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- Research Articles
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Referees

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

Amit Kumar Basantaray, Department of Economics,Central University of Himachal Pradesh, Dharamshala

Beena P L, Centre for Development Studies, Thiruvananthapuram

A J C Bose, Shri Ram College of Commerce, Delhi University, Delhi

Keshab Das, School of Social, Financial & Human Sciences, KIIT Deemed to be University, Bhubaneswar

Ashish Kumar Meher, Department of Economics,Manipal University, Jaipur

Shradhanjali Panda, Department of Business Administration, Ravenshaw University, Cuttack

Hastimal Sagara, Faculty of Commerce, GLS University, Ahmedabad

Editorial

In this issue of the *Odisha Economic Journal* most of the articles attempt investigating factors responsible for certain economic development or policy processes. The opening article (by J. S. Darshini and K. Gayithri) engages with an interesting issue of varied spending patterns by states in response to the changes in the conditional and unconditional central transfers. Focusing on six major states, the study discusses the role of unconditional transfers in soft budget constraints at the sub-national level. Asymmetric development sector spending could be due to diversion or a squeezing of funds made available to states. Possibility of political factors influencing such spending has also been highlighted.

With a historical perspective, the second paper (by Rajiv Jha) delves into factors determining the commanding position enjoyed by a vital industry, namely, that of the machine tools. In this analysis of a few globally dominant economies, it appears likely that those keeping pace with the fast-changing technologies and reorienting their market positioning strategies would emerge successful. The article has implications for developing economies who could enhance their base globally at least in a few subsectors.

An article (by Dipti Mohanty, Prasanta Patri and Ashis Kumar Pradhan) enquires into what facilitated or induced a major rise in acceptance of digital payment mechanism as it took off during the pandemic times. The article, drawing upon a micro study, points to the role played by demographic and socio-economic factors as gender, age, education andsource of income. An overriding aspect was also the perception that this form of transaction would reduce chances of physical contacts as an important health anxiety during then.

Keeping with the specific concerns as occurred during the pandemic another article (by Swarna Prava Hota) looks into possible impact of the unprecedented devastating event on the Indian economy. That the industrial sector was hard-hit implied that employment and income sources were adversely affected. Albeit the situation is gradually improving, the decline of GDP and within that the share of secondary sector have been particularly worrying.

Engaging with an undesirable situation of distress-driven migration inducing school dropouts the article (by Sabitribala Dash and Mrutyunjay Swain), based on a field survey in south Odisha, discusses employment implications of

abstaining formal education in early years. In migrating families, children (especially, girls) have additional responsibilities of taking care of the household as also younger siblings. Chances of well-paying jobs wane as both education and skill levels remain low.

Towards unravelling changes in educational inequalities as Right to Education Act has come into being the article (by Tanusree Dash and Ananya Ghosh Dastidar) analyse subnational data on educational attainment. The authors use both direct (Education Gini coefficient) and indirect (Education Lorenz Curve) measures to highlight state-UT level comparison.

With an increasing emphasis on human resource information system (HRIS) in the evolving business landscape, the article (by Sonal Jain) deals with the need for a clear strategy that would draw upon an open system of data generation and accessibility across different departments. It discusses the strategic function and relevance of HRIS, with particular reference to enhancing firm competitiveness.

In an insightful research note (by Sandhya Krishnan, Sanket Gharat, Prasanna Surathkal, Puja Guha, Neeraj Hatekar and Amalendu Jyotishi) a disaggregated analysis of patterns of rural deprivation has been presented using Mission Antyodaya data at the village level. Inter alia, this brief study, raises questions about the claim of reduction of poverty in Odisha as it has moved up to be part of the group of middle income states in India.

The issue ends with the review (by Dillip Kumar Muduli) of a book on Indian farm exports.

Keshab Das
Editor-in-Chief,
Odisha Economic Journal

Article

An Empirical Analysis of Expenditure Asymmetry in India: A Comparative Analysis of Select Indian States

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J. S. Darshini
K. Gayithri

Abstract

This paper attempts to empirically examine the asymmetric response of state spendingto the positive and negative changes in the conditional and unconditional central transfers in six major states such as Bihar, Kerala, Karnataka, Haryana, Odisha and Punjab, for the period from 1981to 2015. The NARDL time-series regression model has been employed to test the asymmetry in spending. The study reveals the role of unconditional transfers in soft budget constraints at the sub-national level. A fiscal restraint form of asymmetry is evident in development sector spending during the reduced allocation of central funds as is the fungibility of resources. Diversion or reduced allocation of state funds could explain such asymmetry. The paper also highlights the influence of political factors on the composition of spending.

Keywords: Intergovernmental transfers, development spending, Asymmetry, NARDL Model.

J. S. Darshini, Doctoral Teacher Fellow, Institute for Social and Economic Change, Bengaluru and Faculty, Department of Economics, Government First Grade College, K. R. Puram, Bengaluru. Email: darshini.darshinijs@gmail.com

K. Gayithri, Consultant (Academic and Research), Fiscal Policy Institute, Government of Karnataka, Bengaluru. Email: gayithri1960@gmail.com

1. Introduction

Allocation of expenditure and revenue responsibilities to different levels of government is a fundamental issue under fiscal federalism. India is a federal country with asymmetric levels of development (Reddy & Reddy, 2019). In essence, revenue mobilisation has not kept pace with expenditure responsibilities at both levels of government; meanwhile, the resource gap has long remained much higher and more intense across the states. For instance, the resource gap at the sub-national level increased from 7.91 per cent in 1990-91 to 8.02 per cent in 2000-01. It came down to 7.37 per cent in 2004-05 before increasing again to 8.44 per cent of GSDP in 2015-16 (Isaac et al.,2019). States in India shoulder a more significantresponsibility of providing public services of socio-economic importance with a lower tax buoyancy, as compared to the central government. However, poor efforts on their part in mobilising adequate resources from their own sources exert increased pressure on state fiscal health, causing a larger resource gap and necessitating increased dependency on other sources of revenue.

Transfers are a substantial mode of spending for the provision of public goods by the central government. With a growing revenue crunch and debt servicing obligations, states increasingly depend on federal transfers to bridge the fiscal gap. The resultant increased resource or vertical fiscal gap necessitates more federal transfers in the path of fiscal management[1]. The extent of dependence of Indian states on the central fiscal transfers has increased steadily over the years. For instance, the proportion of revenue gap bridged by the central transfers increased from 2.53 per cent during the Ninth Finance Commission (FC) to 2.93 per cent of GDP during the Thirteenth FC and 3.89 per cent of GDP during the Fourteenth FC (Panda, 2019).

As per the existing literature, compositional shifts in transfers, temporal variations in planning commission transfers, and inaccurate central tax revenue forecasting methods (Dholakia, 2005) have an adverse impact on the states' spending patterns with increased dependency on central transfers. Compared to the 1980s, transfers started showing a decreasing trend during the 1990s,

[1] In bridging the existing resource gap, Finance Commissions (FCs) determine a significant part of formula-based general-purpose devolution. Besides FCs, Planning Commission (now NITI Aayog) and Central Ministries - provide "Plan Purpose" and "Specific Purpose" transfers.

with an adverse impact on state fiscal health. For instance, aggregate central transfers to the states, as a percentage of GSDP, declined from 4.89 per cent in 1990-91 to 3.79 per cent in 1999-00 before increasing moderatelyto 4.30 per cent in 2003-04 (Chakrabarty et al., 2009). A significant rise in transfers wasobserved in 2004-05, 2005-06 and 2009-10, followed by a sharp decline in the transfers between 2007-08 and 2009-10 (Chakrabarty & Bhadra, 2010). Therefore, increased variations in the revenue sources may lead to an asymmetric response to development spending. On the part of states, over-reliance on central transfers may soften the budget constraints while possibly distorting the local government policy decisions.

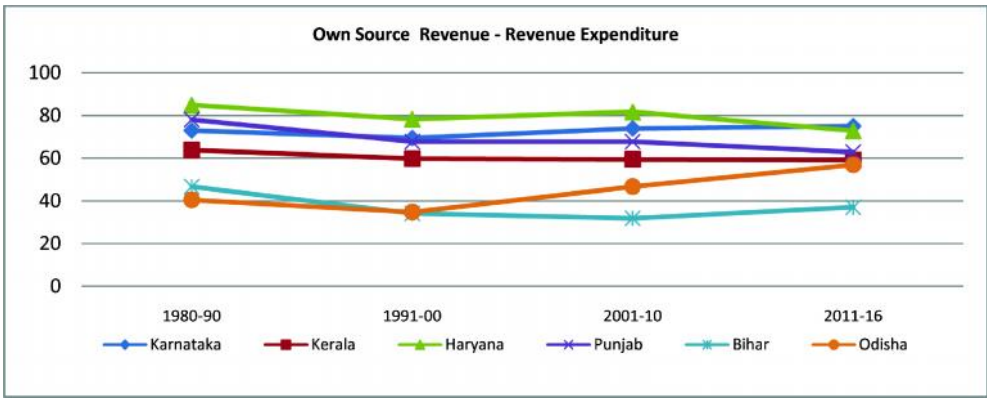
Asymmetry in spending has been a debated issue in fiscal federalism literature. The magnitudeof revenue receipts determines the level and quality of public spending. Besides own-revenue cyclicality, variability in federal funding may further squeeze and alter the states' fiscal space, with development spending becoming more vulnerable to overall revenue uncertainties and an exponential rise in committed spending and debt servicing. Against this backdrop, this paper attempts to empirically test the validity of an asymmetric spending responseto the positive and negative changes in the conditional and unconditional transfers in 6 states[2] from 1981-82 to 2014-15.

2.1 Pattern and Decomposition of Resource Dependence

Trends in some macroeconomic indicators with respect to six Indian states are presented in Figures 1 and 2. Comparing the relative share of own tax spending and central dependency in financing the total revenue expenditure, among the six states[2], Bihar and Odisha are more dependent on central transfers, whereas Punjab, Karnataka and Haryana are relatively more dependent on their own revenue for financing their expenditure. Stagnant growth or gradual fall is observed in Kerala, Punjab and Haryana despite a relatively lower level of dependency on central transfers. Odisha's tax spending and central dependency on spending have remained progressive in addition to expenditure management measures. Despite several reform initiatives, states continue to face own-revenue crunch and have become more dependent on central funding and obligatory sources of revenue in recent years.

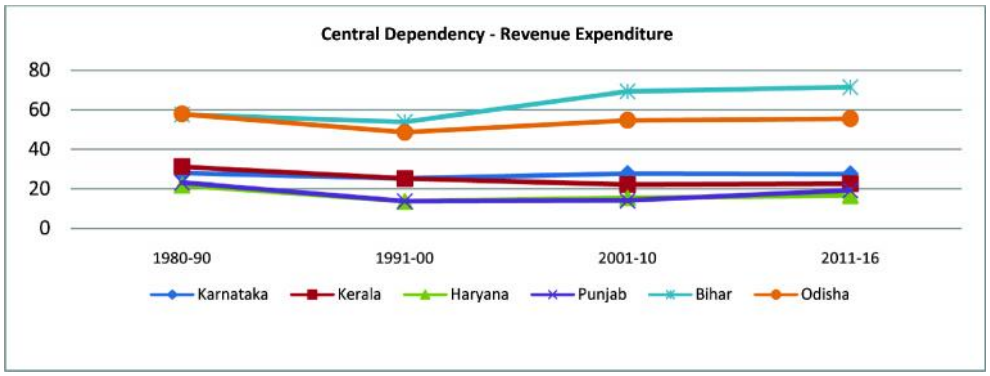
[2] The six major states are: Bihar, Kerala, Karnataka, Haryana, Odisha and Punjab. To ensure comparability Bihar is considered together with its respective newly carved state Jharkhand.

Figure 1: Own Source Revenue Spending (as % of revenue expenditure)



Source: Authors' compilation

Figure 2: Central Dependency on Revenue Spending
(as a percentage of revenue expenditure)



2.2 Trends and Composition of Public Expenditure

In total expenditure, both revenue and capital comprise development and non-development expenditure. Compared to the 1990s, expenditure composition has changed significantly since 2003-04, although heterogeneity persistsmore significantly across the states. Rising debt burdens reduced the flexibility of states to use funds for development activities in the 1990s. However, the changed fiscal scenario (FRBM, 2004) has gradually improved spending quality, followed by a surplus in the revenue account.

Table 1: Expenditure and Quality of Expenditure

Revenue Expenditure as % of Total Expenditure						
Period	Karnataka	Kerala	Haryana	Punjab	Bihar	Odisha
1980-91	87.79	87.95	85.74	89.02	82.40	79.26
1991-01	87.82	92.69	91.48	92.01	94.04	87.02
2001-11	83.24	94.85	88.19	92.91	83.90	89.71
2011-15	83.00	93.03	89.22	94.87	83.36	85.84
Capital Outlay as % of Total Expenditure						
Period	Karnataka	Kerala	Haryana	Punjab	Bihar	Odisha
1980-91	12.21	12.05	14.26	10.98	17.60	20.74
1991-01	12.17	7.31	8.52	7.99	5.96	12.98
2001-11	16.76	5.15	11.81	7.09	16.10	10.29
2011-15	17.00	6.97	10.78	5.13	16.64	14.16
Expenditure on Developmental Heads as % of Total RE						
Period	Karnataka	Kerala	Haryana	Punjab	Bihar	Odisha
1980-91	68.21	68.86	72.21	68.95	68.41	69.80
1991-01	65.88	59.36	55.34	51.08	59.50	62.61
2001-11	62.54	49.24	63.33	40.90	67.46	54.43
2011-15	58.75	48.38	63.13	49.50	63.58	67.60
Expenditure on Developmental Heads as % of Capital Ooutlay						
Period	Karnataka	Kerala	Haryana	Punjab	Bihar	Odisha
1980-91	97.40	96.75	97.11	90.79	98.58	97.76
1991-01	97.69	94.91	96.77	97.60	98.45	98.02
2001-11	96.41	95.05	93.58	94.68	96.25	95.31
2011-15	96.51	96.50	94.07	90.31	92.59	94.61

Source: Authors' compilation.

An interesting pattern that emerges from this trend is that fiscal consolidation positively impacts the states' fiscal performance, mainly in the development heads of revenue expenditure in Haryana, Bihar and Odisha. The situation is different for Karnataka, Kerala and Punjab as there is a constant fall in thm. Capital outlay is more progressive in Karnataka, Haryana, and Bihar. Odisha and Kerala failed to improve their share of the capital outlay in the immediate aftermath of the FRBM initiative but have remained progressive in recent years. In the case of Punjab, overall development spending is lagging compared

to the other remaining states under consideration. Despite the fiscal consolidation measures that have helped the states make their own space in their budgetary spending, consistency has not been maintained for a long time.

3. Theoretical Framework

Flypaper Effect and Symmetric Hypothesis: The Flypaper effect is one of the most frequently discussed subjects in the empirical literature of fiscal federalism. It refers to a phenomenon meaning 'money sticks where it hits' (Gamkhar & Oates, 1996). According to the median voter theory, flypaper is due to voter misperception (Courant et al., 1979). According to the flypaper effect, as per Oates's symmetric hypothesis, state governments increase their spending with increased transfers and vice versa. As an alternative, the asymmetric hypothesis assumes that a state's response to spending varies with an increase or decrease in central transfers (Nguyen-Hoang & Hou, 2013).

If the transfers have a long-lasting effect, states tend to respond asymmetrically. If an asymmetric response is observed, sub-national governments attempt to retain the same spending level by mobilising additional tax revenue (fiscal replacement form of asymmetry). In a fiscal restraint form of asymmetry, a decrease in spending in response to a decrease in transfers is higher than a symmetric response. (Santiago, 2008). Several studies have also theorised the effect of political variables on the allocation of transfers and implementation of development programmes (Arulampalam et al., 2008; Khemani,2007).

4. Review of Empirical Literature

Several empirical studies have dealt with the impact of federal fiscal transfers on the budgetary response (Gamkhar & Oates,1996; Nguyen-Hoang & Hou, 2013). However, this issue has not drawn much attention in India, and only a few studies have been conducted. In the Indian context, Lalvani (2002) founda fiscal replacement form of asymmetry in 14 states from 1980 to the 1990s. Likewise, the incentive effects of federal lump-sum transfers on state expenditure were analysed by Prasant and Nirmala (2013), using panel data from 22 states from 1980 to 2005. Panel static model analysis revealed that lump-sum transfers stimulate public expenditure at the sub-national level. Similarly, Samal (2018) found a fiscal replacement form of asymmetry during the post-reform compared to the pre-reform period. Some studies focused on the influence of political awareness on the quality of public expenditure and the provision of social services (Keefer & Khemani, 2003; Khemani, 2007)

While there are several studies on probable linear relationships, an empirical analysis of the asymmetric response of development spending to federal transfers, which tests the probable non-linear relationship, is absent. Hence, we aim to bridge this gap in research through this study.

