determinants of daily earnings using a multiple linear regression model. The key determinants include skill level, district, workplace location, gender, and experience. The results reveal significant regional and gender disparities, with higher skills associated with better earnings — underscoring the need for targeted skill development. Lastly, the successful implementation of the labour codes and proper implementation of the BOCW Act is recommended for the overall upliftment of such labourers and to ensure the sustainability of the industry.

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Introduction

In the state of West Bengal, where the majority of the workforce remains in the informal sector, the construction sector plays a crucial role. On average, during 2018-19 to 2023-24, its contribution to the NSDP has been estimated at 9.11 per cent and since 2018-19 the sector accounted for over 11 per cent of the state's workforce (Figure 1).

Figure 1: Share (%) of GVA and Employment of the Construction Sector in West Bengal
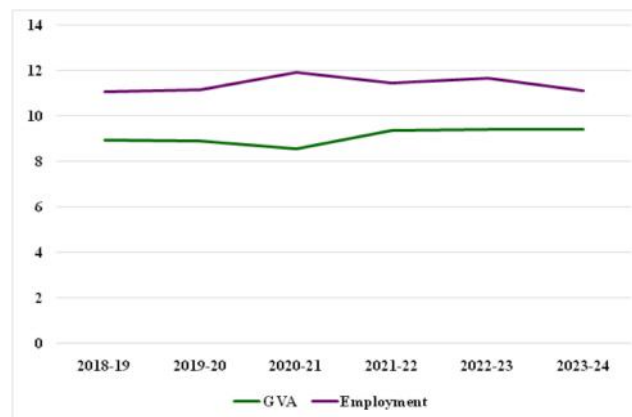
Source: Authors' calculation based on RBI and PLFS data

This study examines the earnings of the self-employed (including own account) labourers, based on primary surveys conducted in two blocks each from Cooch Behar (North Bengal) and North 24 Parganas (South Bengal) districts in West Bengal. The paper is organized as follows: Section II reviews the literature on the determinants of earnings for informal construction workers. Section IV covers the study's objectives, data sources, study areas, and methodology. Section V presents earnings profiles and econometric analysis of key determinants. Section VI concludes with policy recommendations.

Review of Literature

This review is focused on issues concerning earnings in the informal sector, particularly, construction. Parajuli (2014) found that gender, experience, and education have a significant impact on the hourly wage rates of informal workers in Nepal. Chheda & Patnaik (2016) employed the Mincerian wage function to identify the key determinants of wages for construction labourers in India.They added technical education and vocational education as explanatory variables and found that work experience has a

positive impact on wages, aligning with Tansel's (1999) findings. Çaðlayan Akay &Kangallý Uyar (2017) using Turkish data and an extended Mincerian model, found a negative relationship between experience squared and earnings.

Using the Mincerian earnings function, Das (2012) found that both technical and general education, along with work experience, significantly and positively influenced the wages of informal workers in India. Mazumdar et al. (2017) found factors such as gender, age, education, industry, and sector as significant in estimating wage or earnings equations for Indian labourers. Zuo (2013) found that gender, education, location, and migrant status influence monthly wages of informal workers in China. In terms of important explanatory variables, we have identified the following from the literature: experience (Tansel, 1999;Dahl & Kaiser, 2009; Kahyalar et al., 2018), educational qualification (Kahyalar et al., 2018), gender and location of the workplace (Tansel, 1999; Abraham, 2017; Kahyalar et al., 2018).

We have found limited research exclusively on informal construction workers and, especially, on how earnings of the self-employed group of informal construction workers vary by gender and region.

Objectives of the Study

The two main objectives of the study are: a. To draw a profile of the daily earnings of the informal construction workers in the two selected districts in West Bengal; and b. To identify factors that influence the daily earnings of informal construction workers belonging to the 'self-employed' category.

Sources of Data and Study Area

For the selection of districts, a stratified random sampling method has been applied. The districts were first grouped into two categories based on their per capita GSDP (in Rs.) from the construction industry - one having a higher per capita value of GSDP (construction) than the state's average (Rs. 2500), and the other having a value lower than the state average (*Statistical Handbook, West Bengal, 2014*[1]). We have randomly chosen the North 24 Parganas district from the first group, with a per capita GSDP (construction) estimated to be Rs. 3200 during 2013-14 (quick

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[1] This was the latest available data for selecting the districts.

estimate at constant prices). Conversely, the Cooch Behar district has been chosen randomly with a per capita (construction) figure of Rs. 1700 from the second group.

Based on the share of non-farm employment as per Census 2011, rural and urban blocks were chosen from the two districts. From North 24 Parganas - Baranagar (urban) and Swarupnagar (rural) were chosen with 95.81 per cent and 26.38 per cent non-farm employment, respectively; and from Cooch Behar - Dinhata (urban) and Sitalkuchi (rural) were selected with 95.42 per cent and 11.52 per cent non-farm employment, respectively. Of the 9 sites in Cooch Behar (5 in Dinhata and 4 in Sitalkuchi) and 13 sites in North Parganas (7 in Baranagar and 6 in Swarupnagar), finally a total of 130 interviews of informal construction workers were considered for this analysis.

Methodology

The present study aims to identify the significant determinants that have influenced the daily earnings of construction workers in two different districts of West Bengal, using a multiple linear regression model (Table 1).

Positive signs suggest greater employment consistency and higher income. In contrast, negative signs indicate income insecurity implying that to secure uninterrupted working days, individuals are willing to accept lower pay. The proposed regression equation (Equation I) is

$$\log(earnings) = \ + \ .X1 + \ .X2 + \ .X3 + \mu .X4 + \ .X5 + \ .X6 + \ .X7 + \ .X8 + e$$

Table 1: Description of the Variables

Explanatory Variable	Nature	Relevant information	Expected Sign
Gender (X1)	Dummy Variable	Male:1 & Female:0	+
District Dummy (X2)	Dummy Variable	Cooch Behar:1 & North 24 Parganas:0	-/+
Skill of labourer (X3)	Dummy Variable	Unskilled-0, skilled-1	+
Experience Dummy (X4)	Dummy Variable	Less than 15 years:0 & above 15 years:1	+
Experience Square (X5)	Non-Dummy		+/-
Education in years (X6)	Non-Dummy		+
Average working Days in the last quarter (X7)	Non-Dummy		+/-
Location of the workplace (X8)	Dummy Variable	Urban:0 & Rural:1	-

Source: Authors' estimation

The estimation has been done using the software 'Jamovi' (Jamovi Project, 2021) after fulfilling and satisfying the assumptions of non-multicollinearity, normality etc. through the Variance Inflation Factor (VIF), and the Shapiro-Wilk test (Appendix Table A2), respectively.

Analysis of Data and Findings

Descriptive Statistics of the Sample

The sample included 130 labourers aged 16-65 (mean 39, SD 11), comprising 71 per cent males and 29 per cent females. Most female workers (65%) were unskilled, performing tasks such as carrying materials and cleaning, compared to 32 per cent of males. Skilled workers performed tasks like masonry, roofing, and painting. However, most of them did not have any formal or vocational skill training certificates, although they had acquired them through informal apprenticeship (mainly by the 'learning by watching and doing' technique). Labourers were included in the sample if they had been working independently of others. The majority of female workers either assisted their husbands or skilled workers at the worksite. The other relevant socio-economic characteristics of the sample have been presented in Table 2.

Table 2: Socio-economic Profiles of Samples Collected from Two Districts

Socio-economic factors	Geographical Location	Mean		Standard Deviation	
		C. Behar	N. 24 Parganas	C. Behar	N. 24 Parganas
Distance of workplace from residence (in km.) (on average)	Rural	4.14	2.44	0.512	0.458
	Urban	1.91	2.77	0.502	0.504
Average Working days in the last month	Rural	22.2	23.2	2.05	2.86
	Urban	21.7	22.1	2.31	2.43
Experience (in years)	Rural	14.6	15.4	6.68	6.49
	Urban	14.3	11.6	8.57	7.99
No. of family members	Rural	4.27	5.44	1.08	2.02
	Urban	4.49	5.00	1.05	1.78
No. of earning members	Rural	1.95	1.76	0.660	0.723
	Urban	1.60	1.48	0.653	0.640
Education in years	Rural	10.4	10.6	1.33	1.70
	Urban	8.67	10.7	3.17	1.80

| Skill of labourer | Rural | 0.500 | 0.550 | 0.512 | 0.502 |
| | Urban | 0.720 | 0.600 | 0.458 | 0.504 |

Source : Primary Survey, 2023-24.

Profile of Daily Earnings of Informal Construction Workers

As shown in Table 3, daily income in the range of Rs. 300-500 was the most frequent (50 per cent) range followed by about 31 per cent earning Rs. 500-700 and a mere 3 per cent receiving income Rs. 700-900 as highly skilled labour.

Table 3: Daily Earnings of Construction Workers

Daily earnings[2] (In Rs.)	Frequency	Per cent of the total
100-300	21	16.15
300-500	65	50.00
500-700	40	30.77
700-900	4	3.08
Total	130	100.00

Source: Primary Survey, 2023-24

Table 4 shows that unskilled women workers earn 49 per cent less than men in rural areas and 12 per cent less in urban areas. Notably, the earnings of unskilled workers often fall below the government's minimum wage of Rs. 376/day. Unskilled women in rural areas earn less than Rs. 200 daily, which is below the minimum wage for unskilled agricultural workers (Rs. 294), bidi leaf pluckers (Rs. 334), and fishing workers (Rs. 334). Skilled construction workers, however, earn above the legal minimum wage. The study found a gender gap in daily earnings; for males, earnings vary from Rs. 200 to Rs. 800, while for females, it is Rs. 110 to Rs. 600. In rural areas, skilled women earn 18 per cent less than men; in urban areas, the gap is 10 per cent. Therefore, the study, controlling such factors, affirms the earnings gap and such discrimination goes against women workerswithdifferences varying between 10 and 49 per cent. This observation confirms the findings by Tansel (2000).

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[2]   This study does not account for non-working days of self-employed construction workers.

Table 5 analyses the daily earnings of the informal workers by location, controlling for district and skill. In Cooch Behar, unskilled workers face a 20 per cent earnings gap, while skilled workers have a smaller gap of about 12 per cent. Conversely, for the North 24 Parganas district, this figure is estimated to be extremely high, at 45 per cent in rural areas and 30 per cent in urban areas, respectively. These findings are similar to that in Ramaswamy (2013).

Table 4: Daily Earnings of Informal Construction Labourers and Minimum Wage Rates by Gender and Skill

(in Rs.)

Unskilled Workers						
Location	Type of Labourer	Gender	Mean	Standard Deviation	Maximum	Minimum
Rural	Unskilled	Male	365	84	500	200
		Female	186	88	300	110
Urban	Unskilled	Male	415	127	650	280
		Female	370	63	500	250
Rural+Urban	Unskilled	Male+Female	350	124	650	110
Minimum Wage Rate	Unskilled	Male+Female	376	As of 2023, for construction workers in West Bengal		
Skilled Workers						
Location	Type of Labourer	Gender	Mean	Standard Deviation	Maximum	Minimum
Rural	Skilled	Male	420	108	550	250
		Female	345	122	525	200
Urban	Skilled	Male	500	140	800	370
		Female	450	117	600	330
Rural+Urban	Skilled	Male+Female	457	124	800	200
Minimum Wage Rate	Skilled	Male+Female	455	As of 2023, for construction workers in West Bengal		

Source: Primary Survey, 2023-24. For minimum wages, https://surl.li/ruhpek

Table 5: Descriptive Statistics of Earnings of Informal Construction Workers by Location

District	Type of Labourer	Geographical location	Mean	Standard Deviation	Maximum	Minimum
Cooch Behar	Unskilled	Rural	290	135	500	110
		Urban	360	119	around 650	around 250
	Skilled	Rural	390	76	525	250
		Urban	440	92.4	600	300
North 24 Parganas	Unskilled	Rural	230	69	380	110
		Urban	425	103	650	200
	Skilled	Rural	400	132	550	280
		Urban	575	131	800	350

Source: Primary Survey, 2023-24

Thus, based upon the analysis, it is inferred that the informal construction sector exhibits notable earning disparities in terms of gender and geographical location. Further, the results of the t-test (Table 6) confirms this occurrence. Women workers oftenreceive less earnings for the same work as their male counterparts. Similarly, labourers in rural areas receive lower earnings than workers in urban areas.

Table 6: Examining Earning Disparities Using the t-test

Comparison between different groups of labourers	t statistic	Df	P value	Remarks
Group-I (Female Workers) < Group-II (Male Workers)	-4.63	128	<0.001	Significant
Group-I (Workers in Urban areas)> Group-II (Workers in Rural areas)	4.05	128	<0.001	Significant

Source: Primary Survey, 2023-24

Determinants of Daily Earnings

The regression equation, as specified in Equation I, has been estimated using a different set of predictors. While Model I considers eight predictors, including average working days in the last quarter, Model II additionally includes an interaction term between average working days in the last quarter and skill. The interaction term is expected to

reflect the fact that, in reality, these two effects actually influence each other. Model I and Model II satisfy all the requisite assumptions of linear regression. The collinearity statistics and normality test results for the models have been presented in Appendix Tables A1 and A2, respectively. The results of the regressions are presented in Table 7. Model I has a good adjusted R-squared value of 0.50. The p-value of the F-statistic is less than 0.001, confirming the overall significance of the model. A similar result is also obtained for Model II. However, the positive interaction term requires further attention, which has been added and described later.

In both Model I and Model II, predictors such as gender, district, skill, location, working days, and experience squared are found to be significant. Notably, informal workers in North 24 Parganas earned more than those in Cooch Behar, likely due to urbanization and higher demand for skilled labour. However, this trend did not hold in the rural areas of North 24 Parganas. It is interesting to note that the district dummy has been significant, indicating that the daily earnings (on average) of informal construction workers in the North 24 Parganas district were higher than those in the Cooch Behar district.