5. Econometric Analysis

The variables and their data sources considered in the model are presented as follows (Appendix Table). Before estimating the model, it is necessary to check the order of integration of all the variables. Hence, the ADF unit root test is conducted using the Akaike Information Criterion for optimal lag length selection.As per the unit root test results, all variables are integrated of order one, I(1) at the level and stationary at the first difference at a five per cent significance level (Tables 2 and 3).

Table 2: ADF Unit Root Test

Variables	Bihar		Odisha		Karnataka	
	At Level	At First Difference	At Level	At First Difference	At Level	At First Difference
ln (Unconditional Transfers)	-0.212	-5.615*	-0.366	-7.510*	0.016	-6.146*
ln (Conditional Transfers)	-3.360*	-9.490*	-2.181	-3.223*	-2.786	-6.270*
Revenue Diversification	-2.121	-5.625*	-2.057	-7.604*	-1.305	-4.814*
ln(Debt)	-1.564	-5.778*	-1.557	-5.856*	-0.909	-5.865*
ln(development Expenditure of Revenue Account)	-0.608	-6.326*	0.397	-8.360*	-0.570	-9.671*
ln(development Expenditure of Capital Account)	-0.839	-5.863*	-0.531	-6.261*	-0.210	-6.140*

Note: * significant at 1% level ** Significant at 5% level *** Significant at 10% level

Table 3: ADF Unit Root Test

Variables	Kerala		Haryana		Punjab	
	At Level	At First Difference	At Level	At First Difference	At Level	At First Difference
ln (Unconditional Transfers)	0.055	-9.528*	-1.127	-6.099*	-1.721	-8.215*
ln (Conditional Transfers)	-0.906	-8.429*	-0.606	-4.648*	-4.952**	-9.104*
Revenue Diversification	-2.057	-7.604*	-2.661	-4.910*	-1.697	-6.830*
ln(Debt)	-0.759	-4.883*	-1.179	-5.945*	-1.043	-6.839*
ln(development Expenditure of Revenue Account)	3.038	-7.215*	-0.025	-8.041*	-1.546	-6.071*
ln(development Expenditure of Capital Account)	-0.188	-6.010*	-2.229	-6.047*	-4.311**	-6.928*

Note: * significant at 1% level ** Significant at 5% level *** Significant at 10% level

5.1 Model Specification - NARDL Model

Shin et al. (2014) proposed an asymmetric ARDL model to simultaneously estimate a dynamic long-run and asymmetric relationship between the variables to assess the non-linear relationship. This NARDL model decomposes the partial sums of positive and negative changes in the same explanatory variable. Partial sum decompositions of positive and negative changes, which represent increases and decreases in the same explanatory variable, are as follows:

$$\text{Ln UCT}_t = LnUCT_0 + LnUCT_t^+ + LnUCT_t^-$$

$$\text{Ln CT}_t = LnCT_0 + LnCT_t^+ + LnCT_t^- \quad \ldots\ldots\ldots\ldots\ldots(1)$$

Where:

$$LnUCT_t^+ = \sum_{i=1}^{t} \Delta LnUCT_i^+ = \sum_{i=1}^{t} max\,(\Delta LnUCTi, 0)$$

$$LnUCT_t^- = \sum_{i=1}^{t} \Delta LnUCT_i^- = \sum_{i=1}^{t} min\,(\Delta LnUCTi, 0)$$

Following Shin et al. (2014), a long-run-on-linear asymmetric model can be expanded as:

$$\Delta y_t = \beta^+ UCT_t^+ + \beta^- UCT_t^- + \beta^+ CT_t^+ + \beta^- CT_t^- + \varepsilon_t \ldots\ldots(2)$$

Equation (2) is included in the asymmetric ARDL error correction mode. Similarly, following Shin et al. (2014), the proposed non-linear asymmetric conditional NARDL model is as follows:

$$\text{Equation-2:}\Delta y_t = \alpha_0 + \rho y_{t-1} + \alpha^+ UCT^+_{t-1} + \alpha^- UCT^-_{t-1} + \alpha^+ CT^+_{t-1} + \alpha^- CT^-_{t-1} + \alpha^+ RD^+_{t-1} + \alpha^- RD^-_{t-1} \gamma \delta_t + \sum_{i=1}^{p-1} \varphi_i \Delta y_{t-i} + \sum_{i=0}^{q-1} (\gamma^+ \Delta UCT^+_{t-i} + \gamma^- \Delta UCT^-_{t-i}) + \sum_{i=0}^{q-1} (\gamma^+ \Delta CT^+_{t-i} + \gamma^- \Delta CT^-_{t-i}) + \sum_{i=0}^{q-1} (\gamma^+ \Delta RD^+_{t-i} + \gamma^- \Delta RD^-_{t-i}) + \varepsilon_t \ldots\ldots\ldots (3)$$

y_t, the dependent variable, represents development expenditure.

Theasymmetric coefficients are estimated as follows:

$\alpha^+ = -\frac{\rho}{\beta+}$ and $\alpha^- = -\frac{\rho}{\beta-}$

'p' and 'q'are the lag order of dependent and independent variables, respectively. The ρ coefficient indicatesthe speed of adjustment. α^+ and α^- are long-run and are short-run coefficients; γ is the coefficient of dummy variables used as determinants only in the long-run and εtis the error term. To test asymmetry, the Wald test is used to check the null hypothesis $\alpha = \alpha^+ = \alpha^-$. The lag order of two is selected based on Schwartz Bayesian Criterion.

6. Empirical Results

NARDL test results of the first part of Table 4and Table 8 confirm long-run co integration among the variables wherein development expenditure of revenue and capital accounts are dependent. Furthermore,in the second part of the tables referred to above, reports of diagnostic test results confirm that models are well specified. The test results related to long-run asymmetric values at the disaggregated level are presented in Table 5 and Table 9. In contrast, the long-run asymmetric statistics and Wald test, which prove asymmetry, are presented in Table 6and Table 10. Asymmetry is observed concerning the sign and significance level of the positive and negative partial sum of variables.

In general, an increase in spending for positive coefficients UCT_t^+ and CT_t^+ indicates an increase in spending with an increase in the flow of central funds, whereas, a decrease in spending for positive coefficients UCT_t^+ and CT_t^+ and indicates fungibility of resources from a targeted area to an untargeted area at the sub-national level even with an increase in the flow of central funds.

On the other hand, a decrease in spending for negative coefficients UCT_t^- and CT_t^- and indicates the inability of the state to continue with the existing level of spending on developmental activities during a fall in the volume of central

transfers/funds. Whereas, an increase in spending for negative coefficients UCT_t^- and CT_t^- indicates that the respective state government supplemented the funds provided by the central government with a specific-sector development activity during a decrease in the volume of central transfers.

An increase in spending for positive coefficient RD_t^+ indicates state efforts towards tax reform have positively linked to its development-oriented spending.

6.1 Development Expenditure - Revenue and Capital Account

In the development part of revenue expenditure as a dependent variable, the test results related to long-run asymmetric values at the disaggregated level proveasymmetrywith the Wald test for unconditional transfers for all the states except Kerala and Haryana. Moreover, for conditional transfers, asymmetry is evident in Bihar, Odisha, Karnataka, and Punjab(Table 6). Finally, for revenue diversification, among the six states, asymmetry is proved with the Wald test in Bihar, Odisha and Punjab. Some of thevariables in the short-run estimates of the NARDL model are found to be significant (Table 7).

Table 4: Results of Cointegration Test Statistics of the Expenditure Asymmetry

States	F_pss	Significance level		Lower Bound	Upper Bound		X 2 SC	X 2 BPG	Ramsey F	R2	F-Stat
Bihar	6.96***						17.43	1.097	0.683	0.94	8.59
Odisha	6.20***	10%	Cont 2.72	C & T 3.45	Cont 3.77	C & T 4.45	17.80	1.037	0.283	0.97	9.37
Karnataka	6.83***						18.22	1.981	2.616	0.90	4.11
Kerala	5.18**	5%	3.23	4.01	4.35	5.07	16.68	0.035	1.112	0.87	2.17
Haryana	5.71**	5%	3.23	4.01	4.35	5.07	14.77	0.005	3.66	0.97	9.60
Punjab	8.20***	1%	4.29	5.17	5.61	6.36	18.23	0.015	3.00	0.98	17.9

Source: Authors' compilation.

Table 5: Estimates of Long-Run Asymmetric ARDL (Development Expenditure/ Revenue Expenditure)

Variables	Bihar	Odisha	Karnataka	Kerala	Haryana	Punjab
ECT	-0.800** (-3.48)	-0.454** (-2.86)	-0.796*** (-3.96)	-0.575** (-3.19)	-0.966** (-2.83)	-0.826*** (-6.55)
$Log\ UCT^{+}_{t-1}$	-0.173** (-2.86)	0.654** (2.75)	0.126 (0.82)	0.447 (1.42)	0.245 (0.76)	-0.310** (-2.78)
$Log\ UCT^{-}_{t-1}$	0.127 (0.88)	2.011*** (4.25)	-1.833*** (-3.88)	0.535 (1.30)	0.044 (0.19)	0.155** (2.82)
$Log\ CT^{+}_{t-1}$	0.064* (2.21)	-0.019 (-0.18)	-0.0013 (-0.03)	0.603*** (4.18)	-0.009 (-0.10)	0.257* (2.44)
$LogCT^{-}_{t-1}$	-0.049 (-0.82)	-0.793*** (-3.99)	0.465*** (5.35)	-0.083 (-0.64)	0.245** (2.01)	0.085 (0.80)
RD^{+}_{t-1}	-1.457** (-2.75)	0.533 (0.74)	1.106** (3.09)	-1.921 (-1.57)	-0.891 (-1.42)	-0.440* (-1.99)
RD^{-}_{t-1}	-0.262 (-0.39)	3.611*** (5.37)	0.989 (1.91)	-1.310 (-1.60)	-0.780* (-2.03)	0.143 (0.36)
Debt Reform Dummy	-----	0.144** (3.08)	-0.182*** (-4.69)	0.046 (0.83)	0.206** (3.47)	-----
FRBM (FRL)	0.102** (2.34)	-----	-----	-----	-0.049 (-0.59)	-----
Liberalisation Dummy	-----	-----	-----	-----	-----	0.479*** (6.07)
Political Strong hold	-----	-----	-0.015** (-2.61)	-----	0.020 (0.41)	-----
Year of Assembly Election	-----	0.456** (3.23)	-----	-----	-----	-0.916** (3.04)
Voter turnout	0.005** (2.51)	-0.008*** (-3.92)	-----	-----	-----	0.012** (2.90)
Trend	-----	-----	-----	-0.108** (-2.47)	-----	-----

Source: Authors' compilation.

Notes: t statistics in parentheses * p<0.10, ** p<0.05, *** p<0.01 denote significant at 10,5,1% levels respectively.

Table 6: Estimates of Long-Run Asymmetry (Development Expenditure-Revenue Account)

Development Expenditure - Long Run Asymmetric coefficients							LR Asymmetry(Wald test)		
States	Bihar		Odisha		Karnataka		Bihar	Odisha	Karnataka
UCT	-0.217	-0.24	1.440	-4.424	0.158	2.301	17.43	7.23	7.20
CT	0.081	0.062	-0.043	1.744	-0.002	-1.584	7.67	4.21	12.36
RD	-1.820	0.328	1.174	-7.942	1.389	-1.242	4.16	4.81	0.66
	Kerala		Haryana		Punjab		Kerala	Haryana	Punjab
UCT	0.779	-0.93	0.254	-0.046	-0.376	-0.189	0.298	3.16	12.29
CT	1.049	0.145	-0.010	-0.253	0.312	-0.104	4.16	11.23	4.27
RD	-3.342	2.278	-0.922	0.808	-0.533	-0.174	0.212	0.135	3.81

Source: Authors' compilation.

Notes: Wald test for the null of long-run symmetry; WALD LR, UCT ;WALD LR, CT and WALD LR, RD refer to the Wald test of long-run symmetry of unconditional and conditional transfers, revenue diversification, respectively.

Table 7: Short-run Estimation Results of the Asymmetric ARDL (Development Expenditure - Revenue Account)

Variables	**Bihar**	**Odisha**	**Karnataka**	**Kerala**	**Haryana**	**Punjab**
$\Delta LogY_{t-1}$	0.113 (0.66)	0.385* (-2.00)	0.462 (1.82)	-0.354 (-1.52)	-0.040 (-0.21)	0.664*** (5.10)
$\Delta LogUCT_t^+$	-0.018 (-0.21)	0.368** (2.62)	0.377* (3.01)	-0.092 (-0.67)	-0.089 (-0.50)	-0.092 (-1.75)
$\Delta LogUCT_{t-1}^+$	-0.098 (-0.64)	-0.430** (-3.49)	0.065 (0.49)	0.088 (0.52)	-0.201 (-1.26)	0.135 (0.72)
$\Delta LogUCT_t^-$	0.001 (0.01)	-0.388 (-1.28)	-1.416* (-4.41)	-0.141 (-0.68)	0.351* (2.22)	0.265 (1.76)
$\Delta LogUCT_{t-1}^-$	0.049 (0.34)	0.145 (0.60)	-0.339 (-2.18)	-1.248*** (-3.60)	0.524* (1.95)	-0.358 (-3.88)**
$\Delta LogCT_t^+$	0.017 (0.62)	-0.034 (-0.36)	-0.196* (-3.04)	0.235*** (3.61)	-0.040 (-0.75)	0.332** (3.56)
$\Delta LogCT_{t-1}^+$	-0.087*** (-3.74)	-0.208** (-2.49)	-0.094 (-1.78)	-0.144 (-1.36)	0.075 (0.65)	-0.076 (-1.94)
$LogCT_t^-$	0.029** (2.68)	-0.062*** (-4.05)	0.063 (1.42)	-0.092 (-0.90)	0.145 (1.30)	-0.038 (-1.07)
$\Delta LogCT_{t-1}^-$	0.064 (1.50)	0.272* (2.01)	-0.227* (-3.23)	0.012 (0.16)	-0.211* (-2.25)	0.051 (0.49)
ΔRD_t^+	-1.772** (-4.81)	-1.079* (-1.97)	-0.083 (-0.28)	-0.089 (-0.10)	-2.229*** (-5.63)	-1.541*** (-5.52)
ΔRD_{t-1}^+	0.073 (0.26)	-0.295 (-0.56)	0.246 (-0.69)	0.729 (1.15)	-0.901*** (-3.46)	-0.923 (-3.08)
ΔRD_t^-	0.374 (0.87)	2.192*** (5.05)	-0.326 (-0.87)	-2.158*** (-3.71)	0.955*** (4.35)	-0.818* (-2.05)
ΔRD_{t-1}^-	-0.722 (-1.89)	-0.876** (-2.43)	-1.314** (-3.24)	-0.726 (-1.20)	0.130 (0.36)	0.497 (-1.11)
Constant	3.548*** (3.55)	1.952** (2.91)	3.351*** (-3.97)	2.480*** (3.13)	4.337*** (4.05)	3.569*** (6.55)

Notes: t statistics in parentheses * p<0.10, ** p<0.05, *** p<0.01 denote significant at 10%, 5% and 1% levels, respectively.

For capital expenditure as a dependent variable, the test results related to long-run asymmetric values at the disaggregated level (Table 10) prove asymmetry with the Wald test for unconditional transfers concerning Bihar, Karnataka, Kerala and Haryana. Regarding revenue diversification, asymmetry has been proved for Bihar, Odisha, and Haryana. The Wald test is evident for debt in Bihar, Karnataka, Kerala, Punjab and Haryana. The short-run estimates of the asymmetric ARDL model are presented in Table 11 with some of the variables found to be statistically significant.

Table 8: Results of Cointegration Test Statistics of the Expenditure Asymmetry

States	F_pss	Significance level	Lower Bound	Upper Bound	X 2 SC	X 2 BPG	Ramsey F	R2	F-Statistics
Bihar	4.66**	10%	2.72	3.77	13.41	0.151	1.751	0.96	9.34
Odisha	13.20***				1.98	1.224	0.072	0.96	10.29
Karna taka	5.83***	5%	3.23	4.35	15.34	0.239	0.737	0.92	3.85
Kerala	5.23**				16.18	1.844	0.801	0.94	4.88
Haryana	12.04***	1%	4.29	5.61	15.74	1.162	1.380	0.97	11.14
Punjab	6.44***				15.72	1.727	0.116	0.95	5.12

Source: Authors' compilation.