The education of the labourer is insignificant. In some literature, vocational training has been identified as an explanatory variable in explaining labourers' earnings; however, in this study, it has not been taken into consideration, as no labourer in the sample was found to have completed formal vocational training. Therefore, the study considers only formal education, taken as the number of years of education. The sign of the estimated value of the gender dummy confirms, as mentioned earlier, that an earnings gap biased against female workers does exist.

Masons and painters are classified as skilled due to the nature of their work, leading to higher earnings, while helpers and loaders are considered unskilled. Regression results show skilled workers earn more than unskilled ones.

This regression model suggests that unskilled workers compensate for their lower remuneration by working for a greater number of days. This strategy has also been pursued in this quarter, aiming to increase working days, and therefore, we found an inverse relationship between it and earnings. The data from last quarter was used, as the current quarter at the time of the survey had not been completed. However, the interaction term between skill and average working days in the last quarter is found to be positive, suggesting that skilled workers benefit from increased workdays due to

higher rewards. The study reveals that informal construction labour returns are segmented by skill level, indicating a labour market where unskilled labour is often oversupplied and poorly compensated.

The 'experience dummy' variable, based on whether workers had up to 15 years of experience or more, showed a negative impact on daily earnings. This indicates that if they cross that threshold in years of experience, their earnings decline, and this may be attributed to their limited mobility and decline in productivity or physical ability over time. The probable reason is that the variable reflects cumulative years of work in the construction sector, where the physical demands of the job may increasingly affect performance with age.

Figure 2 shows that daily earnings increase with experience but at a diminishing rate, eventually declining after a certain point. This explains the negative coefficient for experience squared as seen in Table 7. This result confirms the observations of Zuo (2013) and Dahl & Kaiser (2009). Generally, in this sector, demand for labourers declines with the rise in the age of workers, due to the perception among recruiters that a young worker is more productive than an older worker.

Figure 2: Daily Earnings with the Rise in Experience
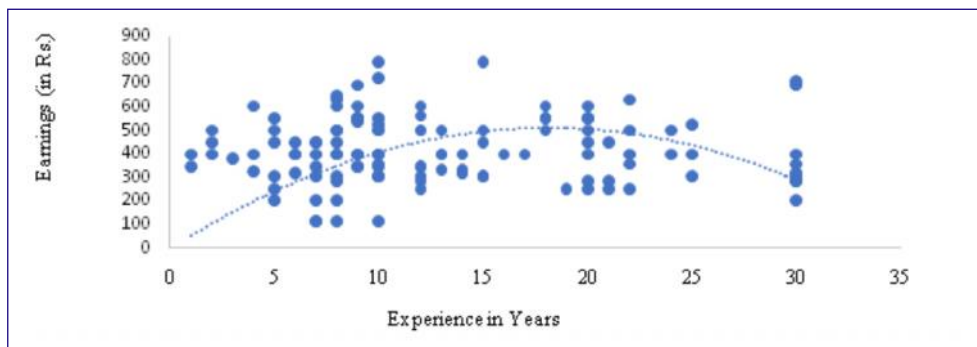
Source : Primary Survey, 2023-24.

Experience square has a significantly negative regression coefficient (the same result has also been found by Kahyalar et al. (2018) and Tansel (1999)), which is very obvious because, at higher experience years, earning starts to increase at a decreasing rate. After a certain threshold point, they cease to grow and eventually start to decline. So, the negative coefficient of the quadratic term indicates an inverted 'U' shaped curve (Hair et al., 2011).

We have also run several other regression models, considering age and age squared instead of taking experience as an explanatory variable; here, we have also obtained a negative sign for the coefficient of age squared on earnings. However, the issue of multicollinearity arose between age and age squared; therefore, Model III was not considered for analysis. The results of such a model, however, have been reported in Appendix Table A_4.

To overcome the multicollinearity issue, we have used age-centered (i.e., age minus the mean age) and age-centered square instead of age and age squared, and run a regression (Model IV). This transformation improves the VIF values; however, the value of R-squared remains the same as in Model-III, and the normality issue persists. Therefore, Model IV was also not considered and was not taken up further. However, we have reported the coefficients and model fitness in connection with that model in the appendix.

Table 7: Results of the Regression

Dependent Variable: log of daily earnings	Model-I	Model-II
Adjusted R-squared	0.50	0.50
Variable	Coefficient	Coefficient
Intercept	3.03***	3.03***
Gender dummy *(reference category: female workers)*	0.098***	0.100***
District dummy *(reference category: North 24 Parganas)*	-0.11***	-0.11***
Skill of labourer *(reference category: Unskilled)*	0.103***	0.080**
Experience dummy *(reference category: 0 to 15 years of experience)*	-0.006	-0.013
Experience square	-1.06e"4**	-1.00e"4**
Education in years	0.0016	0.001
Geographical location of workplace *(reference category: Urban)*	-0.104***	-0.104***
Average working days in the last quarter	-0.021***	-0.021***
Average working days in the last quarter X level of skill (interaction)	-	8.51e"4
F Statistic (Overall model fitness)	15.9***	15.4***
AIC	-171	-170

Source: Authors' calculation using the 'Jamovi' software

Note: *** at 99 per cent confidence levels, **at 95 per cent confidence levels

In addition, we have also run another regression (Model-V), replacing experience and age-squared by the interaction of age and experience as an explanatory variable. However, the normality condition has not been satisfied, and therefore, we have not taken up this model either. Lastly, as per the model specification criteria, since the slightly lower value of AIC for Model-II over Model-I, Model-II is chosen. Therefore, the coefficients of explanatory variables of Model-II have been mentioned in Table 7.

Concluding Observations

The present study identifies key factors influencing the daily earnings of informal construction workers in West Bengal, including skill, geographical location, district, and gender. Urban workers earn more than rural ones; the gap is more pronounced in North 24 Parganas than in Cooch Behar. On the other hand, the study finds the issue of gender disparities in earnings, which goes against women workers. The earnings gap ranges between 10per centto 49 per centafter controlling for location and skill. The mean daily earnings of construction workers in Cooch Behar was19.73 per cent less than that in North 24 Parganas.The study recommends the need for targeted policy interventions aimed at enhancing skills among unskilled workers through training, as skills have a positive impact on earnings.

To improve the efficiency and large-scale implementation of the Building and Other Construction Workers (BOCW) Act, 1996, there is a need for better enforcement, awareness programs at the worksite, simplification of the registration process for easy disbursement of benefits, and other measures, which could significantly improve the welfare of millions of construction labourers.

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Appendix

Table A1: Collinearity Statistics (using VIF)

	Model-I	Model-II
Predictors	VIF	VIF
Geographical location	1.19	1.19
District	1.26	1.27
Exp. Dummy	1.36	1.39
Exp. Square	1.16	1.20
Education in years	1.29	1.30
Skill of labourer	1.25	2.9
Gender	1.14	1.26
Avg. Working days in the last quarter	1.27	1.28
Avg. Working days in the last quarter X Skill	N.A.	2.9

Source: Authors'calculation using the software Jamovi.

Table A2: Normality Test (Shapiro-Wilk)

Model	Statistic	P
Model-I	0.983	0.104
Model-II	0.983	0.101

Source: Authors' Calculation.

Table A3: Other Regression Models

Model-III		Model-IV		Model-V	
Adjusted R square	0.485	Adjusted R square	0.485	Adjusted R square	0.485
Variable	Coefficient	Variable	Coefficient	Variable	Coefficient
Intercept	3.00***	Intercept	3.00***	Intercept	3.01**
Gender dummy	0.095***	Gender dummy	0.095***	Gender dummy	0.094**
District dummy	-0.10***	District dummy	-.096***	District dummy	-0.100***
Skill of labourer	0.069*	Skill of labourer	0.069*	Skill of labourer	0.067*
Age	0.0010	Age centered	-0.001	Age X experience	5.56e−6
Age square	-2.75e−5	Age centered square	-2.75e−5	Age square	-1.68e−5
Education in years	0.004	Education in years	0.004	Education in years	0.004
Average working days in the last quarter	-0.022***	Average working days in the last quarter	-0.022***	Average working days in the last quarter	-0.022***
Average working days in the last quarter X skill (interaction)	0.0014	Average working days in the last quarter X skill (interaction)	0.0010	Average working days in the last quarter X skill (interaction)	0.0018
Geographical location of workplace (Urban/Rural)	-0.105***	Geographical location of workplace (Urban/Rural)	-0.105***	Geographical location of workplace (Urban/Rural)	-0.105***
F Statistic (Overall model fitness)	14.5***	F Statistic (Overall model fitness)	14.5***	F Statistic (Overall model fitness)	14.5***
Remarks	A multicollinearity issue is found between age and age squared, as the VIF has come out extremely high. The R-squared value is comparatively less than Model I and II. Normality issue is also there.	Remarks	R-squared remains the same as Model-III, no such improvement. Normality issue is still present.	Remarks	Normality criteria have not been satisfied. The R-squared value is comparatively less than Model I and II.
Decision	Not taken up the model	Decision	Not taken up the model	Decision	Not taken up the model

An Assessment of Factorial Impetus of Financial Inclusion through PMJDY: Evidences from Madhya Pradesh and Rajasthan

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Abstract

This paper examined the impact of PMJDY in Madhya Pradesh and Rajasthan and investigated how demographic and socio-economic factors influence beneficiaries' behaviours and attitudes toward adopting the scheme. This study further assesses its role in financial empowerment, particularly for women. The empirical analysis revealed significant disparities in financial behaviour, preferences, and accessibility across gender, region, and category for the two states. Key findings include the underrepresentation of female beneficiaries compared to males, underscoring the need for gender-sensitive measures to bridge this gap.

Keywords: Financial Inclusion, PMJDY, Financial Literacy, Economic Empowerment.

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Introduction

Since independence, financial inclusion has been a cornerstone of India's development agenda. The Pradhan Mantri Jan Dhan Yojana (PMJDY) sought to provide a holistic financial inclusion program and integrating the unbanked into the formal financial sector. The scheme's slogan, "*Mera Khata – Bhagya Vidhata*" (My Account - The Fortune Maker), emphasised its goal of providing banking facilities to all households in the country and allaying their financial hardships. Setting a world record by opening 1.5 crore accounts on its launch day, the scheme's growth has been phenomenal, with accounts increasing from 14.72 crore in March 2015 to 54.58 crore in March 2025, 56 per cent held by women and 67 per cent in rural areas. In this context, examining the behavioural and demographic dimensions of PMJDY adoption becomes necessary to evaluate the scheme's effectiveness and shape future interventions. Hence, this paper examines how demographic and socio-economic factors influence PMJDY adoption by the beneficiaries in the Indian states of Madhya Pradesh and Rajasthan.

Due to scant literature on assessing the impact of PMJDY in Madhya Pradesh and Rajasthan, the current study examines these two states. Most of the workers in these states are part of the informal sector, which makes these states even more strategic in assessing the impact of PMJDY. To achieve this objective, a mixed stratified and convenience sampling method within demographic, socio-economic and geographic sub-groups yielded 1,434 samples in Rajasthan and 1,070 in Madhya Pradesh. Anon-parametric chi-square test assessed the impact of age, gender, occupation, and income on beneficiaries' behaviour and attitudes.This paper has been organised as follows. Section 2 presents a literature review, followed by the methodology in Section 3. Section 4 presents findings and results. Section 5 presents the discussion, and the last section comprises the conclusions.

Review of Literature

Financial inclusion is often referred to as the "process that ensures the ease of access, availability, and usage of the formal financial system for all members of an economy" (Sarma, 2008). The Government of India's Committee on Financial Inclusion (Rangarajan Committee, 2008) defines financial inclusion as providing access to financial services and timely, adequate credit to vulnerable segments, such as low-

income and disadvantaged groups, at an affordable cost. Hannig and Jansen (2010) suggest that financial inclusion includes the "unbanked" population and the process can be measured through access, quality, usage and impact. Policy efforts should focus on addressing market inefficiencies and removing non-market barriers to ensure broader access to financial services.

Several studies have shown a long-run, positive, and bi-directional causality between financial inclusion and economic growth. Drawing on panel data from 31 developed and developing economies, Sethi & Acharya (2018) show a long-run, two-way correspondence between financial inclusion and economic growth. Aportela (1999) observed that families in developed cities had an average of seven percentage points higher savings than low-income households in developing cities, hence financial inclusion can shrink the growth of informal credit sources categorised by higher interest rates, illegitimate enforcement mechanisms, and lack of transparency. The Self-Help Group (SHG) and bank linkage programme in Assam had ensured successful financial inclusion and reduced social exclusion (Maity, 2023).

Informal sector has long seen and faced the brunt of financial exclusion. A field experiment conducted in Nepal on a sample of 1118 female households showed that a savings account with zero transaction costs and high proximity to a bank branch led to high take-up and usage rates compared to similar studies in other settings and improved the households' self-reported financial situation (Prina, 2015). The size of the informal sector is a crucial characteristic of emerging markets. It contributes to about a third of the GDP and employs more than 70 per cent of the population in developing economies (Ohnsorge & Yu, 2022). Due to the magnitude and heterogeneity of the informal workforce, the adaptation of individuals and companies to the financial structure would be greatly conducive to economic growth (Sarma & Pais, 2011). Rising demands in the financial service field has greatly raised the need and demand for innovative and applicable financial products catering to various consumers with their specific requirements. Various reasons are associated with financial exclusion described by Sharma (2016), including the lack of banking access, financial literacy, inappropriate products, complexity, low income, distance to bank locations, and social or psychological barriers to take advantage of the financial services acting as the "5As" of financial inclusion: availability, awareness, affordability, adequacy, and accessibility. Empirical evidence illustrated by a panel study of 152 countries has indicated that improved financial inclusion can lead to a decrease within the levels of

informality, improving financial resilience for households within those structures (Lahura & Vargas, 2021).

There is recent evidence illustrating some socio-economic factors that determine financial inclusion. According to Mose et al. (2024), digital financial inclusion in Kenya is higher among males, young persons, educated, employed, and richer persons. This is also supported by Sethy et al. (2023) and Kumar et al. (2024), who argue that age, gender, education, income, and regional variables are important factors influencing financial inclusion, especially within South Asia, where there are continued gaps between genders.

Recent studies highlight the socio-economic determinants shaping financial inclusion outcomes. Mose et al. (2024) found that in Kenya, digital financial inclusion is higher among men, younger individuals, the educated, employed, and wealthier groups. Similarly, Sethy et al. (2023) and Kumar et al. (2024) identified age, gender, education, income, and regional factors as significant determinants in India and South Asia, with persistent gender disparities. Cicchiello et al. (2021) further emphasised the role of economic growth, literacy, and employment in advancing financial inclusion.

Financial inclusion has also been a central focus for Indian policymakers since independence. Prior literature has shown that exclusion from the financial ecosystem would result in a vicious circle of social inequality and involuntary poverty (Aghion & Bolton, 1997; Banerjee & Newman, 1993). According to the recent report of the World Bank, as of 2021, 11.9 per cent of the population in India is living in poverty on 2.15$ per day, a substantial reduction from that of 63.11 per cent in 1977. The Government of India and the Reserve Bank of India have taken various measures over the years to circumvent financial exclusion. The policy implementation of financial inclusion has been in three phases (Gupta & Singh, 2013; Mathew & Kurian, 2017). The first phase (1947-1991) dealt with bank nationalisation, developing cooperatives, RBI branch licensing, RRBs, and NABARD, thereby improving rural lending considerably. The second phase (1991-2005) emphasized inclusion through the SHG-Bank Linkage Program, Kisan Credit Cards, and Swarojgar Credit Cards. The third phase (2005 onwards) articulated the inclusion objective through Business Correspondent Facilitator concepts, digital expansion, Electronic Benefits Transfer, inclusion funds, and Aadhaar-based identity solutions.

This electronic identification has been a catalyst for improving inclusivity in the financial sector, especially for the poor, as the Aadhaar card is accepted by banks, government officials, and insurance companies as a valid identification proof. According to the *World Development Report* (2016), Aadhaar has facilitated speeding up the Know Your Customer (KYC) process. Additionally, the government of India initiated the Swabhimaan campaign in 2011 to bring branchless banking to areas that lack access to physical branches by using Business Correspondents to provide services like deposit, collection, remittances, etc.

Financial inclusion is crucial for human development (Singh, 2014), yet a large part of India's population is excluded from banking services despite India's remarkable banking sector performance (World Bank, 2022)[1]. According to Census 2011, around 42 per cent of households and almost half of households in rural areas did not have access to formal financial services. Previous research monitoring financial inclusion programs suggested ways to further accelerate this process through strategic collaboration by banks and policymakers (Sharma & Kukreja, 2013; Mohan, 2014). Still, effective coordination was weak; hence the dependence on informal moneylenders increased, leaving the most helpless members of society victims of such moneylenders (Arulmurugan et al., 2013).

The need to reform credit and financial service delivery to enhance financial inclusion was proposed by the Rangarajan Committee (2008), which emphasised that easy access to structured financial products enables underprivileged communities to achieve economic stability and social integration (Beck et al., 2008). In response, the Government of India launched the Pradhan Mantri Jan Dhan Yojana (PMJDY) during the third phase of financial inclusion to expand beneficiaries' absorptive and earning capacities (Thapar, 2013). The scheme's impact is evident in the rise of adult account ownership from 35 per cent in 2011 to over 90 per cent[2] in 2021 (Klapper et al., 2021).

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[1]   http://www.indiaenvironmentportal.org.in/files/file/global%20findex%20database%202021.pdf

[2]   For details, see https://economictimes.indiatimes.com/news/india/29-3-persons-aged-15-24-yrs-not-in-education-employment-or-training-nsso-survey/articleshow/98482135.cms?from=mdr

Thus, the existing literature is limited to finding reasons for exclusion from such financial penetration schemes (Verma & Garg, 2016; Singh et al., 2021). On the inauguration day of PMJDY, 1.5 Crore bank accounts were opened. PMJDY accounts have grown three-fold from 14.72 crore in March 2015 to 46.25 crore in August 2022. Their exists limited empirical research disaggregating beneficiary behaviour across states with differing socio-economic contexts. The present study examines how demographic and socio-economic factors influence beneficiaries' behaviour and attitudes toward the scheme to address this gap.

Data and Methodology

Sampling Framework and Data

The present study has targeted two states - Madhya Pradesh and Rajasthan, with an approximate sample of 3000. These states are selected due to their large rural and underbanked populations, significant socio-economic diversity, and the presence of marginalised communities, who are primary targets of the scheme. Their socio-cultural variation, from tribal regions in Madhya Pradesh to desert areas in Rajasthan, provides scope for comparative analysis across different geographies and communities. Additionally, the availability of secondary data and supportive state policies makes them strong case studies for evaluating PMJDY's intended and actual outcomes.

We have systematically and scientifically chosen five divisions in each state and 30 districts of these states. Responses were collected from the beneficiaries located in Rewa, Gwalior, Ujjain, Jabalpur, and Hoshangabad divisions of Madhya Pradesh, and Jaipur, Jodhpur, Bharatpur, Pali, and Bikaner divisions of Rajasthan. The selection of these areas is based on the principle of maximum coverage of beneficiaries across all demographic and socio-economic strata in all four zones (North, South, East and West).

Following a stratified sampling approach, the population was categorised into sub-groups based on geographical location, demographic variables, and socio-economic status. Within each subgroup, samples were then randomly drawn. The study collected 1,500 responses in Rajasthan and 1,418 in Madhya Pradesh, from which a final sample of 1,434 in Rajasthan and 1,070 in Madhya Pradesh were used for analysis. Table 1 presents the stratified distribution of respondents from the two selected states.

Table 1: Distribution of Sample for Madhya Pradesh and Rajasthan

State	Division	District	Responses	Region
Madhya Pradesh	Gwalior	Gwalior	37	Urban
		Shivpuri	101	Semi-Urban
		Guna	100	Rural
	Jabalpur	Jabalpur	106	Urban
		Narsinghpur	51	Semi-Urban
		Mandla	50	Rural
	Narmadapuram	Narmadapuram	98	Urban
		Halda	91	Semi-Urban
		Betul	51	Rural
	Rewa	Satna	80	Urban
		Singrauli	65	Semi-Urban
		Rewa	70	Rural
	Ujjain	Ujjain	56	Urban
		Dewas	84	Semi-Urban
		Shajapur	30	Rural
Rajasthan	Bharatpur	Bharatpur	96	Urban
		Sawai Madhopur	99	Semi-Urban
		Karauli	100	Rural
	Bikaner	Bikaner	104	Urban
		Sri Ganganagar	97	Semi-Urban
		Hanumangarh	99	Rural
	Jaipur	Jaipur	97	Urban
		Dausa	57	Semi-Urban
		Alwar	111	Rural

	Jodhpur	Jodhpur	100	Urban
		Barmer	100	Semi-Urban
		Balotra	70	Rural
	Pali	Pali	91	Urban
		Jalore	43	Semi-Urban
		Sirohi	50	Rural
		Shivpuri	68	Semi-Urban
		Guna	52	Rural

Source: Authors' compilation

Sample Characteristics

We present the beneficiaries' profiles across various categorical variables under demographic, socio-economic, and geographic sub-groups. Table 2 presents the demographic and socio-economic distribution of the PMJDY beneficiaries surveyed in Madhya Pradesh and Rajasthan. In terms of gender, female representation is higher in Madhya Pradesh (52 per cent) compared to Rajasthan (32 per cent). Most respondents in both states fall within the 18–39 age group. Caste-wise, OBCs constitute the largest group in both states, followed by SCs and unreserved categories. Educational attainment is relatively low, with a substantial proportion having only primary or no formal education. Most beneficiaries earn less than Rs. 10,000 per month, with a slightly higher proportion in Rajasthan falling in the lowest income bracket. Regionally, the sample includes a balanced mix of rural, semi-urban, and urban respondents, with Madhya Pradesh showing a higher concentration of urban beneficiaries (47 per cent) than Rajasthan (33 per cent). Figures 1 and 2 exhibit the Rajasthan and Madhya Pradesh sub-groups, respectively.

Table 2: Demographic and Socio-Economic Profile of PMJDY Beneficiaries in Madhya Pradesh and Rajasthan

Particulars		Madhya Pradesh (%)	Rajasthan (%)
Gender	Male	46	68
	Female	52	32
	Transgender	2	0
Age Group	Below 18	14	5
	18-39 Years	50	55
	40-60 Years	29	30
	60 Years and Above	7	10
Category	Unreserved	24	16
	OBC	33	39
	SC	28	26
	ST	13	13
	EWS/Others	2	6
Educational Qualification	Uneducated	21	23
	Primary	28	26
	Matriculation	23	16
	Higher Secondary	16	20
	Graduate	11	13
	Post Graduate	1	2
Monthly Income	Less than 5000	28	30
	5000-10000	36	29
	10000-20000	28	31
	More than 20000	8	10
Region	Rural	33	34
	Semi Urban	20	33
	Urban	47	33

Source: Authors' compilation

Figure 1: Sample Distribution in Rajasthan

Source: Authors' compilation

Figure 2: Sample Distribution in Madhya Pradesh

Source: Authors' compilation

Methodology

Given the categorical nature of the key variables involved in analysing beneficiary behaviour, such as gender, occupation, income group, region, and adoption of digital financial tools, a non-parametric statistical chi-square test of independence was employed. This test examines the associations between demographic characteristics and behavioural responses related to financial inclusion, transaction activity, digital tool adoption, and perception of direct benefits under PMJDY.

The rationale for applying the chi-square test is based on various reasons. First, the nature of the data used in the study necessitated a non-parametric approach, as the key demographic and socio-economic variables are categorical. Second, the data failed to meet the normality assumption required for applying parametric tests, thereby justifying the use of chi-square test. Finally, the primary objective of the analysis was to explore if statistically significant relationships exist between various demographic groups and key indicators of financial behaviour, such as financial participation, awareness, and empowerment, within the framework of the PMJDY. All demographic and socio-economic variables were pre-coded and categorised to provide analytical transparency and clarity.

The study focused on analysing key behavioural dimensions to assess the impact of PMJDY on financial inclusion outcomes. Financial awareness was measured to understand beneficiaries' knowledge of banking services offered and the efficiency of financial tools in catering to their requirements. Frequency of transactions was studied as a proxy for the intensity of active financial activity, indicating how frequently beneficiaries accessed formal banking channels. The study also assessed the level of direct benefit transfers that the beneficiaries received, which reflected the efficiency of the scheme in providing welfare payments and government subsidies. Additionally, the use of digital financial instruments such as RuPay debit cards and UPI was analysed to gauge the beneficiaries' shift toward a cashless economy, emphasizing the increased utilization of digital channels. These dimensions were analysed along with demographic factors to evaluate how various beneficiary groups engage with and gain from the PMJDY.

Findings

The results of chi-square test (Table 3) found that social categories have a significant effect on PMJDY awareness in Ujjain and Jaipur. Income is significant only in Madhya Pradesh. Occupation shows highest significance in Rajasthan, especially in Bikaner & Bharatpur, where unorganized sector employees have higher awareness due to increased interaction with government or banking agencies. Education has highest significance in Rajasthan. However, age was insignificant in various regions.

Table 3: Level of Awareness across Demographics and Socio-Economic Factors in Madhya Pradesh and Rajasthan

	Statistics	Gender	Category	Income	Occupation	Qualifications	Age	Region
Madhya Pradesh	Overall	5.419	3.542	11.681**	9.400	8.906	3.924	11.854*
	Gwalior	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Rewa	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Narmada puram	3.363	0.503	7.259***	4.990	5.022	0.565	0.409
	Jabalpur	1.522	1.370	1.376	2.399	2.873	2.790	13.538*
	Ujjain	0.457	10.298**	4.570	3.696	4.379	4.142	18.250*
Rajasthan	Overall	0.586	2.485	0.894	358.339*	70.581*	1.128	0.515
	Bikaner	0.000	1.140	0.921	76.971*	5.683	4.596	3.948
	Bharatpur	0.000	1.799	1.747	147.498*	5.597	0.764	2.027
	Jaipur	0.078	3.833*	2.743	4.015	4.779	0.570	1.107
	Jodhpur	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Pali	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Source: Authors' compilation
Note: *, **, and *** show significance at 10 per cent, 5 per cent and 1 per cent levels, respectively

Table 4: Frequency of Transactions across Demographics and Socio-Economic Factors in Madhya Pradesh and Rajasthan

	Statistics	Gender	Category	Income	Occupation	Qualifications	Age	Region
Madhya Pradesh	Overall	15.110	19.222	56.541*	467.264*	26.385	59.685*	128.267*
	Gwalior	8.275**	6.797	15.863**	44.429**	8.533	19.079*	110.604*
	Rewa	6.658	21.243*	22.198*	54.008***	19.035**	21.475*	105.707*
	Narmada puram	7.424	18.122**	17.064*	19.971	24.401*	15.630**	3.086
	Jabalpur	16.886**	20.410***	21.400**	149.603*	18.294	7.628	38.688*
	Ujjain	4.615	9.764	10.459	6.801	6.793	10.578	3.515
Rajasthan	Overall	17.481**	89.733*	59.309*	380.844*	54.073*	32.995*	31.264*
	Bikaner	9.376***	27.312**	7.463	67.403	7.964	12.584	32.736*
	Bharatpur	5.443	21.759**	8.925	55.069	11.180	8.560	57.176*

Rajasthan	Jaipur	18.750*	31.411**	34.084*	100.531*	28.187	10.065	46.537*
	Jodhpur	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Pali	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Source: Authors' compilation
Note: *, **, and *** show significance at 10 per cent, 5 per cent and 1 per cent levels, respectively.