Table 9: Long-run Estimation Results of the Asymmetric ARDL (Development Expenditure - Capital Account)

Variables	Bihar	Odisha	Karnataka	Kerala	Haryana	Punjab
ECT	**-0.747*** (-4.11)**	**-0.954*** (-4.00)**	**-0.928* (-2.19)**	**-0.952*** (-3.46)**	**-0.616*** (-4.47)**	**-0.979*** (-4.79)**
$LogUCT_t^+$	-2.15* (-2.07)	-3.60*** (-4.44)	-0.963 (-0.77)	2.554** (2.76)	5.179*** (6.41)	3.921** (2.78)
$LogUCT_t^-$	5.80* (2.21)	-4.695** (-2.82)	-7.803** (-3.34)	4.028*** (3.21)	3.425*** (3.34)	2.706* (2.11)
RD_t^+	3.68 (1.37)	1.393 (0.44)	2.876* (2.27)	-8.93 (-1.68)	5.615*** (3.16)	1.433 (1.09)
RD_t^-	0.634 (0.38)	9.734*** (5.94)	8.868** (3.48)	1.09 (0.80)	12.14*** (4.13)	-5.972** (-2.78)
$LogDebt_t^+$	1.23** (2.48)	-0.675*** (-4.23)	0.494** (2.90)	-0.001 (-0.01)	0.0978 (0.33)	0.428 (0.96)
$LogDebt_t^-$	-1.22** (-2.43)	-0.695*** (-4.06)	-0.608 (-1.71)	-0.795* (-1.96)	-0.873** (-3.00)	-0.328 (--0.94)
Debt Reform Dummy	--------	--------	-0.910*** (-4.48)	--------	-1.390** (-2.36)	--------
Incumbency Dummy	-------	0.644*** (5.78)		--------	--------	-1.762 (-1.92)
FRBM (FRL)	0.779* (2.23)	1.048*** (7.49)	0.499*** (3.19)	--------	1.637** (3.10)	-1.457** (-3.14)
Year of Recession	--------	--------	--------	-0.12 (-1.82)	-0.553* (-2.14)	0.466* (2.07)
Political Ideology Dummy	--------	0.394*** (4.67)		--------	--------	--------
Regional party Dummy	0.593 (0.93)	0.488*** (4.15)	-------	--------	--------	0.587 (1.50)
Year before assembly Election	-0.036 (-0.48)	-0.119** (-2.35)	--------	0.0636 (-0.70)	--------	-0.101 (-0.13)
Year of Assembly Election	--------	--------	--------	6.273*** (3.33)	--------	--------
Voter turnout	--------	--------	--------	-0.086*** (-3.33)	--------	--------
Trend	------	0.28*** (4.37)	0.083 (1.72)	--------	-0.215** (-2.19)	--------

Source: Authors' compilation.

Notes: t statistics in parentheses * p<0.10, ** p<0.05, *** p<0.01 denote significant at 10%, 5% and 1% levels, respectively.

Table 10: Estimates of Long-Run Asymmetry (Development Expenditure - Capital Account)

Development Expenditure - Long Run Asymmetric Coefficients							LR Asymmetry		
States	Bihar		Odisha		Karnataka		Bihar	Odisha	Karnataka
UCT	**-2.889**	**-7.763**	-3.774	4.923	1.037	**8.404**	**15.21**	1.08	**8.55**
RD	4.929	-0.849	1.46	-10.20	**3.098**	**-15.06**	3.11	**5.90**	**3.52**
Debt	**1.648**	**1.638**	-0.708	0.728	0.533	**0.655**	**7.23**	0.006	**7.69**
	Kerala		Haryana		Punjab		Kerala	Haryana	Punjab
UCT	**2.684**	**-4.233**	**8.406**	**-5.56**	4.003	-2.762	**5.522**	**4.33**	1.11
RD	-9.384	-1.156	**9.114**	**19.70**	1.464	6.097	1.94	**4.91**	**10.49**
Debt	-0.001	**0.836**	0.159	**1.417**	0.438	0.335	**6.496**	**5.28**	1.85

Source: Authors' compilation.

Table 11: Estimates of Short-Run Asymmetric ARDL (Development Expenditure - Capital Account)

Variables	Bihar	Odisha	Karnataka	Kerala	Haryana	Punjab
$\Delta LogY_{t-1}$	0.060 (0.36)	0.563 (3.07)	0.023 (0.08)	0.087 (0.43)	-0.632 (-3.36)	-0.224 (-1.30)
$\Delta Log\ UCT_t^+$	-1.411 (-1.43)	-0.522 (-1.34)	0.949 (1.35)	0.890 (1.39)	5.772 (5.98)	1.358 (1.86)
$\Delta LogUCT_{t-1}^+$	1.245 (1.45)	3.119 (8.20)	-0.227 (-0.25)	-0.802 (-1.42)	-2.650 (-3.06)	-5.508 (-3.76)
$\Delta Log\ UCT_t^-$	3.621 (1.60)	4.328 (3.34)	-9.092 (-5.69)	-1.906 (-1.99)	-5.864 (-7.44)	-3.729 (-2.44)
$\Delta LogUCT_{t-1}^-$	-2.170 (-2.90)	(-0.54) 1.918	-1.222 (-0.99)	-1.739 (-1.62)	-10.91 (-5.68)	0.491 (0.84)
ΔRD_t^+	4.598 (2.16)	(-0.44) 0.918	4.408 (2.69)	-6.11 (-1.23)	8.012 (3.07)	0.819 (0.61)
ΔRD_{t-1}^+	4.337 (2.32)	(-0.21) 1.618	2.678 (2.7)	-5.05 (-1.65)	-2.021 (-1.16)	2.356 (0.90)
ΔRD_t^-	1.143 (0.83)	4.433 (3.00)	-1.178 (-1.17)	1.084 (0.84)	-3.022 (-1.13)	-0.880 (-0.49)
ΔRD_{t-1}^-	-0.825 (-0.32)	2.221 (1.90)	-6.452 (-3.73)	1.096 (0.89)	8.094 (2.77)	2.144 (1.97)
$\Delta Log\ Debt_t^+$	0.183 (0.73)	0.162 (2.23)	0.0241 (0.16)	-0.020 (-0.21)	-0.676 (-2.42)	-0.135 (-0.54)
$\Delta Log\ Debt_{t-1}^+$	-0.909 (-2.97)	0.572 (5.39)	-0.421 (-2.67)	0.016 (0.10)	-0.233 (-1.02)	-0.879 (-1.65)
$\Delta Log\ Debt_t^-$	-0.931 (-1.39)	-0.165 (-1.53)	-0.104 (-0.29)	-0.099 (-0.23)	1.471** (3.81)	0.173 (0.41)
$\Delta\ Log\ Debt_{t-1}^-$	1.562 (2.36)	0.211 (2.01)	0.224 (0.65)	0.369 (1.16)	0.418 (1.38)	1.116 (3.13)
Constant	3.263*** (3.73)	5.695*** (3.46)	4.737* (2.06)	6.381** (4.99)	4.635** (4.52)	4.892 (4.58)

Notes: * p<0.10, ** p<0.05,***p<0.01 denote significant at 10%, 5% and 1%, respectively.

Among the six, Bihar and Odisha, which have higher allocations of central funds, show higher spending. Comparing the both, a positive sign in unconditional transfers indicates that Odisha could enhance its development spending by properly utilising central transfers, given the fiscal space with a revenue surplus in its revenue account. In the case of Bihar, a positive sign for conditional transfers shows its utilisation of centre-specific transfers for development activities, though the sign is negative for unconditional transfers (Table 5).

Regarding development expenditure under capital outlay, Bihar doubled its share from Financial Year (fy) 2002-03 to FY 2012-13. A decline in debt repayment obligations enabled the state to make more capital investments post-FRBM despite the state's changed spending priority(ADRI Report, 2007). This could be the reason for debt being positively related to capital expenditure. In Odisha, central transfers and debt have failed to improve the state's spending under capital outlay despite the state experiencing an upswing in capital spending in the recent past compared to the 1990s. A progressive trend in revenue mobilisation and expenditure cutback measures led to Odisha's development initiatives from 2005 to 2013. As per the 2018 NIPFP report, in Odisha, CSSs have positively contributed towards social and economic development despite ambiguity in its trend. This could be why the FRBM dummy positively relates to capital expenditure in Odisha and Bihar.

The fiscal scenario of the states changed following several fiscal reform initiatives undertaken in the subsequent years. The improved fiscal performance enabled them to avail of debt write-off to a larger extent under debt consolidation and relief facility, as recommended by the 12th FC. With such initiatives, public debt and outstanding liabilities had gone down substantially. In Odisha, outstanding liabilities to GSDP decreased from 61.82 per cent to 19.65 per cent during FY 2002-12, while in Bihar, the share of repayment of public debt under capital expenditure decreased from 47 per cent to 21 per cent during the period 2001-2012 (Panda, 2014). Such efforts to substantially slash their debt burden and downsize committed spending enabled the fiscal space to enhance the relative shares of development expenditure. The states could utilise substantial obligatory resources for capital investment rather than account spending. Such a significant shift in the spending pattern in the post-reform has improved spending quality, enabling states to make capital investments of their choice.

Although a fiscal restraint form of asymmetry was evident concerning both states, they showed a lesser interest in continuing with their own spending during downturns in transfers despite benefitting from a higher quantum of central funds. Bihar failed to continue with its development spending during downturns in transfers. At the same time, Odisha could retain its share only in cost-sharing central programmes even during a fall in conditional transfers. Moreover, its spending under capital outlay remained lower even after FRBM was implemented. For instance, the capital outlay was 1.70 per cent from 1999 to 2004 and 1.88 per cent from 2004 to 2010, but in the recent past, it has increased to only 3.44 per cent in FY 2014-15 andfive per cent in FY 2015-16 (Mahapatra, 2005; Panda, 2014). Odisha experienced sluggish growth in development spending for extended periods even after the reform initiatives due to structural problems. This was not the case with Bihar where debt is positively related to capital spending.

On the contrary, in the case of Punjab,a negative sign of transfers to development spending reveals a larger proportion of transfers being utilised for committed spending. Although the state's spending on area-specific cost-sharing programmes seems to be progressive, it was not complementary, for which it received the central assistance. Due to a weak fiscal position and increased indebtedness, the state failed to allot its share in matching funds to centrally sponsored schemes *(Planning Commission Review Report, 2009)*. The share of development expenditure shows a constant decline over the years. Regarding capital outlay, an increase in debt repayment obligations forced the state towards a lesser capital investment during post-FRBM. Compared to the 1980s and 1990s, the share of capital expenditure showed a constant decrease in the last decade, besides remaining at a significantly lower level, which was evident. For instance, from 2007-08 to 2016-17, capital expenditure to GSDP was about 1.9 per cent; similarly, capital outlay declined to about one per cent of GSDP. The state utilised60 per cent to 70 per cent of its borrowing to repay its earlier borrowings, 20 per cent to 35 per cent for revenue expenditure and only 8 per cent to 10 per cent for capital expenditure (Pradhan & Prashad, 2018). Such constant deterioration in the state's fiscal health could be why debt is insignificant, and the FRBM dummy is negative but significant. However, transfers were positively related to capital expenditure. This shows the state's inability to continue spending on development services. Besides, an increase in non-plan grants has paved the way for an increase in the state plan grants, while a constant fall in the flow of funds under CSSs between 2006 and 2017 is also noticeable (Tables 5 and 9).

A broad overview of Punjab's fiscal scenario shows that in the past 12 years, the state's tax revenue has grown steadily at a slower pace, while the state has increasingly resorted to borrowings right from the mid-1990s, posing a threat to the fiscal prudence of the state. The history of state finances reveals that the share of committed spending declined in the mid-1990s to the early 2000s, moderate in the aftermath of the 12th FC, before increasing in the second half of the 2000s (Pradhan & Prashad, 2018). Hence, it is evident that a significant proportion of the total expenditure has remained committed. For instance, the share of committed expenditure amounts to more than 60 per cent of its revenue receipts and 48 per cent of revenue expenditure for 2011–12 (*State Finances*, RBI). Over time, several populist policies and debt liabilities have led to a rise in the share of non-development expenditure. However, despite an improved fiscal situation since the late 2000s, consistency has not been maintained in development spending. Its fiscal deficit has breached the FRBM threshold level. Punjab is one of the states more dependent on borrowing to finance its growing debt servicing and committed spending obligations.

Apart from Punjab, in Haryana and Kerala, the fiscal scenario has not remained entirely different, with the compositional shift in their revenue account being minimal even during the post-FRBM period. Kerala has remained at the forefront of social sector spending. The positive sign for conditional transfers shows its utilisation of central-specific transfers for development activities, though the unconditional transfers have remained insignificant. State spending on area-specific cost-sharing programmes remained progressive; CSSs have also positively stimulated spending on socio-economic areas. Further, overall transfers have contributed positively towards capital expenditure, but fiscal restraint form of asymmetry has been evident during downturns in transfers. The state has failed to retain its cost-sharing prioritised development spending with a growing fiscal mismanagement (Tables 5 and 9).

Kerala represents a fast-growing economic paradox with persistent fiscal stress due to fiscal mismanagement. Since the mid-1990s, Kerala has been under fiscal stress despite its fast-growing economy. For instance, the state revenue mobilisation capacity has decreased constantly from 5.60 per cent from 1982-92 to 1.96 per cent from 2002 to 2017 (Sebastian, 2019). On the expenditure front, Kerala has spent a higher amount on committed services, besides spending on social infrastructure. The state's efforts to improve its fiscal sustainability compressed the overall spending as per cent of GSDP in the post-FRBM. For instance, from 2002 to 2014, a period of accelerated economic growth, Kerala

experienced a lower level of total spending compared to a moderate growth period from 1987 to 2001. Until the mid-2000s, spending on development services decreased constantly, but the situation reversed later (Nair & Sensarma, 2017). Even with some reform initiatives, capital account development expenditure decreased constantly with a rise in the state's commitment to retain its existing ongoing plans on social and community services, which further contributed to ever-growing non-plan revenue expenditure. Overall, its efforts to improve its fiscal situation by adhering to the fiscal rule have failed due to insufficient revenue, ever-growing deficits, and debt burden.

In Haryana, the revenue account has remained less responsive, while its capital expenditure has been relatively more responsive to overall transfers. Compared to other states, Haryana has experienced an upswing in capital spending for a longer period. The sign for unconditional transfer to capital spending is positive, though it has remained insignificant for the development part of the revenue account. The positive sign of transfers to capital spending reveals that a more significant proportion of transfers and the state's own revenue has been utilised for development purposes. A progressive trend in revenue mobilisation and revenue diversification, along with expenditure cutback measures, has led to development initiatives for a longer duration (Tables 5 and 9).

In the total expenditure, the share of development expenditure has remained progressive, but consistency has not been maintained for a longer duration.In Haryana, wider fluctuations in the yearly growth pattern of different expenditure components, especially in the case of capital outlay, reflect the lack of seriousness in proper planning in fiscal management initiatives. For instance, the growth rate of capital outlay to GSDP was 5.8 in 2005-06, and it decreased to 0.71 in 2009-10 and even lower to -1.37 in 2010-11 and again increased to 7.41 in 2015-16 (Ashra & Rupamanjari, 2018). This indicates an erratic pattern of growth rates. The state has failed in credible expenditure planning during fiscal management initiatives (Pratap, 2009). Compared to the remaining states, Haryana's overall compositional shift in revenue and capital accounts has remained minimal even during the post-FRBM period. For instance, on average, the share of development expenditure to GSDP was 9.2 per cent during 2010-15, as against 9.3 per cent during 2004-08, while the capital outlay to capital expenditure remained stagnant at 0.11 per cent in 2004-05 and 0.10 per cent in 2016-17 (*Haryana State Finances*, various issues).