The analysis of the frequency of transactions made by PMJDY (Table 4) reveals that gender is a significant factor for Rajasthan and Jaipur, but less significant for Madhya Pradesh, with the exception of Jabalpur. The effect of social variables and income is considerable for the frequency of transactions in various districts. The level of education increases the frequency of transactions, and this effect is prominent in the districts of Rewa and Narmadapuram, which indicates proper awareness about money management for the educated population. The factor of age is also significant for various regions. Rural and urban differences exist, and for Rajasthan, the rural population shows a higher frequency of transactions, but for Madhya Pradesh, the semi-rural population demonstrates a higher frequency of transactions.

The next question under study is the preference for PMJDY facilities, as shown in Table 5. An analysis in MP reveals that gender significantly sways preferences in Rewa and Jabalpur. Social factors significantly influence MP, Gwalior, Rewa, Narmadapuram, and Jabalpur. Economic standing shapes preferences in MP, Gwalior, Rewa, Narmadapuram, Ujjain, and Jabalpur, while occupational profiles impact preferences in MP, Gwalior, Rewa, Narmadapuram, Jabalpur, and Ujjain. Educational attainment and age also significantly modulate MP, Gwalior, Rewa, Jabalpur, Ujjain, and Narmadapuram preferences. Regional disparities further influence these preferences, particularly in MP, Gwalior, Rewa, Jabalpur, and Narmadapuram.

Table 5: Preference of PMJDY Facilities across Demographics and Socio-Economic Factors in Madhya Pradesh and Rajasthan

	Statistics	Gender	Category	Income	Occupation	Qualifications	Age	Region
Madhya Pradesh	Overall	80.111*	162.121*	79.003*	635.338*	75.168*	66.919*	66.955*
	Gwalior	9.193	86.494*	55.360**	243.278*	52.694	38.830***	118.372*
	Rewa	35.980*	45.262*	27.284**	111.063	48.471*	24.081	76.499*

	Narmada puram	11.376	50.125*	33.932*	112.013*	22.772	25.238**	19.435**
	Jabalpur	23.089**	81.265*	26.110**	129.866***	49.477*	27.607**	24.223*
	Ujjain	54.623*	27.04	35.677*	52.819***	30.737***	16.57	10.768
Rajasthan	Overall	22.090***	100.550*	54.715*	304.918	55.080**	49.646*	142.601*
	Bikaner	16.473*	18.645	26.207**	108.41	19.257	10.808	33.731*
	Bharatpur	12.940**	30.520***	34.032*	137.251**	26.535	63.922*	132.499*
	Jaipur	15.489**	43.391**	27.031	84.045	54.492**	36.167**	28.905**
	Jodhpur	3.12	29.199**	31.487*	42.978**	35.606**	95.493*	99.990*
	Pali	2.051	63.694*	27.195*	60.449*	41.695*	45.964*	59.652*

Source: Own calculation
Note: *, **, and *** show significance at 10 per cent, 5 per cent and 1 per cent levels, respectively.

In Rajasthan, the analysis uncovers a gender-based divergence in facility preferences, particularly pronounced in Bikaner and Jaipur. Social stratifications further complicate these preferences, with significant variations observed across Rajasthan, Bikaner, Jaipur, Bharatpur, and Jodhpur. Economic standing and occupational profiles also emerge as influential factors, especially in Rajasthan, Bikaner, Bharatpur, Jodhpur, and Pali. Educational attainment and age further modulate these preferences, with notable effects in Rajasthan, Jaipur, Bharatpur, Jodhpur, Pali, and Jodhpur. Geographical disparities, particularly in Rajasthan, Bikaner, Bharatpur, Jaipur, and Jodhpur, add another layer of complexity to these preferences.

As far as Direct Benefit Transfer (DBT) is concerned, in both states, gender emerges as a significant determinant, with certain districts like Bikaner, Jaipur, Gwalior, Jabalpur, and Ujjain showing greater impact (Table 6). This highlights potential gender disparities in the ultimate receipt and benefit of direct benefits, necessitating gender-sensitive approaches in the scheme's implementation. Social stratifications based on caste and religion influencethe benefits across multiple districts in both states. Economic standing and occupational profiles also significantly shape the benefits, particularly in districts like Bikaner, Bharatpur, Jodhpur, Pali, Gwalior, Rewa, Ujjain, and Jabalpur. This suggests that the scheme's benefits are closely tied to the financial needs and work nature of the beneficiaries. Educational attainment and age further modulate the benefits, with districts like Jaipur, Bharatpur, Jodhpur, Pali, Gwalior, Rewa, Jabalpur, and Ujjain showing significant effects. This indicates that financial literacy, eligibility criteria,

and financial needs or habits associated with different age groups are important considerations. Lastly, regional disparities significantly affect the benefits, particularly in districts like Bikaner, Bharatpur, Jaipur, Jodhpur, Gwalior, Rewa, Jabalpur, and Narmadapuram.

Table 6: Receipt of Direct Benefits across Demographics and Socio-Economic Factors in Madhya Pradesh and Rajasthan

	Statistics	Gender	Category	Income	Occupation	Qualifications	Age	Region
Madhya Pradesh	Overall	43.413***	116.479*	75.207	543.703	148.226	214.904*	81.264*
	Gwalior	12.604*	14.191	21.527**	62.313**	27.931**	15.521***	47.433*
	Rewa	12.314	33.009	100.262*	64.003	35.388	139.464*	30.725*
	Narmada puram	22.136	22.683	30.842	43.821	22.33	43.791**	29.778**
	Jabalpur	24.366*	57.105*	24.026*	74.294	79.258*	15.457***	61.172*
	Ujjain	20.969	68.826**	57.516**	257.190*	62.879***	63.756***	60.566*
Rajasthan	Overall	123.387*	148.529*	217.519*	577.111	180.037*	147.418*	382.733*
	Bikaner	23.386*	31.587	35.19	541.182*	55.288	28.465	25.793
	Bharatpur	19.711**	51.202	99.340*	318.222*	57.911	27.729	34.537**
	Jaipur	20.475	48.519	86.099*	297.491*	77.645	71.929*	58.103*
	Jodhpur	32.931	108.941*	134.308*	133.160*	104.031*	95.493*	303.536*
	Pali	23.390*	94.354*	71.038*	73.666**	78.883*	46.913*	260.129*

Source: Own calculation
Note: *, **, and *** show significance at 10 per cent, 5 per cent and 1 per cent levels, respectively.

Next, we find that the usage of UPI for transactions is influenced by demographic and socio-economic factors, where gender emerges as a significant determinant in both states, as shown in Table 7.

Table 7: Usage of UPI across Demographics and Socio-Economic Factors in Madhya Pradesh and Rajasthan

	Statistics	Gender	Category	Income	Occupation	Qualifications	Age	Region
Madhya Pradesh	Overall	87.562*	45.548*	62.313*	782.409*	78.781*	75.428*	23.672**
	Gwalior	15.284**	19.801	32.443	107.260**	47.537**	16.439	96.512*
	Rewa	19.585***	27.390	42.419*	264.030*	59.588*	38.331**	84.669*

	Narmad apuram	14.179	29.015***	71.221*	59.018	31.238***	21.157	43.185*
	Jabalpur	35.171*	40.320*	17.706	123.707	34.067**	12.153	35.067*
	Ujjain	11.157	26.967	18.169	50.089	34.908**	47.077*	14.215
Rajasthan	Overall	63.093*	71.729*	113.323*	445.898*	124.656*	65.909*	57.933*
	Bikaner	56.148*	27.776	65.811*	213.729*	78.557*	37.233*	27.439*
	Bharatpur	16.036*	21.380	76.561*	221.084*	43.446**	22.163	75.960*
	Jaipur	15.129**	31.303	26.449***	124.990***	53.346*	17.375	64.187*
	Jodhpur	13.781***	34.471*	42.423*	27.473	47.681*	20.643***	25.078*
	Pali	4.792	47.728*	59.510*	54.605*	104.210*	51.080*	67.238*

Source: Own calculation
Note: *, **, and *** show significance at 10 per cent, 5 per cent and 1 per cent levels, respectively.

Gender significantly influences adoption, with 42.3% of females in Jaipur using digital wallets. Social factors, including caste and religion, affect usage more broadly in Madhya Pradesh (Rewa, Narmadapuram, Jabalpur, Ujjain) than Rajasthan (Jodhpur, Bharatpur, Jaipur, Pali). Income and occupation strongly impact adoption, particularly in Madhya Pradesh, while educational qualifications influence usage more in Rajasthan. Age is also significant, with greater effects in Madhya Pradesh. Regional disparities further shape UPI adoption, notably in Rajasthan's Bikaner, Bharatpur, Jaipur, Jodhpur, and MP's Gwalior, Rewa, and Jabalpur.

Table 8: Saving Habits across Demographics and Socio-Economic Factors in Madhya Pradesh and Rajasthan

	Statistics	Gender	Category	Income	Occupation	Qualifications	Age	Region
Madhya Pradesh	Overall	0.571	84.895*	29.445*	120.988**	45.954*	12.410	22.800*
	Gwalior	0.618	24.642*	8.235	24.325	20.292**	13.926**	14.626*
	Rewa	15.378*	30.165*	8.263	16.911	10.067	3.306	14.707*
	Narmada puram	3.178	30.481*	38.720*	51.412*	30.943*	4.365	8.919***
	Jabalpur	9.604**	3.117	11.397***	51.998	13.523***	3.674	15.545*
	Ujjain	11.838**	32.897*	14.006**	14.188	17.687**	4.703	9.097***
Rajasthan	Overall	29.585*	48.251*	29.641*	293.853*	32.496*	21.246**	111.267*
	Bikaner	0.008	4.657	2.783	12.346	2.436	0.758	0.522

Bharatpur	0.000	3.775	1.059	4.143	3.226	4.744	0.998
Jaipur	23.598*	25.271**	21.569**	195.628*	47.709*	25.481*	67.849*
Jodhpur	6.514	3.104	5.136	39.019*	15.105	11.535***	4.855
Pali	6.915**	21.030*	20.551*	20.163***	10.885	11.314***	9.802**

Source: Own calculation

Note: *, **, and *** show significance at 10 per cent, 5 per cent and 1 per cent levels, respectively.

Developing savings habits after opening a PMJDY account yielded interesting results (Table 8). In MP, while gender does not significantly influence the development of saving habits at the state level, it does play a significant role in Rewa, Jabalpur, and Ujjain. Social factors, income, occupation, qualifications, and age also significantly influence the development of saving habits in MP, particularly in Gwalior, Rewa, Narmadapuram, Jabalpur, and Ujjain. While both states show similar trends, there are notable differences. Income levels and occupations notably impact the development of saving habits in both states, but the influence is greater in MP, particularly in Gwalior, Rewa, Narmadapuram, and Jabalpur. In Rajasthan, gender, social factors, income, occupation, qualifications, age, and region significantly influence the development of saving habits, with more pronounced effects in Jaipur, Jodhpur, and Pali.

Table 9: Preference of Savings Instruments across Demographics and Socio-Economic Factors in Madhya Pradesh and Rajasthan

	Statistics	Gender	Category	Income	Occupation	Qualifications	Age	Region
Madhya Pradesh	Overall	65.419*	72.321*	44.212	425.056	50.807	35.579	97.872*
	Gwalior	21.546**	51.615**	24.895	160.144*	50.328	30.348	72.310*
	Rewa	10.914	46.056*	41.859*	96.013	33.664	15.758	29.134*
	Narmadapuram	9.724	39.570	48.393*	208.724*	58.544*	19.288	29.587**
	Jabalpur	39.265*	54.230*	30.335***	96.139	68.197*	23.502	79.765*
	Ujjain	36.749*	21.305	18.319	30.560	18.168	49.747*	13.127
Rajasthan	Overall	39.761*	106.263*	92.233*	332.329	101.594*	67.711*	156.935*
	Bikaner	17.782*	25.692	36.836*	110.946	23.588	26.692**	13.405
	Bharatpur	14.719*	12.022	23.088**	67.707	14.419	25.261**	10.909
	Jaipur	21.733*	36.537	41.414*	140.825***	83.992*	10.524	39.672*

Jodhpur	7.579	52.659*	36.830**	47.299	54.206**	33.946**	123.239*
Pali	3.780	44.635**	33.027**	42.646	56.195**	39.004*	81.538*

Source: Own calculation

Note: *, **, and *** show significance at 10 per cent, 5 per cent and 1 per cent levels, respectively.

Regarding preferred savings instruments, the findings reveal that in Rajasthan, factors such as gender, social background, income, occupation, qualifications, age, and region significantly impact savings preferences. Gender and social factors, in particular, emerge as influential across multiple regions, indicating potential disparities in preferences for savings options within these demographics. In contrast, in Madhya Pradesh, while gender does not play a significant role at the state level, it impacts Gwalior, Jabalpur, and Ujjain. Additionally, social factors, income, occupation, qualifications, and age substantially shape Madhya Pradesh preferences, particularly in Gwalior, Rewa, Narmadapuram, Jabalpur, and Ujjain. Notably, Gender is a more decisive factor in Rajasthan than Madhya Pradesh, whereas social factors exert a more decisiveinfluence in MP. Income levels and occupation shape savings instrument preferences in both states (Table 9).

Table 10: Usage of Saving Instruments across Demographics and Socio-Economic Factors in Madhya Pradesh and Rajasthan

	Statistics	Gender	Category	Income	Occupation	Qualifications	Age	Region
Madhya Pradesh	Overall	23.903*	82.809*	44.212	234.843	58.995*	33.406**	64.048*
	Gwalior	10.873***	49.478*	10.934	137.516*	31.764	13.633	52.011*
	Rewa	9.704	61.476*	28.730*	51.802	40.218*	9.770	20.991*
	Narmada puram	7.488	26.813**	43.029*	62.882**	39.708*	23.155**	24.987*
	Jabalpur	17.496**	21.346**	19.785***	94.881	33.693*	16.815	36.049*
	Ujjain	21.524*	25.350***	22.923**	27.091	17.110	46.475*	7.712
Rajasthan	Overall	35.939*	112.916*	60.067*	268.892*	64.254*	70.581*	133.254*
	Bikaner	14.265*	18.078	28.214*	54.734	21.395	28.594*	9.309
	Bharatpur	6.714	20.294	27.361*	76.351	14.412	18.801***	13.688***
	Jaipur	14.003*	29.986**	21.869**	74.557	56.090*	6.589	30.871*

Jodhpur	3.589	52.343*	25.525**	33.832	33.365**	43.076*	137.868*
Pali	8.982***	57.179*	21.534**	47.316*	35.003**	49.618*	123.853*

Source: Own calculation
Note: *, **, and *** show significance at 10 per cent, 5 per cent and 1 per cent levels, respectively.

The analysis of savings instrument usage reveals some regional and demographic differences in Rajasthan and Madhya Pradesh. In Rajasthan, gender has been found to be significant in determining preferences for instruments in Bikaner, Bhartpur, and Jaipur, while income and occupation have been important determinants in Bikaner, Bhartpur, Jodhpur, and Pali. The influence of age and educational qualification has also been found to impact the instrument choice, thereby revealing the importance of financial literacy and life cycle needs. On the other hand, regional differences also highlight some financial infrastructure inequities. In contrast, the impact of gender has been seen in select districts of Madhya Pradesh, while social, economic, occupation, education, and age factors have played a strong role as determinants of instrument preferences. A comparative analysis of chi-square results in Rajasthan and Madhya Pradesh is provided in Table 11.

Table 11: Comparative Analysis of Beneficiaries' Behaviour in Madhya Pradesh and Rajasthan

Parameters	Madhya Pradesh	Rajasthan
Financial Awareness	52% Female beneficiaries, 41% under-privileged section and 20% semi-rural beneficiaries. Significant differences across social categories in Ujjain.	32% Female beneficiaries and 39% underprivileged section. Significant differences across occupations in Bikaner and Bharatpur. Significant differences across social categories in Jaipur
Frequency of Transactions	Significant differences across gender and region in Gwalior and Jabalpur. Significant differences across educational qualifications in Rewa and Narmadapuram	Significant differences across gender, category and region in Bikaner and Jaipur. Significant differences across categories in Bharatpur.
Preference for PMJDY Facilities	Significant differences across gender, category and region in Rewa and Jabalpur. Significant differences across various income slabs in all divisions.	Significant differences across gender, category and region in Bharatpur and Jaipur. Significant differences across gender and region in Bikaner.
Direct Benefits	Significant differences are observed across gender, category, and region in Jabalpur. Significant differences across age groups in all divisions.	Significant differences across gender categories and regions in Pali. Significant differences across gender in Bikaner and Bharatpur.

		Significant differences across categories and regions in Jodhpur. Significant regional differences in the receipt of DBTs in Bharatpur.
Usage of UPI	Significant differences are observed across gender, category, and region in Jabalpur. Significant differences across educational qualifications in all divisions.	Significant differences across gender, category and region in Jodhpur. Significant differences across gender and region in Bikaner, Bharatpur and Jaipur.
Saving Habits	Significant gender differences in Narmadapuram and Ujjain.	Significant differences across occupations in Pali.
Preference cum Usage for Saving Instruments	Significant differences across various income slabs in Jabalpur and Ujjain.	Significant differences are observed across various income slabs in Jaipur, Jodhpur, and Pali.

Source: Own compilation

Discussion

The study highlights that initiatives to enhance financial inclusion through the PMJDY scheme require more than access. It also calls for informed participation, community trust, and a strong infrastructure. A pressing need identified is the gap in financial literacy. Many respondents, 47 per cent in Rajasthan and 67 per cent in Madhya Pradesh, were not engaging in formal saving or investment. To address this, banks could collaborate with local universities and colleges to roll out short financial literacy modules, particularly in rural and underserved areas. Banks can encourage community-centric financial education by partnering with universities, enhancing the PMJDY impact. Gender inclusivity also emerged as a concern, particularly in Rajasthan, where only 32 per cent of surveyed beneficiaries were women. One way to improve this is by increasing the presence of female Bank Mitras. Women agents could help in inspiring greater comfort and confidence among female customers. Their presence could bridge cultural and logistical gaps, encouraging more women to open and actively use their PMJDY accounts. Notably, within the underprivileged communities, especially those belonging to SC/ST groups, the data suggests some differences in scheme awareness and usage. Here, financial inclusion must be focused on community engagement through regular meetings and financial awareness sessions led by banks. Further, in rural areas, where digital adoption remains uneven, skill-building and digital literacy programs become vital. Aligning with the vision of Atmanirbhar Bharat, such training should include basic computer literacy and hands-on banking skills to help rural beneficiaries use digital platforms. Another way to ease access and support

digital financial transactions would be establishing Common Service Centres at the gram panchayat level.

The study also points to gaps in infrastructure. Only 20 per cent of beneficiaries in Madhya Pradesh and 45 per cent in Rajasthan reported weekly financial transactions, while just 18 per cent used ATMs, highlighting the gaps in formal banking. Previously introduced innovative solutions like the "SBI Tiny Project" or "Bank in a Box" could still serve as models for low-cost remote banking services. Another overlooked feature of PMJDY is the overdraft facility, which, despite its potential, is used only by 10 per cent of respondents in Madhya Pradesh and 23 per cent in Rajasthan. This could be either a lack of awareness or confusion around eligibility. Lastly, around 46 per cent of beneficiaries in Madhya Pradesh still lacked RuPay debit cards, limiting access to cashless services. This could be curbed by increasing card distribution, incentivising usage through discounts or cashback, and partnering with local merchants to support these transactions.

Conclusion

The study examined the impact of demographic and socio-economic factors on the behaviour and attitude of beneficiaries in adopting the PMJDY. We present an empirically informed perspective into the key behavioural dimensions under the PMJDY scheme, such as financial awareness, transaction frequency, direct benefit transfers, and use of digital financial services. These behavioural aspects were carefully analysed in combination with demographic and socio-economic attributes to have a detailed and data-driven image of beneficiaries. Second, the study identifies significant demographic gaps in financial behaviour and access, especially female beneficiary underrepresentation and weaker financial knowledge in rural regions. These findings identify the presence of informational and structural obstacles preventing equal access. Third, state-specific policy recommendations from the comparison between Madhya Pradesh and Rajasthan emerge. Gender-targeted interventions are the priority in Rajasthan to increase female enrolment. Conversely, in Madhya Pradesh, the focus should be on increasing outreach and improving the rural spread of financial knowledge.

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India's Digital Labour Platforms in the New Era of Work: Challenges and Possibilities

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Abstract

This paper highlights the effects of labour platforms on employment in India. It introduces the challenges confronting platform economy workers and proposes avenues for enhancing the future of work in India. These platforms offer new employment opportunities but expose workers to precarious working conditions, income instability, lack of jobs, and social security. The study provides insight into the interaction between the nature of work and workers in the digital environment of the rising platform labour economy. While these platforms offer new employment opportunities, they expose workers to precarious working conditions, income instability, job insecurity, and limited access to social protection.

Keywords: Platform labour, Social security, Livelihood, Future of work, Informality

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Introduction

Over the last few decades, the number of people engaged in 'flexible' employment, also known as 'platform' work, has steadily increased. In 2020, the platform economy in India experienced rapid growth, with an estimated 15 million platform labourers. This figure is expected to increase to 23.5 million by 2029-30 (Suryavanshi, 2022). These workers are not entitled to social security benefits. According to the Social Security Code 2020, a platform worker is defined as an individual who engages in any form of employment and earns income from these activities without being in a traditional employer–employee relationship (Ministry of Labour and Employment, 2025). The platform economy promises to provide greater flexibility and autonomy for workers regarding work locations and durations. It provides new working opportunities, especially in urban areas. Several workers had to use non-permanent or casual contractual work in a major status or part-time to fulfil their basic income requirements. Considerable changes have been observed in the labour market, with a transition from full-time traditional employment to contract work in the service sector, such as professional services, transportation, and delivery.

The labour process theory (LPT) offers a framework to analyse the dynamics of work in the gig and platform economy. It provides a background for studying the relationships among labour, capital, and the control of labour during the work process in the capitalist system (Braverman, 1974). The notion of control, deskilling, and alienation can also be examined in the rise of the gig and platform economy. The platform is the production point in the gig economy in all its forms, as it facilitates the workplace. The notion of point of production, emotional labour, and control in the context of the gig economy shows that platforms depict a digitised point of production where rating, ranking, and feedback play a crucial role in the labour process. Algorithmic control replaces managerial control (Gandini, 2019). The use of big data analytics to attract consumers with various offers, or to inform delivery workers about demand surges, etc., is controlled. Companies capture and use customers' tastes and preferences through the free digital labour of platform users. The algorithmic management and self-discipline by the ratings and feedback are termed Neo Taylorism or digital Taylorism by Shibata (2022). Here, digital technology is used as a new means of controlling workers, accelerating exploitation, and preventing resistance. This mechanism is an operating black box, as its mechanisms are hidden, mysterious, and opaque to workers and users, who have exclusive control of the platforms (Faraoun, 2024).

The growth of the gig and platform economies poses significant challenges to the rights of engaged workers, including social security and job instability, which could lead to exploitation(Aneja et al., 2019). This type of classification, which falls outside the traditional purview of workers, subjects them to exploitation and financial instability because they are deviant in terms of job security, paid leave, health coverage, and other aspects of social security (Stewart & Stanford, 2017; De Stefano, 2015). India's government has begun to acknowledge the significance of the platform economy. Provisions for contract and platform workers were incorporated into the Code on Social Security, 2020, for the first time, indicating a shift toward providing some form of social security for this booming workforce. It aims to address the unique needs and vulnerabilities of platform workers, including job security, income stability, and access to traditional employment benefits. The Code mandates the establishment of a Social Security Fund funded by central and state governments, platform firms, and workers themselves (Farooqui et al., 2020). This study explores how employment is evolving and the challenges workers encounter on digital platforms in the Indian context.

Data Sources

This paper evaluates the challenges and difficulties of digital platforms in India via extensive secondary data evaluation from government publications, scholarly studies, industry analysis, and policy documents. NITI Aayog publications, industry studies, the Periodic Labour Force Survey (PLFS), the ILO, WEF, and several survey reports on gig workers are among the information sources.

Global Perspective on Platform Labour

The WEF's *Future of Jobs Report 2025* revealed that demographic shifts, geographical fragmentation, and uncertainty in the world economy will be major drivers of jobs until 2030. It also highlights digital access as a catalyst in job transformation in technology-dominated and overall job markets. Automation and artificial intelligence (AI) will transform 22% of today's jobs worldwide over the next 5 years. It will lead to job creation, destruction, deskilling, and reskilling. It will also lead to the displacement of 92 million current jobs, amounting to 8% of current jobs; in total, it is expected to increase by 7%, or 78 million jobs, between 2025 and 2030 (World Economic Forum, 2025: 5). The fastest-growing jobs will include agricultural workers and casual

labourers, followed by delivery services, software and application developers, construction workers, and shop sales persons. In contrast, the top five leading job occupations will include cashiers and ticket clerks (administrative assistants and executive secretaries), building caretakers, cleaners, and housekeepers, material recorders and store keepers and printing-related trade workers (WEF, 2025: 24). The core skills of 38 % of workers in India will be disrupted and transformed over the next five years (WEF, 2025: 34). In addition to being crucial now, abilities such as AI and big data, analytical and creative thinking, resilience, adaptability, agility, and technology literacy are expected to become increasingly important in the future. (WEF, 2025: 40).

The first economic indicator of the online platform economy is the Online Labour Index (OLI), which tracks the demand and supply of platform workers in real time across occupations and countries by tracing tasks and project counts on freelancing platforms.

Figures 1 and 2 illustrate that India hosts the highest proportion of freelancers worldwide, accounting for 26.1% of the global digital workforce. The Global South, specifically South Asia, accounts for only 53.3 % of the global digital workforce. While the Global South dominates the supply of digital labour, demand is dominated by countries in the Global North. The United States alone accounts for 40.2% of digital labour demand, followed by the United Kingdom (8.2%) and India (6.6%). Digital workers in the United States have more high-value projects and tasks (Stephany et al., 2021). India dominates five of the six occupation types in terms of digital labour supply.