The prime intention of the FRBM Act was to create fiscal space to enhance

capital expenditure through fiscal correction measures. However, it did not happen in Haryana. Instead, it squeezed capital outlay despite a surplus in revenue accounts and increased dependence on central transfers to expand development spending. Although development spending remainedprogressive for the period 2000 to 2014, dueto a lack of consistency in the pattern of spending, Priority sector spending has been badly affected, followed by the state's inability to garner enough revenue from its own resources in the last decade (a remarkable decline in non-tax revenue from 22 per cent of total revenue receipts in 2002 to 12 per cent of total revenue receipts in 2017 (Ashra & Ray, 2018). Given its insufficient revenue, the state has increasingly resorted to public borrowings to finance its expenditure obligations over time. Finally, in the case of Karnataka, the fungibility of the state resources during upturns in unconditional and conditional transfers and a fiscal replacement form of asymmetry during downturns are observed for the development part of revenue and capital spending in respect of unconditional transfers. However, for conditional grants, a restraint form of asymmetry is observed.

In Karnataka, fiscal consolidation measures brought about a shift in the pattern of development spending. Its improved fiscal situation enhanced the fiscal space created by adhering to the fiscal targets,enablingit to reprioritiseits expenditure in favour of development services. Although, due to differences in the state prioritised spending, the state funding failed to complement the central-specific cost-sharing schemes funding, with fungibility of state resources also evident. Despite the state's effort to compensate for the loss of central funding due to a structural shift in the central funding pattern for the state plans and CSSs, an overall deduction has adversely impacted spending, mainly in the social sector. Fiscal correction measures compressed the total expenditure, with its development component being affected, while capital outlay remained relatively more progressive (MTFP, various issues).

In Karnataka, due to poor fiscal performance and increased committed spending, the overall progress was unsatisfactory in the 1990s. From the second half of the 1990s to the early 2000s, the revenue deficit resulted in the crowding out of development spending and the use of borrowings to finance its expenditure. Reform initiatives have slowly brought Karnataka on the path of fiscal sustainability, as well as helping the state reprioritise its expenditure towards development services. For instance, capital spending to GSDP increased from 3.5 per cent to 4 per cent between 2008-09 and 2011-12 (MTFP, 2018).

Despite the state's efforts to divert all government borrowing towards development activities, the development part of spending has remained more vulnerable to economic ups and downs and the changed state spending priorities.

As per the empirical outcome, several political factors stimulate spending on development activities.As per the empirical outcome,the electoral cycleseems more significant among a few states under consideration. The election dummy is positively significant in Odisha and Kerala for development spending, along with the incumbency dummy in Odisha, whereas it is negative in Haryana and Odisha.More often around the election years, incumbents prefer pre-poll populist programmes and are expected to spend more on development activities. For instance, the Member of Parliament (MP) Local Area Development Programme is an annually allotted discretionary fund that allows MPs or incumbent parties to make visible investments around the year of election to enhance their chances of getting re-elected in the forthcoming elections (Blair, 2017). Conversely, it may focus more on identity politics, such that politically induced incentives have failed to impact development activities positively. Research evidence bears similar findings wherein political parties have changed their policy measures and decisions to reallocate towards more visible investment during election years (Nordhaus, 1975).

Voter turnout, in influencing the composition of spending, is positive and significantin Kerala, Bihar and Punjab for development expenditure. This indicates that voters' active participation has positively influenced the state spending policies. Conversely, voter turnout is found negative in Odisha and Kerala, respectively, revealing the failure of voters' active participation in increasing development-oriented spending policies of the states.

Political ideology is positively significant for capital spending in Odisha, indicating a positive influence on spending policies in contrast to the case of Karnataka. A rightist political party's Chief Minister (CM) spends more on long-run development policies than the leftist CM (Singh & Bose, 1986). This implies that when the era of politics is competitive, and the coalition is in place, development spending may remain much unchanged, as the respective governments may fail to undertake long-lasting development activities involving a longer gestation period due to different ideologies, prominence to identity politics, incompletion of ongoing programmes and so on.

7. Conclusions and Policy Suggestions

Drawing on an established set of theoretical and empirical papers on expenditure asymmetry, the present analysis has attempted to examine the non-linear relationship between spending and federal transfers. In the development part of spending, a fiscal restraint form of asymmetry is evident in most cases during the reduced allocation of central funds, and even fungibility of resources is evident. Diversion or decreased allocation of the state's funds might be the reason behind such asymmetry.

Followed by the fiscal reform initiatives, the states have enhanced their development part of spending in the aftermath of reform. However, the process has not remained uniform across the states. Some states have increased their capital outlay at the cost of the development component of the revenue account. In contrast, some states, along with an increase in the development component of revenue spending, have experienced a compositional shift with a decline in the share of social sector spending. Some states have enhanced their relative share of the economic sector at the cost of the social sector. Further, some states have failed to enhance their development component of revenue spending from the existing level, with only stability being maintained. Some states have failed to utilise appropriately or have delayed utilisation of the available fiscal space due to structural problems. So, it is evident from the above analysis that the process and speed of development are heterogeneous across the states and time.

Overall, both the obligatory and non-obligatory sources of revenue have failed to stimulate development spending to the expected level. Both pre- and post-reform, the state's resort to obligatory sources of revenue continues to exist, but the purpose of utilisation has changed, to some extent, in a progressive way. The overall development-oriented capital spending failed to remain progressive, even though a positive trend can be noticed during the post-reform period among several states in India.

States' fiscal health and pattern of spending are closely linked. Revenue surplus in the revenue account plays an important role and even influences the spending pattern at the sub-national level. Along with central dependency, states must focus more on prudent debt management. The path of fiscal adjustment needs to be appropriate and well-planned to retain fiscal space and pave the way for further development in future.

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Appendix

Variable Specifications and Data Sources

Development expenditure	State finance documents (SFD)
Unconditional and Conditional Transfers	
Debt	
FRBM Dummy- the value of 1 for the year of FRBMA implementation and onwards and 0 otherwise	
Debt Reform – schemes formulated by GOI based on finance commission recommendations	
Liberalization dummy – the value of 1 represents 1991 economic reform	
Economic Slowdown	
Revenue Diversification	Suyderhoud, 1994
Political incumbency - takes value 1 if there is no change in the ruling party in the next state legislative assembly, 0 otherwise	ECI
The regional party takes value 1 if the regional party is in power and 0 otherwise.	
Electoral cycle dummies-(ELA- election year of state legislative assembly, BELA-one year prior to election and AELA- one year post-election	
Political Stronghold- Actual value of Stronghold $[z_i = m_{i\,(\text{vote share of winning party})} * v_{i(\text{Winning margin of winner \& Runner-up})}]$ must be equal or greater than the average value of stronghold($\bar{zi}$).$S_w = \frac{ni}{n} * 100$ in which n is the total number of electoral constituencies in each election in a state and n_i is the number of constituencies over which the ruling party has a stronghold ($z_i = m_i v_i$). Larger and safer Constituencies indicate a higher probability of winning in the next election.	Kaushik & Pal, 2012
Form of government-coalition or single party in power at the state level takes value 1, 0 otherwise.	
Centre-state political affiliation variable –the same political parties rule both at the centre, and states take value 1, 0 otherwise	
Ideology stand- value takes 1, if the CM belongs to a Rightist political party; it takes 0, if the CM belongs to a Centrist political party and -1(minus one), if the CM belongs to a Leftist political party	Singh & Bose, 1986
Voter turnout- percentage of the total number of voters casting their votes during a state legislative assembly.	Keefer & Khemani, 2003

Article

Understanding Technological Leadership in the Global Machine Tool Industry: A Historical Perspective

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Rajiv Jha

Abstract

The machine tool industry was pivotal in the industrial transformation of the countries of the Global North. Examining through a historical lens the factors underlying therise of American dominance in the 1850s and the emergence of Japanese leadership in the machine tool industry in the 1980s reveals that the size of the domestic market, when the technology itself is fluid, is clearly of paramount importance. In the 1850s, the impetus to mass produce specialized, light, high-speed machine tools did not exist in the UK because light engineering did not constitute the staple of demand in Britain as it did in the United States. Analogously, Japan leveraged many small and medium subcontractors into adopting hard-wired numerically controlled machine tools when the numeric control technology was in its infancy. These subcontractors, albeit linked to the final assembler of automobiles, were more than just cushions that bore the brunt of fluctuating final demand for automobiles. Small and medium enterprises substantially accounted for the domestic investment in numerically controlled machine tools in Japan in 1980. In the seventies, they constituted a large base of users for low-cost open-loop hard-wired controls for Fanuc. At the same time, the US machine tool manufacturers supplied machine tools embodying more sophisticated closed-loop controls. Still, they cateredto a niche initial market of aircraft manufacturers for the Air Force. In light of this, the implications of the market size for developing countries with small markets and operating at some distance from the global technological frontiers could be more precise.

Rajiv Jha, Associate Professor, Department of Economics, Shri Ram College of Commerce, Delhi. Email: rajivjha976@gmail.com

Keywords: Machine tool industry, American dominance, Japanese leadership, Implications for developing countries.

1. Introduction

Machine tools are defined as "power-driven metal-working machinery that shapes metal through the use of a cutting tool and progressive cutting away of metal chips." Machine tools constitute a heterogeneous set of capital goods, and their composition is apt to change with the structural evolution and the attendant technological changes in the economy.

The machine tool industry emerged between 1840 and 1880 in America and somewhat earlier in Britain as a response to the machine requirements of a string of industries, beginning with textiles and then encompassing a host of other metal-using industries such as firearms, sewing machines, typewriters and bicycles. This ability to design and produce machines for and cater to the specific technical needs of a new product was characteristic of both industrialisation and the emergence of a machine tool industry.

Machine tools played a strategic role in the industrialisation process of the late 18thcentury. Without Wilkinson's boring machine, built in 1775, the gap between the piston and the cylinder would not have been plugged, and Watt would not have been able to build his steam engine (Landes, 1969: 103). Traditional artisans, who used hand tools controlled by the human eye and hand to shape or cut metals to precise specifications and tolerances, were inadequate in using hand tools to shape or cut metals to precise specifications and tolerances. Machine tools not only shaped metals with increasing precision but did so at increasingly lower costs.

By the mid-nineteenth century, led by English pioneers such as Maudslay, credited with the invention of the screw-cutting slide rest lathe, most of the modern machine tools had been invented. These included machine tools invented by Maudslay's apprentices, like the nut milling machine by Nasmyth in 1829 and the planing machine by Whitworth (Gilbert,1958).

The second half of the 19th century saw the emergence of American technological leadership in the global machine tool industry. The causes of this shift must be discerned in the emergence of a new manufacturing paradigm

that originated in the American firearms industry, that of manufacture through interchangeable parts.

However, by the beginning of the 1980s, Japanese dominance in the industry was evident, with microprocessor-based numeric controls characterising the dominant design in machine tool manufacturing, facilitating flexible specialisation for diversified production to reap economies of scope.

This paper examines the history of the machine tool industry divided into two distinct eras, that of American dominance between 1850 and 1970 and the Japanese grabbing the leadership baton in the closing decades of the twentieth century to draw generic implications for the development of the machine tool industry for sustaining industrialisation in the Global South.

2. The Era of American Dominance

The second half of the 19th century saw the emergence of American technological leadership in the global machine tool industry. There was a paradigm shift in manufacturing, which served as a stimulus for the development of new designs and manufacturing methods of machine tools; machine tools, in turn, were the key inputs that contributed to the dissemination of the 'American System of Manufacture' by interchangeable parts and later mass-production methods.

The primary element of this novel manufacturing method was the production of a large volume of identical components necessary to fabricate complex, standardised final products. The final product could be manufactured in several distinct operations, and a machine tool could be assigned to each sub-process. With the standardisation and mass production of the final product, the volume production of accurately machined, identical components would be necessary. The high fixed cost of these specialised machines, an integral part of interchangeable manufacture, could be rationalised only if it was spread over a large volume of standardised output. Identical components transformed manufacture into 'machino facture' by replacing the skill-intensive and wearisome fittingof parts together through filing with the *assembly* of components into the final product. Central to the volume production of standardised components was designing and manufacturing dedicated, high-speed machine tools. The transition from 'manufacture' to 'machino facture'

would have been stillborn without using machines to construct machines. Heralding the shift to manufacturing through interchangeable parts was the American firearms industry. The frenzy of war was an abiding feature of nineteenth-century America (culminating in the Civil War of 1861), and thus, weapons had to be produced in large numbers.Three characteristics of firearms led to their emerging as the mascot for interchangeable manufacture: they had to be produced in large numbers; they were not tailored to the needs of a specific individual and could thus be standardised; it was imperative to reduce the cost and time required for weapon repair through 'hand-fitting' during a war. The latent demand for the assembly and repair of guns through interchangeable parts instead of filing and chiseling was critical in developing the milling machine**.** If gun parts were machined accurately enough, they could be assembled from randomly chosen stock parts instead of being handcrafted to each gun.

After Eli Whitney and Simeon North produced its first crude versions in the 1820s, the milling machine stabilised in design as the Lincoln miller in the early 1850s. Milling machines permit high-speed cutting, and using milling cutters, complex shapes can be machined in a single operation. Between 1855 and 1880, nearly 100,000 of these machines had been built for guns or sewing machines. The Lincoln Miller, critical in manufacturing interchangeable parts, was constructed out of interchangeable parts (Rosenberg, 1969: 70). Machine tools, thus, not only formed the basis of metal-working industries dependent on interchangeable parts but reconstituted their production based on interchangeable parts.

According to Rosenberg (ibid.), the most essential machine tools invented in the US were the milling machine and the turret lathe. Like the milling machine, the turret latheoriginated from the arms industry. The turret lathe, developed around 1845 in the United States, holds a variety of drilling, boring, reaming and thread-cutting tools along a vertical turret (*The New Encyclopaedia Britannica*, 1973-74). Thus, through the longitudinal movement of the turret, the turret lathe can perform a whole sequence of operations on the workpiece without resetting the workpiece. Commercialised by Robbins and Lawrence in 1854, it revolutionised the manufacture of small precision components required in large numbers (such as screws). It was adapted, over time, to manufacture parts for a wide variety of consumer durables such as sewing machines, typewriters, bicycles, even locomotives and automobiles.

Interchangeable components, the shortage of skilled labour and the substitution of fitting by assembly were linked in an industrial system defined by the mass production and consumption of standardised consumer durables. Specialised machine tools were at the vanguard of this 'second industrial revolution' in America, lending coherence to it.

The degree of horizontal specialisation achieved in American machine tool production was contingent upon the mass production of light engineering goods and the simultaneous growth of several light metal-using industries. The pivotal role once played by the firearms industry production as the source of the invention of new machine tools shifted, seriatim, to other consumer durable industries: the sewing machine industry after 1850 (which led to the development of cylindrical grinding machines), the bicycle industry after 1890 and the automobile industry at the beginning of the twentieth century. The American machine tool industry carved out a more significant market by responding to distinct user industries as focal points of demand over time.

Each of these industries was responsible for new technologies that diffused rapidly through the entire metal-using sector; each inherited the industry's technology set up earlier. A machine like the universal milling machine, which owed its origins to the arms industry, soon found application across a swathe of metal-using industries, which included sewing machines, typewriters and bicycles. This pattern of cross-fertilisation was not confined to the sewing machine producers borrowing techniques from the arms makers and bicycle manufacturers from makers of sewing machines but extended to the automobile sector, adapting the machine tools used in other sectors in its nascent phase. 'Technological convergence' (Rosenberg,1963: 423) did not simply augment the productive efficiency of a whole range of existing metal-using industries — it facilitated the emergence of new industries because the skills required to produce their parts already existed. Further, often enough, the machine tool producers constituted the single largest group of buyers for some machines (for instance, the universal milling machine): the 'mother machine' industry had this unique ability to enhance its productivity through innovations that initially catered to the needs of other users.

Technology transfer between metalworking industries occurred due to firms adding to, or switching, their product lines based on their innovations of machine tools. Symptomatic of this trend is the history of Pratt and Whitney - it produced machines not simply for the firearms industry but in succession for

the sewing machine, bicycle and automobile industries. Moreover, firms that produced machine tools switched effortlessly to producing guns, sewing machines and bicycles.

In contrast to the frenetic pace of technological change in the American machine tool industry, the British machine tool industry had squandered its first-mover advantage by the second half of the nineteenth century. This loss in competitive advantage can be primarily attributed to two factors. First, the small size of the light engineering industry in Britain had an enervating impact on the *volume and composition* of machine tool demand (Saul,1979). This adverse impact was compounded by the deadweight of a strong handicraft tradition which pre-empted innovation in machine tools by promoting 'fitting' over 'assembly'.