Figure 1: Online Digital Labour Demand
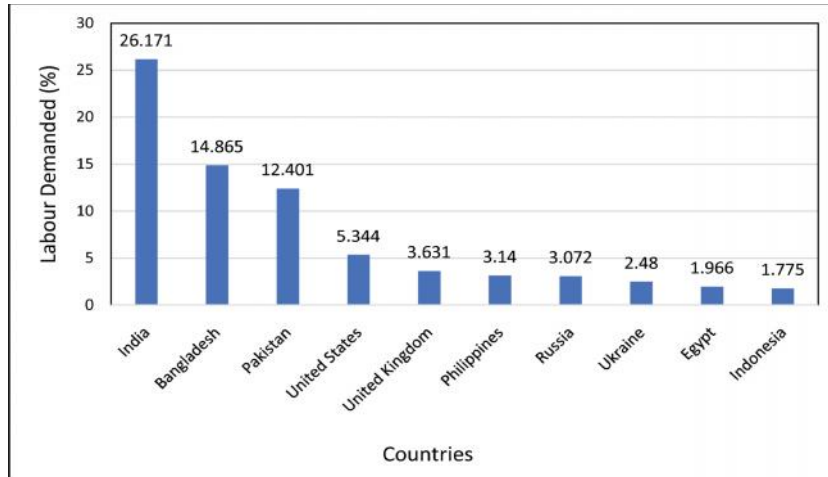
Source: OLI, 2020, onlinelabourobservatory.org

Figure 2: Online Digital Labour Supply
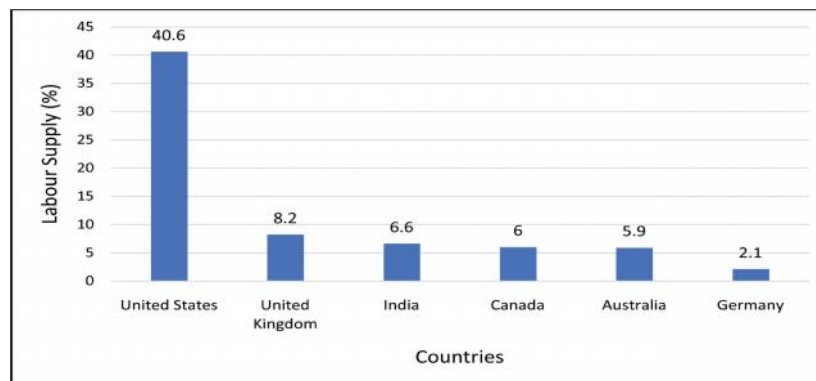
Source: OLI, 2020, onlineabourobservatory.org

Tables 1 and 2 show that occupation-wise, most digital workers in India belong to software and technology, followed by sales and marketing support, and clerical and data entry. The highest demand worldwide comes from software and technology development (38.3%), followed by creative and multimedia.

Table 1: Online Labour Demand by Occupation Share in the World

Occupations	Share
Software development and technology	38.3
Creative and multimedia	21.2
Clerical and data entry	14.7
Sales and marketing support	11.6
Writing and translation	11.2
Professional services	2.9

Source: OLI, 2020, onlinelabourobservatory.org

Table 2: Online Labour Supply from India

(Occupational share as world %)

Occupations	Share
Software dev. and tech	36.7
Creative and multimedia*	17
Clerical and data entry	21.9
Sales and marketing support	35.1
Writing and translation	10.6
Professional services	20.5

Source: OLI, 2020, onlineabourobservatory.org

Note: * Bangladesh with 23 % share dominates in this category followed by India.

Transformation of Work

The platform economy is changing India's workforce. In the next 10 years, the platform economy in India has the potential to reach USD 250 billion in transactions, equivalent to 1.25% of the country's gross domestic product. India's platform workforce grew at a compound annual rate of more than 13% from 2011–12 to 2019–20. Since the pandemic, the number of gig workers has increased from 2.5 million to 6.8 million (NITI Aayog, 2022). By 2019–20, this number had climbed to 67 lakhs. Between 2011–12 and 2019–20 (Table 3), the number of individuals engaged in this particular

type of work for a shorter period of time rose from approximately 0.7 lakhs to 1.1 lakhs.

Table 3: Estimated Platform Workers in India   (in Lakhs)

Years	Number of Gig workers (UPSS)	Number of Gig workers (UPS)	Number of Gig workers (USS)
2011-12	25.2	24.5	0.7
2017-18	52.6	52.1	0.5
2018-19	53.9	53.4	0.5
2019-20	68.0	67.0	1.1

Source: NITI Aayog, 2022

The NITI Aayog anticipates that by 2029-30, the number of gig workers will increase to 2.35 crore (23.5 million). Currently, 47% of gig labouris medium-skilled, 22% high-skilled, and 31% low-skilled. They comprised 1.5% of India's total labour force or 2.6% of the nonagricultural workforce. This number is approximately 26.5 lakhs, which is 1.5 times the 10.6 lakhs reported for 2011-12(Table 4). Real estate, construction, and information technology have taken over this portion. The other three industries that make up the top five in terms of engaging gig force are financial institutions, manufacturing, and information technology. In terms of occupation, shop/market salespersons and demonstrators account for one-third of the gig workforce in India, followed by transportation.

Table 4: Sectorwise Gig Workers Employed in India

Platform	Workers	Share (%) of Gig Workers by Skill Category in 2019-20
Retail trade and sales	26.6 Lakh	
Transportation	13 Lakh	47% are in medium-skill Jobs
Finance and Insurance	6.3 Lakh	31% are in low-skilled Jobs
Manufacturing	6.2 Lakh	22% are in high-skilled Jobs
Education	1 Lakh	

Source: NITI Aayog (2022)

The share of gig workers in the organised sector is 37.6%, whereas 62.4% are in the unorganised sector. Workers in the organised sector are typically those in companies

with more than ten employees. From 2019–20, 62.4% of gig workers were unorganised. However, gig workers are becoming more popular in organised sectors, suggesting that they work for larger organisations. The share climbed from 26% in 2011- 12 to 37.6% in 2019- 20, whereas the unorganised sector decreased. Growing gig jobs predict organised sector growth (Table 5).

Table 5: Share of Gig Workers in the Organised and Unorganised Sectors

Years	% in the organised sector	% in the unorganised sector
2011-12	25.9	74.1
2017-18	30.6	69.4
2018-19	35.7	64.3
2019-29	37.6	62.4

Source: NITI Aayog (2022).

The primary factors that attract young people to gig work are flexibility and increased career options. The gig economy is characterised by diverse activities, such as ride-sharing, food delivery, freelance writing, and graphic design. It is increasingly facilitated by digital platforms and characterised by short-term, flexible employment. The gig economy has been a valuable source of income and autonomy for many, particularly students, homemakers, and those pursuing supplementary income (Kalleberg & Dunn, 2015).

The IBEF anticipates that the gig sector will expand to USD 455 billion by 2024 (India Brand Equity Foundation, 2021). The report notes that contract economy companies are responsible for generating 56% of new employment in India, including both blue- and white-collar workers. ASSOCHAM and Primus Partners estimated its size at 15 million in their report. The report also states that 64% of them are between 24 and 38 years old. The survey reveals that the distribution of gig workersis highest in metropolitan cities (ASSOCHAM & Primus Partners, 2021).

The female population in India is also a major beneficiary of the platform economy. Flexible arrangements and work choices help them increase their earnings and manage their responsibilities at home. The WESO Report (Horne, 2024) highlights that women's representation in the workforce on digital labour platforms is limited,

accounting for only 40% on online web-based platforms and 10% on location-based platforms. Women's intrahousehold responsibilities and the division of labour can adversely affect their decision to work for income, particularly because childcare institutions are inaccessible. The increased number of platform jobs is creating gender inequality, as it has always existed in society, pushing the female population to take part in 'care work' (Hunt & Samman, 2019). The limited participation of women in the gig economy highlights structural challenges in the transformation that extend beyond demand and supply, and a low level of female workforce participation, further exacerbated by limited access and opportunities. Women in the platform economy face challenges such as limited access to the internet and smartphones, low wages, a lack of security, limited bargaining power, and algorithmic discrimination. To promote women's participation in the gig economy, it is necessary to establish the prerequisite physical and social infrastructure.

The emergence of digital labour platforms and the gig economy is impacting the labour market and the informal economy. The rise of the platform economy is expected to facilitate migrants' entry into the workforce via digital labour platforms and to reduce barriers to accessing the Indian Labour Market through networking. Digital labour platforms can rearrange informality, replacing intermediaries or commission agents without providing access to social protection or job security. (ILO, 2018). In developing countries, the rise of DLPs could push well-educated, highly skilled youth into working in perilous conditions under arrangements similar to those of the informal sector (World Bank, 2020). The denial of employee or worker status and the terming of them as independent contractors or partners forms fertile ground for exploitation, as they evade the existing law of the land (Rani & Gobel, 2022). The absence of minimum wages, paid leave, social security, and job security for workers engaged in both online and location-based digital labour platforms makes no significant difference in the working conditions and safety of other informal workers in the context of the Labour Market in India. Approximately 40% of the workforce works on more than one digital platform, indicating that, despite the availability of the platform, they are not receiving work or income to fulfil their needs (Vasudevan et al., 2024).

Challenges Faced by Workers on Digital Platforms

Some aspects of platform work in India today seem to be very attractive, but there is a largely negative side as well. Since there is no pre-employerrelationship, platform workers lack standard protections and benefits, which is a serious problem. There is

no safety net for illness, injury, or economic recession, and there is also a lack of job stability and low income. From the platform's perspective, these employees are 'driver/delivery partners' or 'independent contractors'. Therefore, workers do not enjoy the benefits of labourlaws covering wages, working conditions, and collective bargaining (Ratings, 2020). Platform workers face income instability and volatility, where income is determined by demand, competition, and elusive platform algorithms. In addition to the risk of poverty, out-of-pocket expenditures, and having to meet performance targets, these negative factors affect health and well-being. In the 2021 Fairwork report, a major concern was the employment status of internet workers, as they are often not considered full-time employees and thus lack income and social security. Owing to gaps in work identity and a lack of consistent employment or stable income, most people fall into this classification. For platform workers, income variability is an issue because payments depend on platform demand, competition, and algorithms (Ratings, 2020).

Table 6 illustrates the job security and social security benefits available to regular wage/salaried employees, taking into account written job contracts, paid leave, and eligibility for specified social security benefits employed in the non-agricultural sector. It shows that among regular wage/salaried employees, 58% have no written job contract, meaning they have no job security; 47.3% have no paid leave; and 53.4% are not eligible for any social security benefits. The condition can be particularly detrimental to gig and informal-sector employees across the parameters outlined.

Table 6: Share of the Unsecured among Regular Employees in Non-farm Work
(in %. Usual Status*)

Work Security Dimension	2017 -18 (%)	2018 -19 (%)	2019 -20 (%)	2020 -21 (%)	2021 -22 (%)	2022 -23 (%)	2023 -24 (%)
Regular Workers Without Written Contracts	71.1	69.5	67.3	64.3	62	58.6	58
Not Eligible for Paid Leave	54.2	53.8	52.3	47.9	49.2	46.8	47.3
Not Eligible for Social Security Benefits	49.6	51.9	54.2	53.8	53	53.9	53.4

Source: Compiled by authors from PLFS Annual Report (2017-18 to 2023-24).
Note: * Usual status (PS + SS). PS is Principal Status (usual activity over a year) and SS is Subsidiary Status (secondary work for 30 + days).

This instability increases the risk of poverty, out-of-pocket expenses, and performance pressure, which, in turn, hampers their well-being and overall health. There is an emerging regulatory framework for platform work in India, but existing labour laws do not adequately cover this area. The tasks of identifying, registering, and ensuring compliance are arduous and require extensive coordination and resources. Because of the informal character of platform work, enforcing labour standards is very difficult, as many workers operate without documents, which exposes them to policymakers and regulators and makes it difficult to provide continuous social security coverage. These workers lack significant collective bargaining because they are classified as self-employed and cannot form unions to negotiate for better conditions. With the competitive nature of platform work comes the ready acceptance of exploitation and lower wages.

Participants' limited internet access and skills exacerbate inequalities by restricting access to essential information, such as available rights, benefits, or support services. Social and economic inequalities are maintained through discrimination and biases, such as rating biases, gendered attitudes, and exclusion from higher-paying platforms, particularly among women who experience safety issues and gender harassment. Moreover, national spending for social protection must include fewer than 4 guarantees of one's entire life socially, particularly access to essential healthcare, including maternity, and basic income support comprising education, nutrition, and other services for active workers who are unemployed, sick, on maternity leave, or disabled (Maupain, 2013). Health risks and injuries while working have become prevalent issues among platform workers. A lack of freely provided health insurance coverage from payers, combined with pressure to complete tasks within strict deadlines, increases danger. Social assistance is also linked to, but not limited to, the socioeconomic development objectives of reducing poverty (SDG1), achieving universal health coverage (SDGs, target 3.8), and fostering economic development and decent work (SDG8). It is important to ensure that social security is sensitive to the gender issue, since social measures, such as maternity care, which are directly within the domain of women, may be put in place, and others, such as the provision of child care, elderly care, and nutritional services, are indirectly feministic, thus posing an undue burden on women (Selvi et al., 2021).

Concluding Observations

India's gig economy presents significant challenges for workers, including job security, minimum income, healthcare benefits, algorithmic control, and social security. There

is a need for a comprehensive regulatory framework to address these issues, ensure fair wages, and uphold workers' rights and social security, thereby empowering workers. There is a need for a collaborative stakeholder approach among platforms, workers, and the government to develop a balanced, enforceable framework that adheres to the principles of decent work. There is also a need to study and draw inspiration from best practices in other countries for regulating platform workers to design a more effective framework for workers.

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Minimum Dietary Diversity among Children in Odisha: District-Level Trends in Socioeconomic Inequalities

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Abstract

In Odisha, child nutrition poses a prominent public health challenge, further aggravated by pronounced socioeconomic disparities. This cross-sectional study focused on district-level movements and socioeconomic inequalities in Minimum Dietary Diversity (MDD) among children aged 6–23 months in Odisha, using NFHS 4 (2015–16) and NFHS 5 (2019–21) data. The analysis applies the Erreygers corrected concentration index to quantify wealth related inequality. The result shows that State level MDD increased from about 21% to 40%, but significant gaps remain between best and worst performing districts. Over the study period, certain districts reported substantial improvements in MDD. Additionally, several Tribal-dominant districts showed a decline in MDD inequality. Nonetheless, many districts with higher Scheduled Caste (SC) and Scheduled Tribe (ST) populations exhibit pro rich inequality in MDD, suggesting a rising concentration of adequate diets among wealthier households. These patterns indicate that while coverage has expanded, equity gains are uneven and may constrain translation of dietary improvements into anthropometric progress.