The introduction of highly specialised machine tools in Britain was so fitful and protracted because of the nature of the British market for machine tools: it was dominated by textile machinery makers, locomotive makers, steam engines, shipbuilders and agriculture machinery makers (Saul,1979). Textile machinery-producing firms diversified into producing locomotives in Britain as they did in the US - they manufactured heavy, general-purpose machine tools like lathes, planers and boring machines to cater to the demands of the railway locomotives and textile machine shops. The impetus to mass produce specialized, light, high-speed machine tools did not exist because *light* engineering (say, weapons, sewing machines, clocks and typewriters) did not constitute the staple of demand in Britain as it did in the United States (Rosenberg,1971: 256). Not propelled by the mass demand for specialised machine tools emanating from light engineering, the ordinary machine shop of the 1850s in Britain had no milling machines, turret lathes or grinding machines.

In contrast to the British experience, by the beginning of the twentieth century, however, the US machine tool industry had acquired an irreversible lead. It enlarged its market, built on the principle of designing and producing specialised machines for a particular user industry and the subsequent diffusion of these new machines and techniques to the entire spectrum of metal-using industries. This lead was reinforced by the deleterious impact of the English handicraft tradition, which still celebrates the 'superb work of English fitters.' On the other hand, the defining feature of the 'American system' was that it sought to eliminate the skilled labour-intensive 'fitting' with machine-produced parts for

'assembly'. This was a technical innovation of some significance – Ford underlined its significance by observing that in 'mass production, there are no fitters'.

The American machine tool firms produced a narrow range of machine tools for the mass production of components. In a producer-driven industry, the parts used in the machine tools were standardised and lent themselves to mass production techniques. There was ruthless winnowing out of designs that did not allow a high degree of standardisation. It made sense for a producer of machine tools to design machine tools for large users by using mass production methods and letting other metal-using industries adapt or calibrate the machine tool to their specific, but slightly different, needs.

The automobile, popularised by Henry Ford at the beginning of the 20thcentury, represented both a logical culmination of the dynamic of mass production and specialisation as well as a fundamental shift from the mechanisation of 'transformation' (standardised production of parts) to the mechanisation of 'transfer' (movement of parts through a moving assembly line or a conveyor belt). The automobile industry in the US had, by 1900, taken over the bicycle industry as the primary user of machine tools: the value of automobile production increased from US$26.6 million in 1904 to US$193.8 million in 1909 and jumped another two and a half times by 1914 (Rosenberg, 1963). In Britain, motor car output between 1907 and 1913almost trebled (Saul,1979: 163).

A typical new machine tool that caters to the needs of the automobile industry is the specialised grinding machine. Given its high speeds and the extant rough roads, the automobile generated a demand for more durable gears. Leland and Faulconer, which had pioneered the grinding of hardened bevel gears for bicycles, now transformed itself into the Cadillac Automobile Company to supply gears to the entire automobile industry for a while. In another instance of technological convergence, these improved grinding machines fanned the entire machine tool-using sector, including machine tools. Process and product innovation were coupled in the automobile industry - Ford incurred $18 million in machine tools when he switched from Model T to Model A in 1927 (Hounshell, 1984: 288).

It was not simply innovations in machine tools that were demanded and used by the automobile industry — machine tools and automobiles owed their

operations to similar transmission mechanisms. Innovations and design changes in machine tools, which owed their origins to the automobile sector, eventually fed back into the construction of machine tools and enhanced their productivity. For instance, the transmission mechanism for feeds and drives of machine tools became far more efficient when they adopted alloy steel sliding gears used in automobiles (these gears themselves had initially been made on grinding machines); antifriction bearings, extensively used in automobiles, soon found their way in machine tools; centralised, self-lubrication systems, which prevented breakdowns of sub-systems in automobiles, were soon adopted by machine tool makers. Pratten (1971), in drawing similarities between the machine tool and automobile sector, points to two fundamental differences - the scale of production of cars extends to hundreds of thousands; machine tools are produced in much smaller batches. The second difference refers to pressing operations: automobile components, initially machined on milling machines, drills and lathes, were now stamped directly out of sheet metal — such pressing operations have always been relatively unimportant for machine tools.

If an innovation could be singled out as fundamental, which characterised and differentiated the automobile sector, it would be the moving assembly line. Building on Olds' stationary assembly line, Ford invented the moving assembly line in 1913, which slashed the labour time for assembling his Model T from one and a half days to one and a half hours (Carlsson, 1984: 98). This step-jump in the speed of automobile assembly had two effects on machine tool innovation. First, it created an urgent need for much faster machine tools to avoid logistic problems further down the 'line':thus, precision cylindrical grinders and multi-spindle screw machines made their way into the arsenal of machine tools feeding automobile assembly. Second, it virtually halved car prices and thus gave an unprecedented fillip to the demand for automobiles. The manifold increase in demand justified the introduction of expensivesingle-purpose machine tools. The huge fixed costs of these new special-purpose machines, such as precision cylindrical grinders 'dedicated' to grinding parts of an automobile engine, could be recouped only over a large output volume.

The transfer machine was another innovation of great significance for the automobile industry. A transfer machine consists of several small machines, each performing a distinct operation (drilling or milling) and then transferring the workpiece to the next workstation. Thus, in the first transfer line invented by the Graham-Paige Motor Corporation in 1929, several workpieces were

simultaneously machined for high volume manufacture of automobile engines. 'Detroit Automation' of the early fifties involved nothing but the 'linking…of several transfer machines for high volume production of parts' (Carlsson,1984: 112). So significant was the reduction in costs that the technique was rapidly imbibed by other volume producers – such as those manufacturing household consumer durables or 'white goods.'

Besides, the Second World War gave a phenomenal impetus to aircraft-related technology. The growth of military aviation proceeded at a breathtaking pace and transformed the aircraft industry into one of the most significant users of machine tools. The objective of the US Air Force was to achieve the machining of complex shapes that were impossible to machine with existing metal cutting machines. Through R and D funds and other inducements, the US Air Force directed the development of machine tools towards numerically controlled machine tools. However, the early American lead regarding the first mover advantage in developing the new revolutionary technology in machine tools was closed-loop numeric control. It was lost to Japan between 1965 and 1975, as the producers of numerically controlled machine tools sought to simplify the closed-loop technology and diffuse it amongst a large base of auto-component manufacturers and job shops.

It may be noted, as an aside, that a machine tool consists of four primary elements: the cutting tool, which cuts the metal; the structural element, which carries or supports both the 'workpiece' (the metal piece being machined) and the cutting tool; the transmission/drive elements which move the workpiece or the tool to shape the workpiece; the control element which controls the function of the transmission agent in moving either the workpiece or the cutting tool. In a numeric control system, the commands about the metal part to be machined are stored in digital form on a tape: the control translates it into commands that activate the servomechanisms of the transmission system. The servomechanism then controls the motion of the spindle and the work table. The fundamental technological change in the machine tool industry from 1950 to 1980 pertained to the technology of controls. Between 1950 and 1975, controls were of two types — hard-wired, point-to-point controls (called open loop controls) and hard-wired, continuous path controls (called closed loop controls). Since 1976, soft-wired, microprocessor-based controls (or programmable computer numeric controls) have replaced hard-wired controls globally. In a closed-loop system, information about the actual motion of the machine part is fed back to the control. This feedback loop does not exist in an

open-loop system. In the US, the demand for numerically controlled machine tools rose because of the precision machining requirements of the Air Force. Thus, the first numerically controlled machine tool developed at the MIT Servo Lab in 1952 featured closed-loop controls. The expensive closed-loop controls soon became the dominant design standard in the US machine tool industry. They accounted for 60 per cent of the American market by the early seventies.In Japan, it was realised that 'the satisfactory performance of an open loop configuration required …the use of servomotors that could be precisely operated by the digital signals sent by the control units …' (Mazzoleni,1997: 411). In an instance of inspired adaptive engineering, Fanuc (in Japan) engineers realised that the stepping motor technology would provide sufficient accuracy to the cheaper open loop technology. A prototype was developed by Fanuc and Makino in 1958, though commercial production of machine tools based on open-loop numeric controls did not begin till the mid-sixties.

3. The Era of Japanese Leadership

In Japan's early sixties, numeric control was perceived as aiding flexible manufacturing. The clamour for greater accuracy in machining through closed-loop controls was tempered by the demand for low-cost flexibility, which was possible only through open-loop controls. Japanese control suppliers nurtured job shops and auto-component manufacturers as a potential market for numerically controlled machine tools. Led by Fanuc, machine tools based on open-loop numeric controls penetrated successive layers of users between 1965 and 1975. Thus, when programmable numeric controls (computer numeric controls) emerged as the dominant design in 1976, this vast installed base easily shifted to the new technology, and the baton of machine tool leadership passed into the Japanese hands.

The open loop system was a stepping stone to global leadership. The relevance of the open-loop numeric controls lies not in the fact that it represented a superior technology (vis-à-vis continuous path closed-loop technology) but that it played an instrumental role in the diffusion of numeric control in the market for low-cost machine tools. Fanuc leveraged this installed base in its path to leadership as a new dominant design–the microprocessor-based computer numeric control–which emerged in 1976. This multitude of small job shops and subcontractors could not have been converted into users of numeric control if the focus were on performance standards instead of low costs.

This occurred partly because open loop systems were commercialised at different stages of diffusion of numerically controlled machine tools (NCMT) in Japan and the US. By 1965, the closed loop version of numeric controls was already a decade and a half old in the US: in 1965, while the US produced 2094 NCMTs, only 39 NCMTs were produced in Japan. It is clear that the commercialisation of NCMT in Japan began only in the latter half of the sixties; in the following decade, the Japanese output of NCMT had increased almost forty-fold to 3286 units (Mazzoleni, 1997:418&423).

In the post-war period, the Japanese machine tool builders focused on simple general-purpose machine tools. In a similar development to America's, electronics firms like Toshiba and Hitachi attempted the initial development of NC technology through licensing agreements with Bendix or General Electric. Unlike other Japanese firms which chose the closed-loop version of numeric control, Fanuc, a part of the Fujitsu company, obtained a patent for open-loop controls and developed NC technology in that direction.

By the mid-sixties, advances in the stepping motor technology made the open loop design commercially viable.This opportunity was grabbed by Fanuc when the diffusion of NC was in its nascent stages in Japan. Eliminating the feedback loop of closed-loop controls reduced costs at the expense of accuracy. However, it provided a point of entry for many job shops, the mainstay of the Japanese machine tool industry. This strategy rapidly paid rich dividends.From an industry-wide production of 388 numeric control machine tools units in 1968, Fanuc's output rose to 1683 units in 1969 (Mazzoleni,1997: 420). The large-scale production of standardised parts and subassemblies boosted Fanuc's growth. The firm committed itself to the exclusive use of NC technology in its manufacturing processes while subassemblies that could not be automated were subcontracted. The growing sales in the domestic market, with many machine tool builders featuring Fanuc controls, were buttressed by various marketing agreements abroad.

Underlying the Japanese penetration of the American market in the late seventies and early eighties was their focus, as in the sixties, onlow-priced general-purpose machine tools such as computer numerically controlled (CNC) lathes and machining centres. As job shops and automobile subcontractors constituted the domestic market's primary demand for machine tools, Japanese machine builders channelled their technological efforts into automating controls for low-horsepower general-purpose machine tools. Thus, workhorse machine tools

like CNC lathes and machining centres accounted for 38 per cent of all Japanese machine tool production and 66 per cent of exports by 1981 (Sciberras and Payne, 198: 34). The increase in Japanese exports accounted for the jump in the US import penetration ratio from a quarter to nearly a third between 1980 and 1982. In stark contrast was the user segment demanding automation of controls in America: a small band of sophisticated manufacturers centred around the aircraft industry using single-purpose machine tools for precision manufacturing. Until the beginning of the eighties, the more prominent American machine tool firms were oriented towards supplying expensive precision machines to the aircraft and the automobile sector. A large potential market for low-cost CNC general-purpose machine tools was ignored until Japanese exports flooded the American market.

The prominence of subcontractors had to do with particular institutional features of Japanese industrial organisations. The first was a keiretsu (a 'brethren') relationship, which involved mutual stockholding across firms belonging to a single business group, often centred around a bank. The other, unlike the arm's length relationship between suppliers and assemblers in the United States, was the 'parent-child' relationship, the subcontracting relationship that large firms developed with their regularmedium or small-scale suppliers (Morikawa, 1997: 328). In the automobile industry, for instance, the in-house manufacturing of parts by firms like Toyota and Honda amounted to no more than 20 to 30 per cent of the total parts needed, considerably less than those fabricated by their counterparts in America. The auto-assembler not only owned shares in the first tier of the hierarchy of subcontractors but also directed and guided their technical efforts.

This was of some significance in the diffusion of machine tools.A pyramid of subcontractors and job shops,tiered in order of importance, already using low-costgeneral-purpose machine tools, could potentially switch to CNC general-purpose machine tools. Favouring this interpretation are two facts. By 1980, 64 per cent of the domestic investment in numerically controlled machine tools in Japan was undertaken by small and medium-sized enterprises, while the share of this category of firms in the more expensive hard-wired numerically controlled machine tools was a mere 28 per cent in 1970 (Jacobsson,1986: 45). The subcontractors were not simply cushions that bore the brunt of fluctuating demand and 'legislated social (labour) costs' (Cohen & Zysman,1987: 148). Although linked to the final assembler, they were independent enough to initiate changes in response to shifting market demand. As Japanese industrial production fell by 36 per cent in 1975, they led the shift to labour-saving solid-state control-based machine tools.

The manufacturing techniques adopted by Japanese machine tool builders reinforced the pattern of demand. The traditional model of using general-purpose 'mother' machines to manufacture special-purpose machine tools was reversed. Instead, single-purpose machines were 'dedicated' to manufacturing components of CNC general-purpose machine tools (Piore & Sabel,1984: 219). The machine tool builders were not vertically integrated – they 'bought out' a large part of their mechanical parts and, following the recession of 1975, tended to specialisein a narrow range of low-cost CNC general-purpose tools.

Fanuc, the quasi-monopolistic supplier of CNC controls to the entire machine tool industry, was accepted as the industry standard. It proved extraordinarily adept at fine-tuning its innovation strategy to produce programmable, simply designed, and reliable controls to meet user demand. Threats of actual and potential competition from in-house producers of controls (from firms like Toyoda and Yaskawa), which amounted to 27.2 per cent of control production in 1976, prevented Fanuc from abusing its dominant position (Mazzoleni,1999: 192). Fanuc consolidated its first-mover advantage into a sustainable competitive edge by moving up the learning curve afforded by large volumes.The cost advantage, reaped by Fanuc because of economies of scale, was primarily passed on to machine tool builders, enabling them to adopt a volume production strategy of basic designs. Automobile firms coercing their subcontractors into using CNC machine tools reinforced this paring down of costs. By 1981, numerically controlled lathes constituted more than a third of the volume and 70per cent of the value of lathes produced (Watanabe,1983: 12).

The American market for machine tools, dominated by integrated automobile producers and the domestic aerospace industry, had always been partial to special-purpose machine tools. These machine tools, in particular, are unusually susceptible to the retooling cycles of these user industries and suffer from wide variations in demand and, thus, fluctuating production (Sciberras & Payne, 1985: 35). Following a recession in the late seventies, the rationalisation of the American machine tool industry led to large conglomerates acquiring several small machine tool firms, far more interested in short-term profits than long-term investments. In 1976-78, about 69 per cent of the machine tools (in use) in the US were more than ten years old (Sciberras & Payne,1985: 34).

Further, in the US, the relationship between the major numeric controller suppliers (General Electric and Allen Bradley) and the machine tool builders

had always been messy. While control suppliers in the US pondered over introducing microprocessor-based (soft-wired) controls in the mid-seventies, Fanuc had already licensed and introduced solid-state soft-wired controls by 1976. The US leaders of the field, in closed-loop hard, wired controls, ignored the unique needs of the machine tool firms and refused to switch over to lower-cost solid-state numerical controls until the Japanese import invasion forced them to do so. Meanwhile, Fanuc had emerged as the undisputed leader in control supply: its large installed base of users, acquired in the days of low-costopen-loop hard-wired controls, could not be easily lured into incurring the switching costs to shift to new control suppliers.

From the Japanese experience, it is clear that microprocessor-based numeric controls had emerged as the dominant design in machine tool manufacture by the beginning of the eighties. With the collapse of the Bretton Woods system, saturating markets for mass-produced durables and increased openness to international trade, metropolitan economies have registered a need for flexible production since the seventies. The response led to the emergence of two forms of programmable automation: in America, closed-loop continuous path control carried forward a tradition of precision machining for the aircraft industry; in Japan, a more primitive open-loop technology borrowed from the US and developed by Fanuc, catered to the needs for flexibility of a relatively underdeveloped, but large, engineering industry. America retained its leadership of the machine tool industry till the late seventies; however, it could not ultimately withstand the Japanese assault with Fanuc leveraging its large installed base of users into low-cost microprocessor-based controls.