Keywords: Minimum dietary diversity; child nutrition; socioeconomic inequality; Odisha

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Introduction

Dietary diversity (DD) refers to the variety of foods consumed over a specific time period that ensures an adequate intake of nutrients to support good health and the physical and mental development of individuals (Shumayla et al., 2022). DD is differentiated as household dietary diversity (HDD) and individual dietary diversity (IDD), including child dietary diversity (CDD) and women's dietary diversity (WDD). IDD serves as a proxy measure of the nutritional quality of an individual's diet, particularly its micronutrient adequacy (Habte & Krawinkel, 2016).

DD plays a crucial role in determining children's micronutrient intake and overall nutritional well-being (Barik et al., 2025). To achieve minimum dietary diversity (MDD), the World Health Organization (WHO) recommends that a child aged 6–23 months be considered to have met MDD if she/he consumed foods from at least five out of eight food groups in the previous day or night (WHO, 2008; Gunnal, 2024). These categories include cereals, legumes, nuts, dairy products, meat products, eggs, vitamin A-rich fruits and vegetables, and other fruits and vegetables (Barik et al., 2025).

Notably, since the early 1980s, DDhas been recognized as a significant indicator for evaluating dietary quality, micronutrient adequacy, and food availability (Habte &Krawinkel, 2016; Barik, 2025). DD also plays a vital role in influencing children's health status and acts as a key protective factor against poor nutritional status. Poor nutritional status leads to stunting (chronic malnutrition), wasting (acute malnutrition), and underweight (combined acute and chronic malnutrition) among children (McDonald et al., 2013). Hunger and malnutrition contribute to increased cases of nutrition-related diseases, impaired growth, reduced cognitive ability in children, and deaths (Ogutu et al., 2024).

Therefore, a diversified diet is essential from the sixth month onward, as breastfeeding alone cannot meet the nutritional requirements of a growing child. Unfortunately, only 16% of children in India meet the worldwide criterion for nutritional adequacy, which is even lower than that in some African nations, such as Namibia (24.5%), Angola (22.8%), Nigeria (20.4%), Tanzania (21%), Ghana (26%), and Mali (22%) (Paulo, 2024; Barik et al., 2025). India has been facing substantial challenges in achieving SDG 2 (Zero Hunger) and SDG 3 (Good Health and Well-being) due to persistent

undernutrition, underscoring the urgent need for accelerated progress on children's nutritional indicators.

Despite the introduction of various welfare programs, such as the Public Distribution System (PDS), Integrated Child Development Scheme (ICDS), Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), Antyodaya Anna Yojana, and Poshan Abhiyaan by the government, undernourishment among children aged 6–23 months remains a critical public health concern in India (Barik et al., 2025; Sethy, 2025). Moreover, there is a wide variation in DD across regions in the country as influenced by diverse socioeconomic, demographic, and cultural factors. In an underprivileged state such as Odisha, dietary patterns are influenced by intersecting factors, including income, caste, education, occupation, landholding size, and geographic location (Sethy, 2025). Towards providing policy insights to improv children's nutritional indicators across Odisha, this study analyzes prevalence of and inequality in MDD at the district level using the recent two rounds of the National Family Health Survey (NFHS) data - NFHS-4 and NFHS-5.

In the NFHS data, information on children's feeding diversity on the day before the interview was collected from mothers or caregivers. The food items in the NFHS data are categorized into different food groups, in accordance with the WHO (2010) guidelines for constructing the MDD indicator (process indicator) for children aged 6-23 months. While breast milk was not previously classified as a food group, it was later included as an eighth category in 2017 (WHO, 2021). The MDD is defined as consuming food from five or more of the eight groups, as detailed in Table 1. The analysis included 3,157 and 2,345 children aged 6-23 months from NFHS-4 (2015-16) and NFHS-5 (2019-21), respectively.

The Erreygers Corrected Concentration Index (EI) is applied to measure the extent of socioeconomic inequality in MDD. As MDD is a binary variable, EI facilitates ensuring comparability and corrects for the bounded nature of nutritional outcome, making it particularly apt for assessing inequality with binary variables (Erreygers, 2009). EI could be expressed in the following functional form as a normalized sum of weighted health levels:

$$EI = f(\mu_h, n) \sum_{i=1}^{n} z_i h_i = \frac{8}{n^2(b_h - a_h)} \sum_{i=1}^{n} z_i h_i = \frac{8}{n^2} \sum_{i=1}^{n} z_i h_i$$

a_h and b_h are the lower and upper bound of the MDD. As in case of a binary health variable the lower and upper bounds are 0 and 1, hence we have removed them from the final equation.

Table 1: Description of Minimum Dietary Diversity

WHO Food group name	DHS food items
Breastmilk	Currently breastfeeding
Grains, roots, and tubers	Fortified baby food; bread noodles, or other food made from grains; potatoes, cassava, or other tubers
Legumes and nuts	Beans, peas, lentils, nuts
Dairy products	Tinned, powdered, or fresh milk; baby formula; cheese, yogurt, or other milk products; yogurt
Flesh foods	Chicken, duck, or other birds; liver, heart, or other organs; fish or shellfish; any other meat
Eggs	Eggs
Vitamin-A rich fruits and vegetables	Pumpkin, carrots, squash (yellow or orange inside); dark green leafy vegetables; mangoes, papayas, or other vitamin A fruits
Other fruits and vegetables	Any other fruits

Note: All the answers recorded as "yes", "no", or "don't know". In this study, "don't know" is assumed as no.

Results and Discussion

The district-level MDD in percentage terms for the state of Odisha for both NFHS-4 and NFHS-5 is presented in Table 2. The state average increased by 20% (from approximately 21% in 2015-16 to nearly 40% in 2019-21) indicating an encouraging nutritional improvement at the state level over a five-year period, which could be attributed to policy initiatives at both the state and national levels. However, at the district level, estimates of MDD show a significant gap between the best-performing and worst-performing districts, and the gap was stagnant (28%) over the years in 2016 and 2021. In the 2015-16 round, districts such as Subarnapur (37.11%), Jajpur (37.08%), and Kendujhar (33.65%) reported a relatively higher percentage of MDD in the children's diet, which ranged from 37 to 34 percentage points. By 2021, a new set of leading districts emerged - Jagatsinghpur (55.38%), Sambalpur (55.17%), and Balasore (54.44%), revealing rapid improvements in MDD in different regions of Odisha. One of the most surprising results was that several interior and predominantly tribal districts, such as Koraput (10.09%) and Nuapada (8.0%), which were the worst performing districts in 2015-16 moved over several districts with their improved performance where MDD went up by 25.33% and 33.38%, respectively, in 2020-21.

Table 2: District wise Minimum Dietary Diversity of Children Aged 6–23 Months in Odisha

District	NFHS-4		NFHS-5	
	MDD %	Rank	MDD %	Rank
Subarnapur	37.11	1	47.44	5
Jajapur	37.08	2	31.76	25
Kendujhar	33.65	3	27.47	29
Nayagarh	32.50	4	38.96	16
Malkangiri	29.68	5	45.79	6
Khordha	26.71	6	26.98	30
Bhadrak	26.67	7	41.57	11
Mayurbhanj	25.84	8	38.82	19
Puri	25.32	9	44.62	7
Bargarh	25.00	10	42.25	10
Rayagada	24.07	11	43.93	9
Jagatsinghapur	23.75	12	55.38	1
Jharsuguda	23.27	13	41.51	12
Debagarh	22.89	14	28.79	26
Kendrapara	20.75	15	41.38	13
Sundargarh	19.21	16	38.89	17
Cuttack	19.12	17	35.42	23
Balasore	18.39	18	54.55	3
Ganjam	17.86	19	36.59	22
Sambalpur	17.28	20	55.17	2
Kandhamal	16.95	21	38.84	18
Kalahandi	15.91	22	27.63	27
Anugul	15.04	23	27.50	28
Nabarangapur	12.86	24	37.19	20
Baudh	12.24	25	40.24	15

Balangir	12.12	26	47.95	4
Gajapati	11.43	27	44.58	8
Dhenkanal	11.24	28	33.33	24
Koraput	10.09	29	36.71	21
Nuapada	08.00	30	41.38	14
Odisha	20.94	-	39.57	-

Source: Authors' calculationfrom NFHS-4 and NFHS-5 data

The Scheduled Districts, such as Mayurbhanj (12.98%), Sundargarh (19.68%), Koraput (26.62%), Rayagada (19.68%), Nabarangapur (24.33%), Malkangiri (16.11%), and Kandhamal (21.89%) improved in children's DD between 2016 and 2020-21. Khordha district, where the capital city Bhubaneswar is located, has retained a similar percentage of MDD during these two periods, which caused its rank to slide from 6th position to 30th position. In contrast, the districts of Sambalpur, Boudh, and Balangir improved their rankings, posting 2nd, 4th, and 8th ranks respectively.

The percentage difference in MDD during the considered study period is illustrated in Figure 1. It displays the overall improvement of all districts in MDD, with the exceptions of Kendujhar and Jajpur. In these two districts, MDD coverage has decreased by 6.18% and 5.32%, respectively. The highest level of improvement was found in the district of Sambalpur (37.89%), Balasore (36.16%), and Balangir (35.83%). The lowest level of increase in minimum dietary diversity was found in Khordha (0.27%), Debagarh (5.9%), and Nayagarh (6.46%).

Figure 1: District Level Difference in MDD% (NFHS 5-NFHS 4)
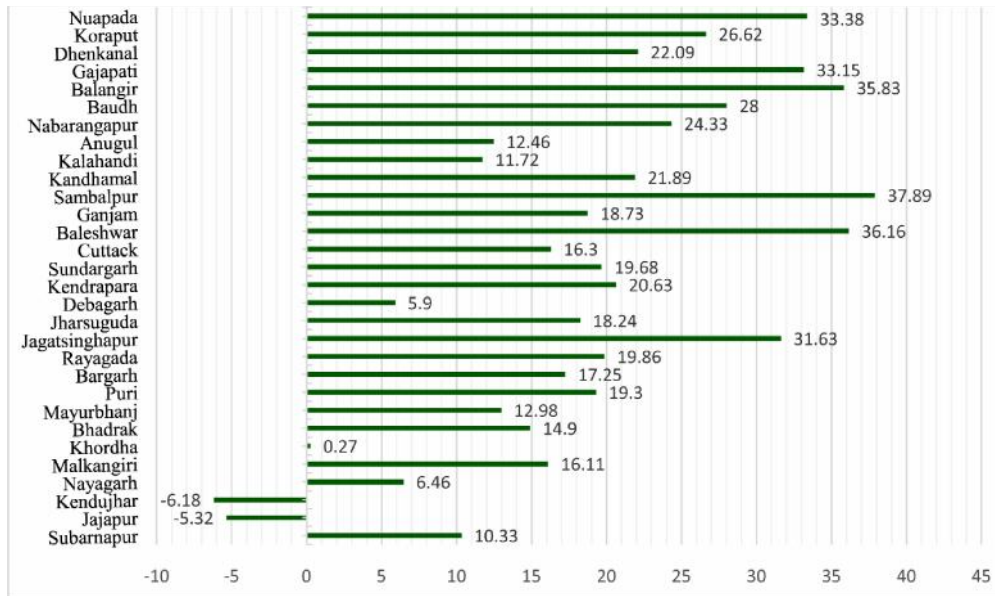
The tribal-dominant districts of Odisha perform relatively well in terms of child MDD, despite high poverty and remoteness. The improved performance of these districts could be attributed to several community-based nutrition-focused initiatives and convergent governance efforts by different levels of government. In addition to these policy initiatives, Odisha's nutrition budget highlights tribal districts as a priority for integrated action under the Poshan Abhiyan and ICDS, which has initiated a combination of supplementary nutrition, intensified counselling on breastfeeding, and complementary feeding. Along with these efforts, context-specific IYCF campaigns in tribal localities might have further diversified complementary foods. A study found that despite socio-economic barriers, DD improved in Sambalpur district through different community-level campaign (Sahu et al., 2020).

The Special Programme for Promotion of Millets in Tribal Areas of Odisha (Shree Anna Abhiyan) was launched by the Government of Odisha in 2017 to revive millets cultivation, processing, and consumption. The state government supplies millet-based foods to preschoolers twice a week through Anganwadis in tribal-dominated districts, boosting iron and calcium intake and diversity (*OMM Report*, 2019). A study conducted in the state of Andhra Pradesh found that undernutrition among tribal children decreased from 35% to 21% by increasing millet consumption from 26% to 39% (Gupta et al., 2025).

The district nutrition profile of Khordha also indicated a stagnant percentage of early initiation of breastfeeding between 2016 and 2021 (District Nutrition Profile, 2022). POSHAN Abhiyan has focused less on Non-High Burden Districts relative to High-burden districts, which could be the reason behind Khordha district's stagnant performance in DD among children's food. A study conducted in Khordha district also found that low literacy in peri-urban areas delayed the complementary feeding. A study in Pune, Maharashtra, found that pregnant women living in slum areas lacked dietary diversity, and 40% exceeded the recommended carbohydrate intake (Deshpande et al., 2024). This could also describe the sluggish performance of Khordha district, which has a relatively higher proportion of slum areas and a lower literacy rate.

The districts that have improved their performance in the context of MDD are mostly those listed as ICDS High Burden Districts or NHM High Priority Districts (National Nutrition Strategy, 2017). The only districts (Jajpur and Kendujhar) where the prevalence of MDD has declined over the years were not in the focus of either NHM or ICDS. An evaluation study reported that due to NRHM's effective performance in high-focused states, those states outperformed non-high-focused states across several indicators of maternal and child health (Evaluation Study of NRHM, 2011). In a similar vein, districts that received greater focus from ICDS and NHM may have accounted for the difference in MDD improvement.

From Table 2, it can be ascertained that inequality at the state level decreased (0.08 in 2015-16 to 0.06 in 2019-21). The district-level analysis shows a mix of pro-poor and pro-rich dietary distribution among children. In 2015-16, Jharsuguda, Dhenkanal, Puri, Ganjam, and Koraput depicted a pro-poor concentration of MDD, whereas Bargarh (0.21), Sundargarh (0.19), and Balasore (0.17) are the three most pro-rich districts in MDD. The prevalence of inadequate diet patterns is more pronounced among children from low-income households, as indicated by the EI value, which revealed that 11 districts have an EI value greater than 0.10. Although inequality has decreased at the state level, it has increased at the district level from 2015 to 2021. Many districts, such as Malkanagiri (0.07 to 0.14), Kandhamal (0.10 to 0.20), and Nuapada (-0.01 to 0.17), are depicted as having increased pro-rich inequality in MDD. However, Bargarh remains the most unequal district, with a relatively higher pro-rich EI value of 0.45. Nonetheless, districts with lower tribal populations also exhibit a pro-rich distribution, such as Bhadrak (0.20), Kendrapada (0.42), Jagatsinghpur (0.15),

Cuttack (0.10), Dhenkanal (0.22), and Ganjam (0.26). Wherein, most of these districts have a higher population of the SC (Census, 2011). Hence, it can be inferred that the district with a higher proportion of SC and ST populations exhibits pro-rich inequality, which aligns with a previous study that found greater unexplained inequality in dietary diversity was due to social exclusion stemming from caste and cultural norms (Sethy & Mahapatro, 2025).

However, the EI values also show that several districts are near equality or have a pro-poor increase in dietary diversity in 2020-21, including Debagarh, Sundargarh, Kendujhar, Mayurbhanj, Balasore, Dhenkanal, Puri, Baudh, Subarnapur, Balangiri, Kalahandi, and Rayagada. Poshan Abhiyaan (2018) prioritised HBDs such as Kalahandi, Rayagada, and Balangir, boosting ASHA counselling on the diversity of diet and the importance of nutrition for child growth. Mother's increasing awareness of child nutrition and the importance of diversified diets for child growth could have reduced the inequality gap between the rich and the poor, and government initiatives provide food supplements and complementary foods. It could be the reason the Erreygers Index is near zero or is pro-poor in distribution. As in prior studies, media exposure and mothers' awareness about the importance of nutrition were significant factors in increasing MDD prevalence (Kundu et al., 2022; Rahman, 2023). Additionally, the state has also allocated funds for encouraging nutrition gardens through the "Mo Upakari Bagicha" model and similar nutri-garden initiatives implemented through the self-help groups (SHGs) of women. These initiatives mighthave amplified the availability of pulses, green leafy vegetables, and fruits, and increased the diversity in children's diet patterns in underdeveloped and rural areas (Bhargavi et al., 2025).

Table 2: District-wise Erreygers Index of Inequality in Minimum Dietary Diversity among Children (6–23 Months) in Odisha

District	EI (NFHS-4)	EI (NFHS-5)
Bargarh	0.21	0.46
Jharsuguda	-0.04	0.06
Sambalpur	0.07	0.16
Debagarh	0.13	-0.02
Sundargarh	0.19	-0.08
Kendujhar	0.16	0.02

Mayurbhanj	0.10	-0.10
Balasore	0.17	-0.00
Bhadrak	0.07	0.20
Kendrapara	0.16	0.42
Jagatsinghapur	0.09	0.15
Cuttack	0.00	0.10
Jajapur	0.10	0.07
Dhenkanal	-0.02	0.22
Anugul	0.11	0.03
Nayagarh	0.13	-0.04
Khordha	0.06	-0.09
Puri	-0.04	0.04
Ganjam	-0.12	0.26
Gajapati	0.16	0.13
Kandhamal	0.10	0.20
Baudh	0.09	-0.10
Subarnapur	0.11	-0.07
Balangir	0.04	-0.01
Nuapada	-0.01	0.17
Kalahandi	0.00	-0.05
Rayagada	0.09	-0.02
Nabarangapur	0.04	0.02
Koraput	-0.01	0.06
Malkangiri	0.07	0.14
Odisha	0.08	0.06

Source: Authors' calculation from NFHS-4 and NFHS-5 data

3. Conclusions and Policy Recommendations

This study examined the prevalence of MDD among children aged 6-23 months and its distribution across wealth quintiles in districts of Odisha. While most districts registered encouraging gains between NFHS-4 and NFHS-5, with statewide MDD rising from 20.9% to 39.6%, inequality patterns revealed a mix of pro-rich and pro-poor shifts, particularly a pro-rich concentration persisting in tribal- and SC-populated districts.Government interventions explain much of the inequality reduction, such as Poshan Abhiyaan, which focused on High Burden Districts and narrowed socioeconomic gaps through intensified ICDS counselling and Take-Home Ration (THR) diversification, complemented by Odisha's Nutrition Budget and tribal-specific initiatives like OPNIP (launched in 2021). OPNIP's Matru Sishu Poshan Kendras and village spot-feeding centres target the first 1,000 days, prioritizing PVTG areas with stark baseline deficits.

Nonetheless, challenges remain despite MDD progress; anthropometric outcomes improved sluggishly, suggesting incomplete translation from dietary diversity to linear growth. Uneven reductions in inequality dampen this pathway. To reduce socioeconomic inequalities in child MDD across districts, policymakers also could pursue equity-focused scaling of proven interventions, particularly targeting low-performing and higher-inequality districts. Low-performing districts could be provided with district-tailored Take Home Rations from Anganwadi centres, especially in urban slums and remote areas, with assistance from SHGs. Concurrently, home visits by trained ASHAs, incorporating ProPAN recipes and Poshan Tracker monitoring, might be able address persistent inequality gaps. For peri-urban migrants, extending OPNIP-style crèches with Mission Shakti-linked DBT subsidies could reduce the inequality. In addition, Annual district audits linking inequality metrics to ICDS performance might ensure sustainable progress for Poshan 2.0 and improvements in child nutritional status.

This analysis is subject to several methodological limitations. First, the NFHS sample sizes at the district level (approximately 50–120 children aged 6–23 months per district) limit the precision of estimated MDD prevalence and inequality, with sampling variability likely to be greatest in districts with low coverage. Second, reliance on a single 24 hour maternal recall introduces potential measurement error, as responses may be affected by recall lapses or social desirability bias, particularly among caregivers

with limited literacy. Third, the cross-sectional design of NFHS limits the ability to make causal inferences or to capture dynamic changes in children's diets over time; longitudinal data would be better suited to tracing trajectories of dietary diversity and their relationships with growth outcomes.

Future studies could investigate contextual factors driving district-level variations in dietary diversity and inequality. Longitudinal data would offer more profound insights into the evolution of dietary patterns among children aged 6–23 months, enabling causal analysis of growth trajectories. Larger district-level sample studies could improve the reliability of inequality estimates and permit disaggregation by socioeconomic characteristics.

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Book Review

Workers, Power and Society: Power Resource Theory in Contemporary Capitalism
Edited by Jens Arnholtz and Bjarke Refslund,
Routledge, New York/London, 2024, pp. xiii+259

Tara Nair

Even as the world is poised for a multifaceted transition thanks to the compounded impact of climate change, technological transformation, and demographic shifts, the world of work is faced with unprecedented challenges. In countries like India, where majority of the workers are outside the scope of legal protection, these challenges play out in peculiar ways. Not only that work has been increasingly contractualised and casualised making the formal-informal dualism almost a farcical conundrum, it has also been rendered hyper precarious. Moreover, the political constituency of workers including the (formal) organized workers has steadily been eroding as the state has progressively limited or withdrawn many of the regulatory safeguards and the employers have found innovative ways to break the possibility of collective resistance by workers.

The book under review presents a collection of essays that seek to advance the power resource theory and reclaim scholarly attention on workers and their power to transform social relations under contemporary capitalism. As the editors point out in the introductory chapter this marks a major deviation from the mainstream scholarly preoccupation with 'business power and power of employers'. The power resource theory was formulated during the golden age of trade unions. Drawing predominantly on the work of the Scandinavian sociologist Walter Korpi in the 1970s and 1980s, the power resource theory focuses on the power of workers and their organisations/ institutions to determine the content and direction of social policies. It alludes to the

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fundamental opposition between labour and capital or the 'labour politics' as the major driver of social development. As workers' unions have started losing their power resources, social change explanations have turned the attention away from labour power. Despite this shift in analytical focus, "…workers still hold enough power to influence both concrete workplace relations and broader political and economic development" (p.3).

The resource-based theory of power advanced collectively by the contributors of this volume distinguishes between five types of power – structural power, organizational or associational power, institutional power, ideational power, and coalition power. Structural power refers to the capacity to control, structure and disrupt production and distribution, while organisational power emanates from trade unions' power to initiate collective action. Institutional power is the capacity of labour to leverage formal rules and regulations to advance labour politics. The capacity to influence the ideational context is referred to as ideational power, whereas coalition power is elaborated as the ability to forge alliances with other actors with a view to initiate joint action.

The volume is organized into two parts. Part one contains five chapters each elucidating one distinct power each. These chapters provide us with analytically useful insights into the complex working of power in segmented labour markets. In Chapter 2 Greer characterizes structural power as the basic building block of worker power. It manifests as the power to disrupt production and exchange and to extract concessions from capital. However, structural power is limited by the extent of competitive pressures on the labour markets arising especially from the ease of replacement of workers, thanks to the presence of large pools of reserve labour. While most workers lack structural power from this perspective, a few like the ones with highly demanded skills can exercise some power over employer actions. As Ibsen (Chapter 3) shows the absence of structural power at the individual level is offset by the associational power or the ability to create unity of action. Importantly, it is argued that associational power is not only about union density (membership base), but has many other components like the internal-external structure, mobilization infrastructure and information sharing.

O'Brady's analysis of institutional power (Chapter 4) throws light on the fact that worker struggles have an institutional context. They do not take place independent of the institutional environments with favourable legislations and regulatory practices.

Any decline in institutional power, however, can be counteracted with strong associational power. Conversely, robust institutions enable strong union actions. McLaughlin and Wright (Chapter 5), in their exposition of ideational power, argue that though neglected typically in the industrial relations scholarship in favour of materialist sources ideational power resources are very critical. They emphasise the need for workers' interests to be articulated as much through ideas and discourse as through institutions. In the subsequent chapter (Chapter 6) by Tattersall reminds one of the importance of coalition power or the capacity of workers' organisations to align their interests with larger communities of other stakeholders and build power resources collectively.

The essays in the first part of the volume thus lays the theoretical foundation for the case studies that empirically apply them in Part 2. In this part one comes across a persuasive analysis by Meradi in Chapter 7 of Italian industrial relations during 2020-21 when the sudden outbreak of the COVID 19 pandemic disrupted the status quo with respect to power resources available with workers. As this article shows, industries like food production, food delivery, metal work, and healthcare worked through the crisis by complementing different power resources. Meradi argues that "The main factor accounting for the different outcomes by sector is the kind of discursive and coalitional resources available, demonstrating the ongoing process of politicization of labour issues during the pandemic" (p.152). Flecker's analysis in Chapter 8 of workers' power in the global production networks (GPN) reiterates that in the analyses of power resources the position of workers within particular supply chains and production networks need to be considered.

Grimshaw and Johnson (Chapter 9) makes an important contribution in Chapter 9 by developing an analytical framework to examine how trade unions influence minimum wage by applying it to France, Germany, the UK and the USA, all known as high income countries. They conclude that unions' influence on statutory minimum wages is shaped by an interplay of institutions and ideas. In a setting where bureaucratic and political forces have overwhelming control over fixing minimum wages, trade unions will have to invest in a range of power resources.

The relationship between migrant workers and trade unions is complex and contested. Migration is a sensitive issue and trade unions often face internal and external tensions while deploying power resources to include the interests of migrant workers. While

analysing the case of migrant workers and trade unions in increasingly fragmented markets, Marino and Martinez Lucio (Chapter 10) point to the need to factor in the risks along with benefits of leveraging power resources in favour of migrant workers. They seem to suggest that a close understanding of the heterogeneity within the migrant worker communities and trade unions and the intersectional issues is a necessary pre condition for deployment of power resources. Innovative strategies – 'ways of working' - are hence necessary to work with migrant workers.

The last case study by Høgedahl and Jonker-Hoffrén of application of power resource theory - public sector labour relations – has typical characteristics (Chapter 11). Unlike the private sector counterparts, there is no antagonism between workers and owners of means of production in public sector establishments. The employment contract guarantees certain rights and 'sheltarability' (as against replaceability) to employees. These characteristics allow trade unions to indulge in collective bargaining and forge alliances with a range of labour market partners on the one hand. On the other they are also vulnerable to changes in formal labour regulation and overall economic policies.

The volume clearly gives the message that in order to advance labour interests all types of power resources need to co-exist in a complementary manner. Even more important is to recognize their working at various levels of industrial relations given the layered structure of industrial organisations spanning scales and geographies. The global value chains, for instance, operate through a web of spatially dispersed subsidiaries and employing workers with varying structural and institutional power. The book also warns about the dangers of adding newer concepts of power resources or 'conceptual proliferation' that may in effect limit their analytical and explanatory potential.

This volume an important source book for labour studies scholars and activists anywhere in the world. In India it is all the more so. At a time when the labour movement is fragmented, labour institutions are rendered powerless, and the state and capital have come together to marginalize the political power of workers, this volume makes a meaningful contribution by reinstating 'power resources' at the centre of the discourse on labour under capitalism. That is the greatest merit of this volume.

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Levien, M. (2018). Dispossession without development: Land grabs in neoliberal India. New York: Oxford University Press.

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Rao, M. G. (2017). Central transfers to states in India: Rewarding performance while ensuring equity. Report prepared for the NITI Aayog. Retrieved from https://niti.gov.in/writereaddata/files/document_ publication/ Final%20Report_25Sept_2017.pdf(Date of last access Month Date Year)

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