4. Conclusion and Implications for Global South

The size of the market and the emergence of new manufacturing paradigms of mass production and flexible specialisation in America and Japan, respectively, have been paramount in the emergence of new leadership in the machine tool industry. History, as expressed in the size of the existing market - the size of the initial domestic market when technology was not yet settled - was an overwhelmingly critical determinant of technological leadership in the machine tool industry of the Global North, which further witnessed a radical change only for the second time in its history with the appearance of programmable, flexible automation.

This conclusion does not augur well for developing the machine tool industry

in developing countries (Global South) to sustain their industrialisation in that in a developing economy, domestic demand is not the prime determinant of the path and pace of diffusion of new technology. Developing countries are still not sites of radical innovation. Technological change caters to the tastes of an elite emulating the consumption patterns of the Global North. The diffusion of new technology occurs through licensing, reverse engineering or the imports of parts and components.

Moreover, attempts to widen the market and create an integrated industrial structure (a complement of consumer and capital goods) through public investment have proved self-defeating in many underdeveloped economies. A developing economy's low per capita incomes create an upper bound in terms of the volume and 'type' of demand for durables and, thus, the 'derived' demand for machine tools. It is widely accepted that the size of the market limits the division of labour in an economy; in other words, the size of, and the pace of innovation in, the capital goods sector.

As such, if the Global South wants to escape technological dependence on the capital goods industries, it would have to use a combination of strategies that include technology transfer and enlarging the market size, possibly through exports from the very start. This proposition can be substantiated by the study of the way the machine tool industries in South Korea, Taiwan and China have developed, which is a long story, not the concern here.

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Article

What Catalysed the Need for Digital Payment Platforms during COVID-19? Evidence from LASSO Regression

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Dipti Mohanty
Prasanta Patri
Ashis Kumar Pradhan

Abstract

The present study attempts to explore the factors influencing the usage of the digital platform during the COVID-19 pandemic. To do so, we collected the primary data using a structured questionnaire from the educated mass of Jagatsinghpur district of Odisha state, India. Using the Double Selection Logit Regression Model, the study produces significant findings. We find that the demographic and socio-economic factors, namely gender, age, education, and source of income, are crucial in influencing the use of electronic digital payment platforms during the COVID-19 pandemic. Therefore, the study's outcome advocates the promotion of digitalization and information and communication technology policymaking. Furthermore, the findings of the study also endorse that the use of the digital electronic platform will reduce physical contact for any transaction and assist in containing the spread of the virus.

Keywords: Digital Payment Platform; COVID 19; LASSO Regression

Dipti Mohanty, PhD Scholar, Department of Commerce, Ravenshaw University, Cuttack, Odisha. Email: diptimohanty.ru@gmail.com

Prasanta Patri, Assistant Professor of Economics, School of Social, Financial & Human Sciences, KIIT Deemed to be University, Bhubaneswar, Odisha. Email: prasanta.iit2020@gmail.com

Ashis Kumar Pradhan, Assistant Professor, Department of Humanities and Social Sciences, Maulana Azad National Institute of Technology Bhopal, Madhya Pradesh.
Email: ashiskumarprdhn@gmail.com

1. Introduction

In 2019, the world confronted an unexpected health-related ailment that suddenly became a global pandemic. As no proper medications were deployed initially to fight the COVID-19 virus, physical distancing is believed to be the only way to control the spread. The novel coronavirus brought a transition in every firm in terms of working from home and social distancing, which has uplifted digitalization (Al-Habaibeh et al., 2021). Digital platforms have evolved into a significant component of undertaking all sorts of daily needs. Therefore, with the advent of SARS-CoV-2 variants, the economy of every country met a downfall; whose resilience relied upon making all the firms operative and increasing the quantum of transactions, digital platforms were the only alternative (Sudha et al., 2020). De Girancourt et al. (2020) holds that the businesses that were early adopters of digital transformation revived from the crisis quickly, which helped economic resilience. Consequently, the pandemic became an "infodemic" (Bunker, 2020).

To break the chain of the virus transmission, the government announced a nationwide lockdown and shutdown, which increased the volume of digital payments. Fields like online grocery purchases, healthcare services, bill payments, recharge (mobile, T.V.), online gaming, online food delivery, online education, and digital payment increased (PwC, 2020; Yan et al., 2021). Amid the upsurge of COVID, all online shopping platforms restricted the cash-on-delivery option, which also catalyzed online payment, especially during the festive season (*Economic Times*, 2020; bt Hassan et al., 2022). In alignment with the growing trends of digitalization, the government initiated plans to accelerate e-payments in terms of Direct Benefit Transfer (DBT) to the bank accounts of beneficiaries to provide financial assistance to poor and stranded labor amidst the COVID-19 crisis (PwC, 2020).

At a later stage, as people became more cautious about avoiding potential viral transmission, the percentage of virus spread stabilized. People were inclined to pay through e-wallets for transactions due to their ease of access, convenience, time effectiveness, safety, and lower transactional costs (Purba et al., 2021; Yan et al., 2021). The young population prefers to use e-platform because of easy accessibility, enhanced speed, security, cash backs, rewards, coupon benefits, and other freebies associated with mobile banking or e-payments in comparison to cash transactions (Patil et al., 2017; Singh et al., 2020; Singh & Sinha, 2020; Purba et al., 2021; Harrison, 2021). Also, the youngsters chose this platform

for the transaction because the chances of counterfeit currency circulation were circumvented. Furthermore, the enforcement of lockdown and a higher risk of contamination through card payment because of its physical contact (Harrison, 2021), card payments at point-of-sale were declined. This is another factor that aided the expansion of digital payments, and several businesses, from street vendors to shopping malls, tied up with payment gateways like UPI, BHIM, and other e-wallet portals. The total digital payment volume propelled to Rs. 4,37,118 lakhs in 2020-21 as against Rs. 3,41,240 lakhs in 2019-20 (Reserve Bank of India, 2021). Thus, the acceleration of digital transformation during the COVID-19 pandemic fuelled digital transactions to a great extent.

The present study attempts to understand the significant factors that have accelerated the use of digital payment platforms during COVID-19. We contribute to the growing literature on information and communication technology and digitalization in several ways. First, the current study examines all potential factors influencing people to use e-platforms for online transactions. This study is conducted on a sample of 125 respondents. The participants belong to the Jagatsinghpur district of Odisha, situated in eastern India. A study on the Indian context is vital because it is the second emerging market economy and the second epicenter of the people affected people by the COVID-19 spread (Ghosh et al., 2020). Second, our contribution to the literature is also methodological. We use the double selection logit regression in a LASSO framework. This method considered sound (Epprecht et. al., 2019) compared to conventional econometric tools such as the stepwise logistic regression model. LASSO regression, in particular, automatically deletes redundant covariates.

The remaining sections of the manuscript are categorized into the following parts. Section 2 provides an overview of the literature on e-platform technology used for payments and transactions. In Section 3, we explain the data and methodology. Section 4 discusses results and discussions, and section 5 concludes with the possible policy suggestions.

2. Review of Literature

The risk of contamination because of the virus spread through cash transactions is a global concern, and WHO recommended banknotes as 'Dirty Money' that clasp the virus on its surface. In order to avoid this potential risk of getting infected, people were advised to use contactless payments (Gardner, 2020;

Samantha, 2020; Huang, 2020), which elevated the use of digital payment platforms. De Girancourt et al. (2020) opined that banks were temporarily closed according to the government's COVID protocol to follow safety and hygiene measures, a stimulus for digital transactions. Furthermore, to revive the economy from this crisis, cross-border remittance transactions among individuals and organizations were encouraged through online platforms. Therefore, several pieces of research highlighted that the utility that users had from using mobile banking service was encouraged individuals to embrace it, that also prevented people from touching the virus-prone surface to avoid contamination (Sreelakshmi & Prathap, 2020; Puriwat & Tripopsakul, 2021). Moreover, Yan et al. (2021) and Khatun et al. (2021) advocated that in Bangladesh, the readymade garment owners had made it compulsory for their employees to receive their salary through mobile banking applications, which increased the number of users during the period of COVID.

During the virus outburst, all hospitals restricted patient visits for their regular health check-ups, even people were reluctant due to fear of getting infected. (Watts, 2020; Ramsetty & Adams, 2020) For the seamless reach to the unserved patients, in-person medicare service switched to tele healthcare services like telescreens, teleconsultation, telemedicine, and e-prescription, increasing e-payments (Aslani and Garavand, 2020; Monaghesh and Hajizadeh, 2020; Ramsetty and Adams, 2020). During the early phases of COVID-19, every country prevented social gatherings and enforced stringent quarantine policies by encouraging 'work from home', and educational institutions were closed. Other vital markets such as shopping malls, cineplexes, airports, and government offices were also closed. Also, the demand for digital payment surged in terms of paying to various over-the-top (OTT) platforms (Netflix, Amazon Prime, Disney + Hotstar) for amusement, school, and college fee payments to avail e-learning, transfer of funds, teleshopping, and agriculture (Yan et al., 2021). Because of mobile banking's hassle-free disbursement, allowance payments were possible during this crisis. The plight of the pandemic brought many misfortunes to people in various ways. People who could not cook because of health issues or other reasons had to use online food delivery applications and digital payment platforms to order food (Purba et al., 2021). Many restaurant owners accepted e-payments through online payment gateways and initiated tie-ups with food delivery platforms to deliver hygienic food to the doorstep of those severely affected by the virus and followed quarantine protocols (Ramos, 2021).

By incorporating a structural equation model on 320 sample of data, the unprecedented virus outbreak compelled the older population to adopt FinTech or financial technology (Santosa et al., 2021). Daragmeh et al. (2021) found that older people continued to use digital payments post-pandemic to avoid the risk of spread, and also ease of operation, functionality and personalization norms. Other studies advocated that improved work performance, effort expectancy, trust, perceived value, perceived utility, satisfaction, and social influence made people inclined toward mobile financial services (Patil et al., 2017; Liébana-Cabanillas et al., 2020; Singh et al., 2020; Puriwat & Tripopsakul, 2021; Yan et al., 2021). Similarly, Al Nawayseh (2020) discussed that perceived well-being and social norms were the motivating factors for the adaptation of FinTech. On the contrary, the author viewed that the risks associated with financial technology could not restrain people from using it. Furthermore, Aji et al. (2020) have described the risk of being infected by COVID-19, the government's reinforcement of using e-wallets, and their usefulness as other influencing factors.

However, Khatun et al. (2021) revealed that to escape the transmission of the virus, the government mandated the mobile banking accounts for employees for simplified payments, streamlined remittance, and disbursement of funds. Mobile banking services and FinTech also brought the untouched portion of the population under the banking purview, spurring financial inclusion (Ozili, 2018; Khatun et al., 2021). Therefore, the literature posits that digital technology assisted several communities in reviving from the crisis (Al Nawayseh, 2020) and asserts that adopting a cashless payment system is essential for the modern economy (Achor & Robert, 2013).

Considering the above, the present study aims to explore the following:

i. Investigate the impact of demographic and socio-economic factors on people's financial literacy.

ii. Potential factors that drive the use of e-platforms for payments and transactions by drawing a sample of 125 responses belonging to the Jagatsinghpur district of Odisha, India.

iii. Impact of the predictors analyzed with the help of a logistic regression model in a LASSO framework.

3. Data and Methodology

3.1 Sampling Strategy and Profile of the Study Area

In the present study, 125 sample respondents have been chosen by selecting two wards from the Jagatsinghpur Municipality, which belongs to the Jagatsinghpur district of Odisha, India. Due to lockdowns, a field visit to collect data was not feasible during the pandemic period. Therefore, data was collected through a structured questionnaire circulated via Google form, and a snowball sampling technique was adopted. Initially, we contacted some people and discussed the purpose of the research. Then we urged them to provide contact numbers of their acquaintances for our snowball. Around 150 questionnaires were circulated and we received 125 replies. The questionnaire was framed after an extensive analysis of previous literature by Vyas (2021). The questions are segregated into different parts according to the global standard, i.e., financial knowledge, attitude, and behavior (Potrich et al., 2015).

The data were collected through a five-point Likert scale and binary scaling techniques. As per Census 2011, Jagatsinghpur district has the second highest literacy rate in Odisha (Census, 2011). It ranks better than the national average in literacy and is at the top of the list for the highest male literacy and second for female literacy in Odisha (Census, 2011). Therefore, Jagatsinghpur district has been selected as the population of the present study. For this study, out of two municipalities in Jagatsinghpur district (Jagatsinghpur Municipality and Paradeep Municipality), Jagatsinghpur municipality has been selected because of better accessibility, lodging facilities, and the presence of some local contacts of the authors who could help by providing crucial information about the sample area. Jagatsinghpur municipality consists of 21 wards, from which two wards were chosen – Ward-8 (Ohal) and Ward-19 (Purohitpur) – as most of the literate dwellers were there.

From the total population of 4664 in these two wards, 125 (2.68% approximately) responses were collected. The male response rate was 56.80 per cent, whereas the female response rate was 43.20 per cent. Respondents' financial literacy has been measured by evaluating their basic financial knowledge regarding some financial concepts, day-to-day financial dealings, computational ability, stock market knowledge, and retirement planning. The correct answers are coded as 1 and incorrect ones as 0, where questions as per the five-point Likert scale are coded as 5 for highest and 1 for lowest weights. The variables taken in the study have been explained in Table 2, and different

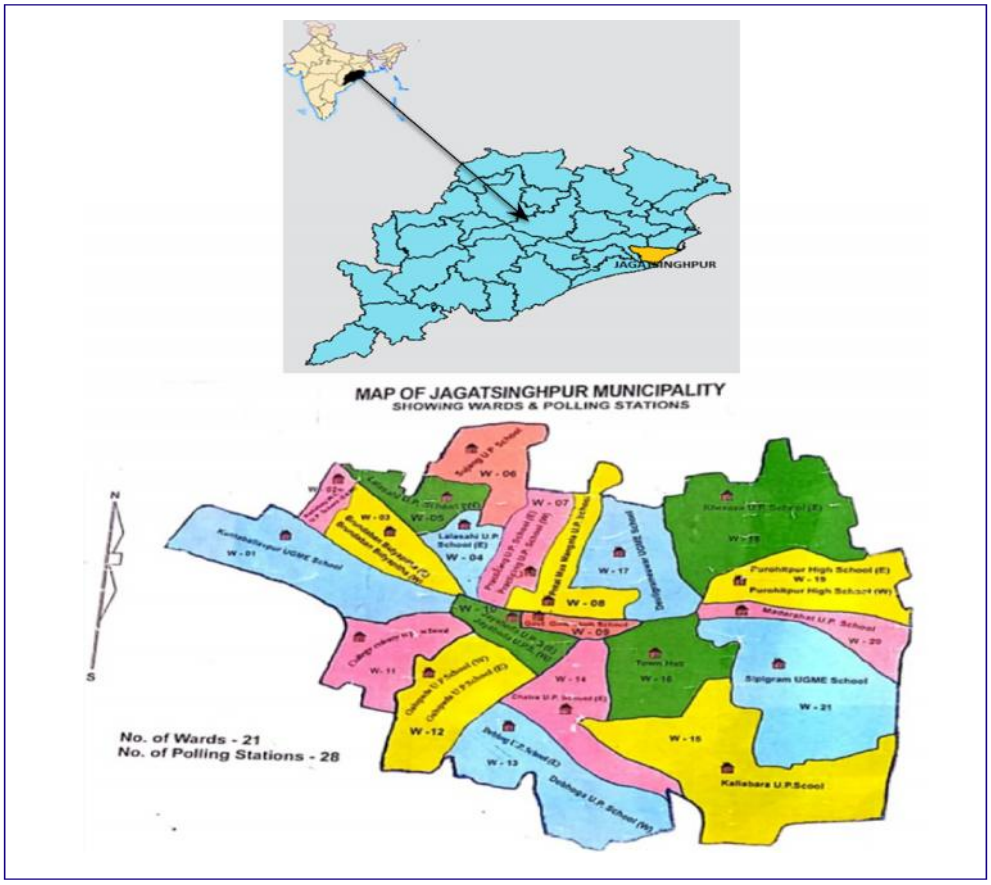
statistical tools like SPSS and STATA have been used to analyze the presented data. The essential characteristics of the sample households are given in table Table 1.

Table 1: Basic Characteristics of the Two Wards and the Number of Sampled Households

Ward Name	Characteristics	Ward No	Surveyed Household
Ohal	District headquarters and township with a municipality	8	63
Purohitpur	District headquarters and township with a municipality	19	62
Total			125

Source: Jagatsinghpur Municipal Corporation (JMC), Jagatsinghpur, Odisha.

Figure 1: Map of Ohal and Purohitpur Wards in Jagatsingpur Municipality



Source: Jagatsinghpur Municipal Corporation (JMC), Jagatsinghpur, Odisha

3.2 LASSO Regression

The least absolute shrinkage and selection operator (LASSO) was developed by Tibshirani (1996). It has become a popular regression model for variable selection and resolving multicollinearity problems. It turns the parameters of specific indicators equal to zero, creating a penalty function to obtain the suitable variable selection. We use the double-LASSO variable selection approach in the current research, which is considered superior to the LASSO regression model. Direct use of LASSO regression estimates may underestimate the non-zero parameters, causing regularization bias and omitted variable bias. Hence, a double-LASSO variable selection procedure is recommended (Belloni et al., 2014). The double LASSO-logit variable selection procedure is a different estimation process for inferring a set of parameters in a LASSO model with binary outcomes. The LASSO variable selection can be expressed as:

$$min \sum_{i=1}^{r} \left(y_i - \alpha_0 - \sum_{j=1}^{P} x_{ij}\alpha_j \right)^2 \qquad (1)$$

$$subject\ to \sum_{j=1}^{p} |\alpha_j| \leq \pi$$

where π notation is adjustable and is *greater than equal to* 0. The terms α_0 and α_j are regression coefficients. Further transforming the above equation to its Lagrange's form, we may obtain the following:

$$\hat{\alpha}(Lasso) = argmin_{\alpha} \sum_{i=1}^{r} \left(y_i - \alpha_0 - \sum_{j=1}^{P} x_{ij}\alpha_j \right)^2 + \lambda \sum_{j=1}^{p} |\alpha_j| \qquad (2)$$

$$= argmin_{\alpha} \sum_{i=1}^{r} ||y - \alpha_0 - \sum_{j=1}^{P} x_j\alpha_j||^2 + \lambda||\alpha||1$$

where, $\lambda||\alpha||1$ refers to a penalty function with a penalty parameter (λ) (such that $\lambda \geq 0$) and $||\alpha||1$ implies 1-norm of α, $||\alpha||1 = |\alpha_1| + |\alpha_2| + ... + |\alpha_j|$. The model is expected to retain more variables when the value of λ is smaller. The selection of the penalty parameter λ is determined using several methods including cross-validation and bootstrap methods. In this study, we use a cross-validation technique to select the λ penalty parameter. The cross-validation technique is explained as follows:

$$C_V(\lambda) = \frac{1}{n}\sum_{i=1}^{r}\left(y_i - \hat{\alpha}_0^{-k(i)} - x_1^T\hat{\alpha}^{-k(i)}\right)^2 \quad (3)$$

where, $\hat{\alpha}_0^{-k(i)}$, $\hat{\alpha}^{-k(i)}$ denotes the fitted parameters after the first k disjoint subset is deleted. k ranges from 1…., K. λ will be optimal when the C_V approaches to a minimum point in the cross-validation process represented as follows:

$$\hat{\lambda} = argmin_{\lambda} C_V(\lambda) \quad (4)$$

We use a logit regression in a LASSO framework in the current study. We construct a binary logit model to identify factors affecting the usage of advanced e-platform/digital pay wallets for transactions during COVID-19. We use a categorical variable with a value of 1 (using advanced e-platform/digital pay wallets for the transaction) and 0 otherwise (not using advanced e-platform/digital pay wallets for transactions). Incorporating the associated probabilities, the binary logit model is framed as follows:

$$Logit\left[P\left(y_i = 1\right)\right] = ln\frac{P\left(y_i=1\right)}{1-P\left(y_i=1\right)} = \alpha_0 + \alpha x_i \quad (5)$$

where x_i exhibit the vector of the factors that affect the usage of advanced e-platform/digital pay wallets for transactions during COVID-19, α are the coefficient of those factors.

Integrating equation (5) with the LASSO variable selection method, the obtained residual sum of squares in equation (2) is restored by the log-likelihood function represented from equation 5. By incorporating the log-likelihood function of n generator samples, the LASSO variable selection estimator can be redefined as:

$$\hat{\alpha}(Lasso) = argmin_{\alpha}[-\log log\, L(\alpha_0, \alpha)] + \lambda||\alpha||1$$

Based on equation (6), the LASSO-logit model is constructed, which explains the usage of advanced e-platform/digital pay wallets for transactions during COVID-19 as follows:

$$logit\left[P\left(y_i = 1\right)\right] = \tilde{\alpha}_0 + \tilde{\alpha}\tilde{x}_i$$

Based on the above theoretical framework, we have developed the following model, which is expressed as:

$$EPLAT = \beta_1 + \beta_2 GENDER + \beta_3 AGE + \beta_4 MIR + \beta_5 EDR + \beta_6 SOI + \gamma_t \quad (7)$$

4. Results and Discussion

4.1 Variables of the Study

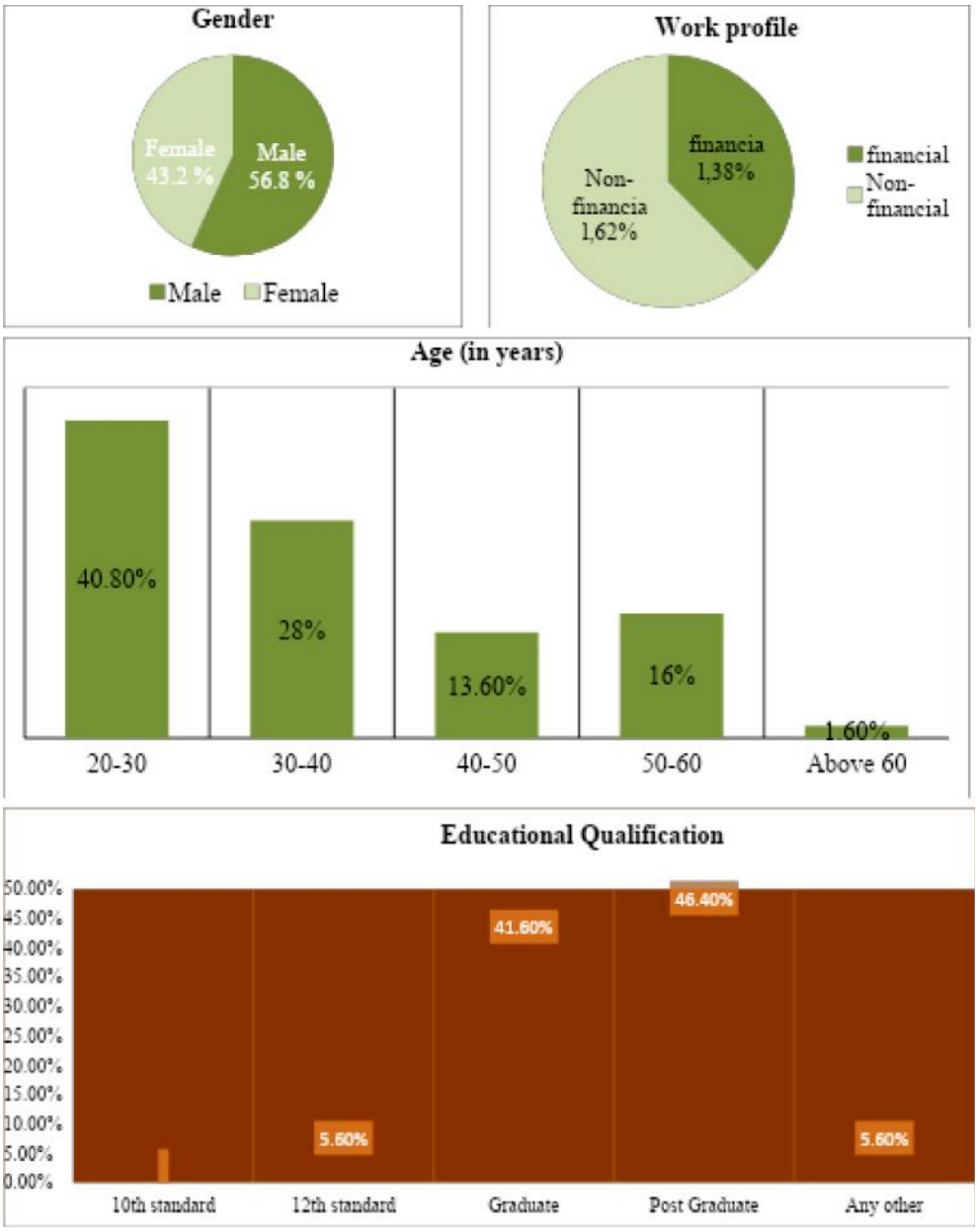
To study the usage of e-platforms during the COVID-19 pandemic, we considered a total of eight variables. The variable e-platform (E-PLAT) is the dependent variable, which is considered an indicator of the usage of digital platforms. We have considered some demographic variables, such as gender and age; economic indicators, like the monthly income of the respondent and source of income; and occupational factors, namely, occupation of the respondent and working profile; and knowledge level measured through the level of education (Table 2).

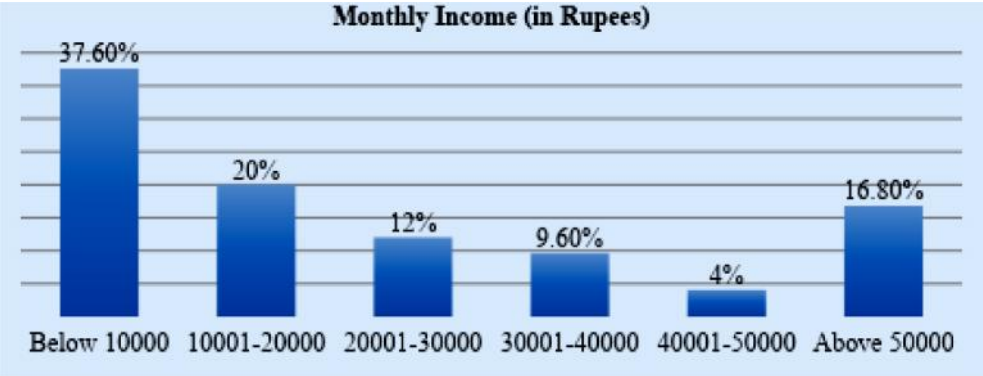
Table 2: Variables of the Study

Domain	Variables	Definition	Expected Impacts	Expected Sign
Dependent Variables				
Financial Knowledge	E-PLAT	Use of internet banking/e-platform by the respondent	The use of an E-platform depends upon the following controlled variables	NA
Independent or Controlled Variables				
Demographic	GENDER	Gender of the respondent	Gender plays a vital role in financial literacy	+
	AGE	Age of the respondent	Age is an essential factor in financial literacy	+
Economic	MIR	Monthly Income of the respondent	As income rises, there is an expected positive impact on financial literacy-cum-knowledge	+
	SOI	Sources of Income	If the sources of income are better, it is expected to lead to financial literacy.	+
Occupational	OCCU	Occupation of the respondent	Better occupation leads to better financial understanding	+
	WP	Working profile of the respondent, whether Financial or non-financial	If the working profile of the respondent is financial, then it is expected to have a positive impact	+
Educational	EDR	Education of the respondent	If the respondent's level of education is high, then there is a positive relationship with financial knowledge-cum-literacy	+

Source: Authors' compilation

Figure 2: Pictorial Representation of all the Variables from Primary Data





Source: Authors' calculation

The choice of the predictors included for the empirical analysis is based on the theoretical literature. We report the descriptive statistics of the variables considered for the analysis in Table 3.

Table 3: Descriptive Statistics

Variables	Mean	Std. Dev.	Variance	Skewness	Kurtosis
EPLAT	.77	.41	.175	-1.32	2.75
GENDER	.43	.49	.24	.27	1.07
AGE	2.09	1.15	1.32	.69	2.25
MIR	2.72	1.85	3.42	.72	2.07
EDR	3.50	.72	.52	-.33	3.43
SOI	3.08	1.68	2.84	.85	2.16
WP	0.37	0.48	0.23	0.51	1.26
OCCUP	2.76	1.63	2.68	0.86	2.53

Source: Authors' own estimation from primary data

Notes: Std. Dev., Standard Deviation; Min, Minimum; Max, Maximum, N=125

Table 3 captures essential insights about the variables considered for the study. We find that the mean value of all the variables is positive. The low values of the standard deviation of all the variables suggest that the observations of the respondents do not deviate significantly. The negative value of the skewness represents that the variables such as 'EPLAT' and 'EDR' are skewed to the left of the distribution with a flatter or longer tail compared to the normal

distribution. Variables with negative skewness suggest that the values of the mean are less than the median value. Except for the variable EDR, all variables exhibit a platykurtic distribution, implying that these variables are less likely to be affected by any extreme events.

Table 4: Correlation among the Variables

Variables	EPLAT	GENDER	AGE	MIR	EDR	SOI	WP	OCCU
EPLAT	1							
GENDER	-0.19	1						
AGE	-0.29	-0.09	1					
MIR	0.16	-0.28	0.30	1				
EDR	0.22	0.15	-0.04	0.05	1			
SOI	0.11	0.20	-0.25	-0.29	0.03	1		
WP	0.14	0.09	0.08	0.18	0.03	-0.17	1	
OCCU	-0.23	0.23	0.06	-0.31	-0.04	0.48	-0.45	1

Table 4 demonstrates the correlation among the variables. The low values of the correlation coefficient of the variables imply less possibility of multicollinearity problems among the explanatory variables. This also shows no perfect linear relationship among the independent variables of interest.

4.2 Discussion of the Econometric Results

Very few studies discuss the factors responsible for the usage of e-payment platforms. However, these studies produce inconclusive results. In this direction, we attempted to explore the determinants for using e-platform payment methods during COVID-19 times.

Table 5: Determinants of E-Platform use (LASSO regression)

E-Platform	Odds Ratio	Robust Std. Err.	Z	P>|z|
GENDER	0.20	0.12	-2.61	0.00***
AGE	0.45	0.12	-2.93	0.00***
MIR	1.33	0.24	1.55	0.12
EDR	2.57	1.03	2.35	0.01**
SOI	1.37	0.24	1.79	0.07*

Source: Authors' own estimation from primary data

Notes: N=125; Wald chi2=22.76, Prob>chi2=0.0004
Dependent Variables=E-Platform
Control variable: Working Profile (WP) and Occupation (OCCU)
***, **, and * represent 1%, 5%, and 10% levels of significance, respectively.

Table 6: Determinants of E-Platform Use (Logistic regression)

E-Platform	Odds Ratio	Std. Err.	Z	P>|z|
GENDER	0.22	0.13	-2.64	0.01***
AGE	0.44	0.11	-3.42	0.00***
MIR	1.42	0.23	2.17	0.03**
EDR	2.67	0.99	2.65	0.01**
SOI	1.23	0.19	1.30	0.19

Source: Authors' own estimation from primary data
Notes: N=125; Wald chi2=22.76, Prob>chi2=0.0004
Dependent Variables=E-Platform
Control variable: Working Profile (WP) and Occupation (OCCU)
***, **, and * represent 1 %, 5%, and 10% levels of significance, respectively.

Tables 5 and 6 portray the effect of gender (GENDER), age (AGE), monthly income of respondents (MIR), educational qualification of respondents (EDR), and source of income (SOI) on the dependent variable, i.e., use of e-platform (E-PLAT) which represents financial literacy. The results of LASSO regression have their expected sign and coefficients. The variable GENDER is found to be positive and statistically significant. This implies that the preference of e-platform users increases with gender diversity. There has been a surge in digital payments by women with the increase in the number of bank accounts. In other words, our findings suggest more women participation and reflect financial inclusion. As per one of the reports by the Global Partnership for Financial Inclusion (2020), in comparison with 2014, 240 million women have accounts, and two-thirds of the female population use digital payments. As in Sinha (2021), two-thirds of the urban women population in India actively use digital platforms.

We also find that the variable AGE is positive and statistically significant. It represents that the use of digital payment platforms increases with age. This also shows that populations with a higher age prefer to use this facility to mitigate the risks associated with the contraction of virus spread. Since the old

age population is more susceptible to virus infection because of low immunity (Bajaj et al., 2021; Palacios-Pedrero, 2021), they prefer to use digital payments as a mode of transaction. Therefore, it is considered the best-coping alternative to COVID-19 (Xiao & Chorzempa, 2020). Our results did not change when logistic regression was employed for robustness.

Although the monthly income of the respondent (MIR) affects the usage of the e-platform, our results did not show any significant impact of this variable on the usage of this facility. Similarly, we find a positive and significant relationship between educational attainment and usage of digital platforms. This implies that literate people will prefer to use digital payment platforms. This also indicates that financial literacy is boosted with an increment in education level, which assists in improving the financial well-being and decisions of individuals. Our results align with the previous findings (Aurazo & Vega, 2021). Likewise, higher education is expected to lower the probability of using cash or checks and a greater probability of using credit cards and digital payment platforms, especially during COVID-19.

The variable source of income was also found to be positive and significant when the Lasso regression model was applied. However, this variable turned insignificant as we applied logistic regression. Digital payment is more likely to lure people with formal employment who can afford to use the internet. The overall findings indicate that gender, age, literacy, and source of income are significant factors influencing the usage of digital platforms for transactions. Our results endorse the promotion of digital platforms for the old age population, as they are more susceptible to pandemic-like events.

5. Concluding Observations

The paper studies the socio-economic and demographic factors responsible for using digital platforms during the COVID-19 pandemic. The study is based on the primary data collected through a structured questionnaire from a sample of 125 people from the Jagatsinghpur district of Odisha in India. Using LASSO regression techniques, the study finds a positive and significant impact of variables, namely gender, age, education, and source of income, on electronic digital payment platforms during the COVID-19 pandemic. However, the variable source of income was found to be insignificant. The outcome of this paper necessitates suitable policy prescriptions. It can specifically help the

government and financial institutions take the initiative to enhance and promote digital platforms and e-banking. Our results also advocate including basic financial training and awareness programs for individuals and involving financial literacy and related concepts in the course curriculum of the schools, which will result in increased use of the electronic digital platform and will have a positive ripple effect on the Indian economy. These findings are very relevant and carry greater significance for all the sub-national governments in general and the central government while preparing their state and central action plans, respectively.

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Article

Socio-economic Impact of Covid-19 on Industrial Sectors in India

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Swarna Prava Hota

Abstract

The pandemic has not only resulted in the loss of human lives but also affected economies across the world. In India, the pandemic has profoundly affected industries, resulting in underutilized capacity and disruption of supply chains, persistent inequality and an unexpected decline in financial activities. Overall growth in the industrial sector has decreased, adversely impacting economic development. The industrial sector's contribution to Gross Value Added (GVA) has diminished as a consequence of the pandemic. The growth rate of the Index of Industrial Production (IIP) was contracted, which serves as a measure of industrial performance. The pandemic had a significant influence on industry performance, resulting in real GDP growth. Statistically, the growth of GVA in the agriculture, industry, and service sectors has been found to be highly significant to overall economic growth and this contribution has been severely impacted during the epidemic. The capacity utilization decreased during the pandemic period, leading to an increase in the urban unemployment rate. This study seeks to evaluate the socioeconomic effects of Covid-19 on Indian industries by analyzing its impact on growth through secondary data sources. It also emphasizes essential actions, including effective policy decisions to facilitate the country' srecovery from the recession.

Swarna Prava Hota, Assistant Professor (Economics), F.M Autonomous College, Balasore, Odisha. Email: swarnahota1978@gmail.com

Introduction

Industries play an important role in the development of country by contributing to GDP. The industrial sector is a significant contributor to the global economy. Due to limited manufacturing, product volume has been moved to the country's low economies. To reduce process costs, the industry implemented just-in-time and lean management ideas. Around 40% of industries had difficulty surviving industrial output as a result of Covid-19. Fears of a pandemic spreading have forced the closure of industrial units in India, which is causing labour shortages. The first instance of Covid-19 patient was recorded in India in January 2020, and the government of India announced a state of emergency in the country to prevent the calamity from spreading and disrupting the supply chain. The unanticipated lockdown resulted in a drop in financial activity. As a result of the outbreak, there had been an increase in unemployment and a decrease in financial activity. The production of world economy was reduced, causing a major recession across the globe. The pandemic had affected their mental well-being and delayed their purchase decisions, resulting in lower market demand for products. It had impacted almost every sector of the economy as well as India's GDP.

Literature Review

The pandemic had disrupted the manufacturing systems and their supply chains around the world, forcing thousands of industries to temporarily curtail or shut down their assembly lines operations in the United States, Europe, and India (Agrawal et al., 2020). It was observed that COVID-19 put an emergency brake on the supply chain in Indian industries, resulting in nationwide lockdowns, mandatory quarantine, home isolation, job losses, and financial activities. The economy was derailed by lack of labour, transportation restrictions, and a cash flow shortfall in the market (Biswas & Das, 2020 and Jothikumar et al., 2020).

The outbreak of COVID-19 implied serious health concerns in India, and had substantial effects on health, society, and economy in the battle against coronavirus (Dhatrak, 2020). It was held that judicious strategies and programmes were essential to combat the devastating impact of COVID-19. Preventive measures must be implemented by the government in order to avoid future economic losses. All public health emergencies, including disease

outbreaks, require an effective and efficient plan to decrease preventable mortality and morbidity while also controlling the economic, social, and security disruptions. Information exchange and communication are important elements for coordinating COVID-19 disease prevention and management.

It was imperative to quantify the nature and extent of effects on the economy due the pandemic (Saleha, 2020), Jadav, 2020; Sahoo & Ashwani, 2020**)**. To cover a large section of the population and provide relief to sectors that generate employment, stability, and aggressive fiscal-monetary stimulus measures, the government needed to announce relevant packages for specific areas, particularly trade, manufacturing, NBFCs, infrastructure, real estate, and unorganized labour.

Objectives and Hypothesis

First, the study focuses on the socio-economic impact of a pandemic on various industrial sectors. Second, it attempts to assess the factors contributing to the economic slowdown and glaring inequality in society. This study considers FY12 to FY21 as its study period. The research uses secondary data. The following hypotheses have been tested.

H0: There is no significant relation between GVA growth of agriculture, industry and services with overall economic growth.

H1: There is significant relation in between GVA growth of agriculture, industry and services with overall economic growth.

Data Analysis and Findings

At current prices, Table 1 displays the GVA growth rate of various economic activities in 2019-20 and 2020-21.

Table 1: First Advance Estimates of GVA by Economic Activity

(at Current Prices)

Industry	GVA (Rupees crore)		Percentage Change Over Previous Year Increase(+)/Decrease(-)	
	2019-20 (PE)	2020-21 (1st AE)	2019-20	2020-21
Agriculture, Forestry & Fishing	3,257,443	3,494,823	11.4	7.3
Mining & Quarrying	393,102	294,249	1	-25.1
Manufacturing	2,775,587	2,553,708	0.3	-8
Electricity, Gas, Water Supply & Other Utility Services	486,516	477,111	6.6	-1.9
Construction	1,384,895	1,213,717	3	-12.4
Trade, Hotels, Transport, Communication & Services related to Broadcasting	3,316,653	2,711,124	5.5	-18.3
Financial, Real Estate & Professional Services	3,842,524	3,896,395	6.1	1.4
Public Administration, Defense & Other Services	2,886,517	2,935,715	15.7	1.7
GVA at Basic Prices	18,343,237	17,576,842	7	-4.2

Source: NSO Notes: PE: Provisional Estimates; AE: Advance Estimates

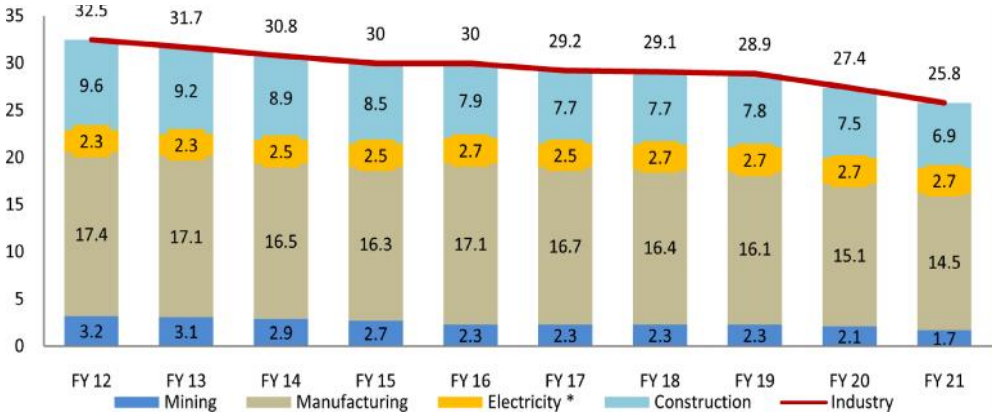
While agriculture contributed 7.3 per cent of GVA growth in 2021, in 2020-21, other sectors such as mining, manufacturing, power, construction, trade, hotel, and transportation & communication contributed negatively to GVA. The sectors were affected during the pandemic in several ways. These are: a) reduction in workforce among all industrial sectors, b) transport and travel restriction, c) low capacity utilization causing low production, d) maintaining social distancing and self-isolation, e) employees losing their jobs, f) scarcity of raw material due to disruption in supply chain, g) inadequate cash flow in market, h) increase in gap between demand and supply of products, and i) health and economic impact of Covid-19 on workers, including migrants.

Figure 1 shows a significant drop of 11 per cent in the industry contribution to GVA from FY 19 to FY 21. During the pandemic, the mining, manufacturing, and construction sectors generated less GVA. In comparison to FY 19, GVA

had decreased by 26 per cent in FY 21. The contribution of the industrial sector to overall GVA was 25.8 per cent in FY21, the lowest of all years.

Figure1: Share of Industry and Its Components in GVA

(Current Prices, Percentages)



Source: *Economic Survey of India 2020-21*

Notes: * Electricity, gas, water supply & other utility services

Table 2 shows the performance of various components of the industrial sector, such as manufacturing, mining and quarrying, electricity, construction.

Table 2: Rate of Growth of GVA in Industry and Its Components

(Percentages)

	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21
Mining	0.6	0.2	9.7	10.1	9.8	4.9	-5.8	3.1	-12.4
Manufacturing	5.5	5.0	7.9	13.1	7.9	6.6	5.7	0	-9.4
Electricity*	2.7	4.2	7.2	4.7	10	11.2	8.2	4.1	2.7
Construction	0.3	2.7	4.3	3.6	5.9	5.0	6.1	1.3	-12.6
Industry	3.3	3.8	7.0	9.6	7.7	6.3	4.9	0.9	-9.6

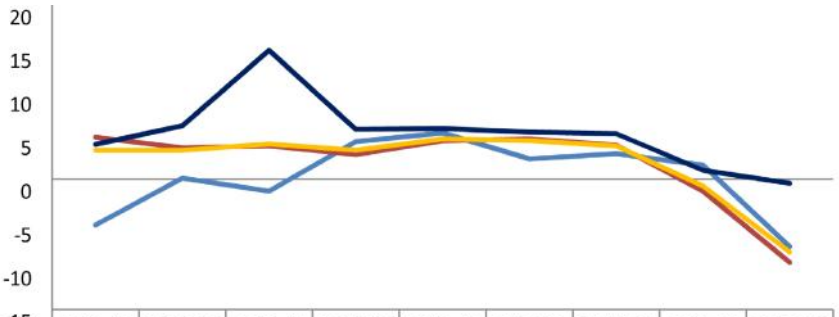
Source: Calculations based on MoSPI data

Note: *Electricity, Gas, Water Supply & Other Utility Services

The industrial sector was anticipated to grow by -9.6% according to the most recent projections for GVA, with an overall contribution to GVA of 25.8 per cent in 2020–21. From 2011–12, the industrial sector's contribution has steadily decreased (Figure 1). The growth rate of GVA in the mining industry increased from 0.2 per cent in FY 14 to 10.1 per cent in FY 16 and considerably reduced from 9.8 per cent in FY 17 to -12.4 per cent in FY 21. Similarly, the growth

rate of GVA in the manufacturing sector increased from 5.0 per cent in FY 14 to 13.1 per cent in FY 16, and then drastically decreased from 7.9 per cent in FY 17 to -9.4 per cent in FY 21. With the exception of Electricity, gas, water supply & other utility services, whose percentage in GVA increased from 2.3 per cent in FY12 to 2.7 per cent in FY21, the share has declined across board. Construction industry GVA growth rate has dramatically decreased from 6.1 per cent (FY19) to -12.6 per cent (FY21). The main threat to GVA growth from FY19 to FY21 has been the pandemic. Different government measures to curb Covid 19 had caused disruption in supply chain, underutilization of capacity, labour scarcity and movement restrictions; all these have resulted in the slowdown of the economy. The Index of Industrial Production has declined in sectors like Mining, Manufacturing, and Electrical from 2018-19 to 2020-21 during the pandemic (Figure 2).

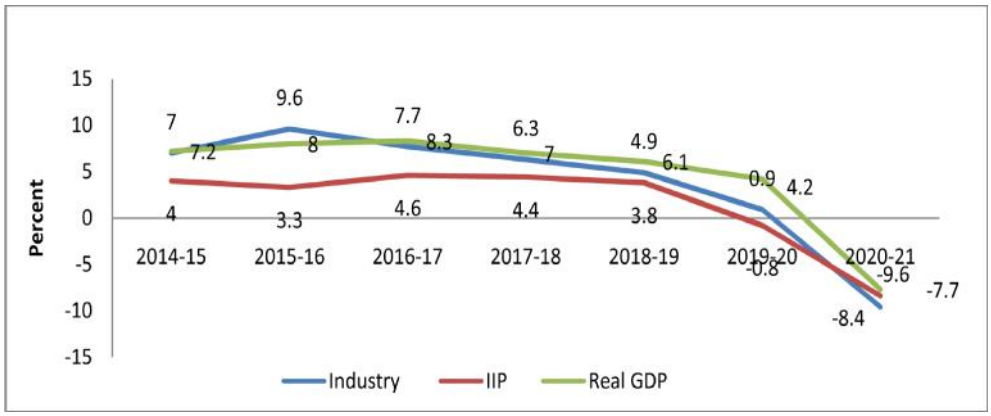
Figure 2: Sector wise Annual Growth Rates of Index of Industrial Production
(Percentages)



	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
Mining	-5.3	0.1	-1.4	4.3	5.3	2.3	2.9	1.6	-7.8
Manufacturing	4.8	3.6	3.8	2.8	4.4	4.6	3.9	-1.4	-9.6
Electrical	4	6.1	14.8	5.7	5.8	5.4	5.2	1	-0.5
General	3.3	3.3	4	3.3	4.6	4.4	3.8	-0.8	-8.4

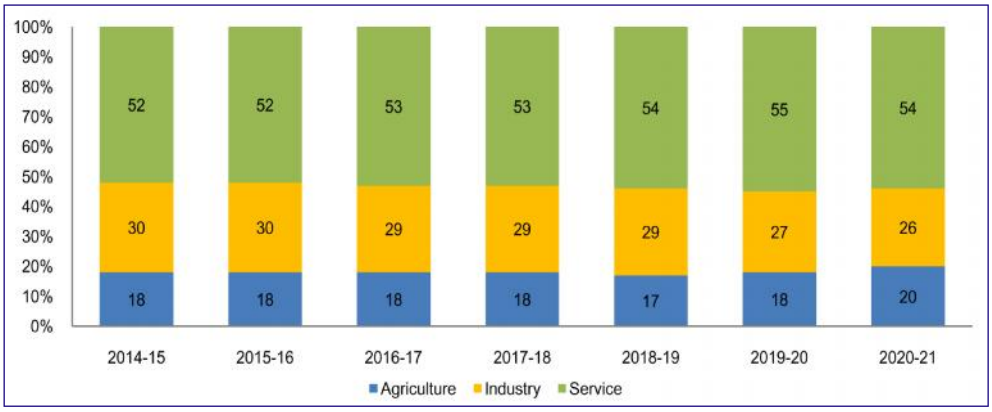
Since 2019-20, the real GDP has been negative. The correlation between industry and GDP growth is 0.98, indicating a significant positive linear correlation. Similarly, correlation between IIP and GDP growth is showing 0.974 by using above data (Figure 3). As shown in Figure 4, industry contribution to GVA was 27 per cent and 26 per cent in 2019-20 and 2020-21, respectively, which had declined to 10 per cent in 2021. That all the three key sectors of the economy have been negatively impacted by the pandemic is obvious in Figure 5.

Figure 3: Industry Contributions to Real GDP



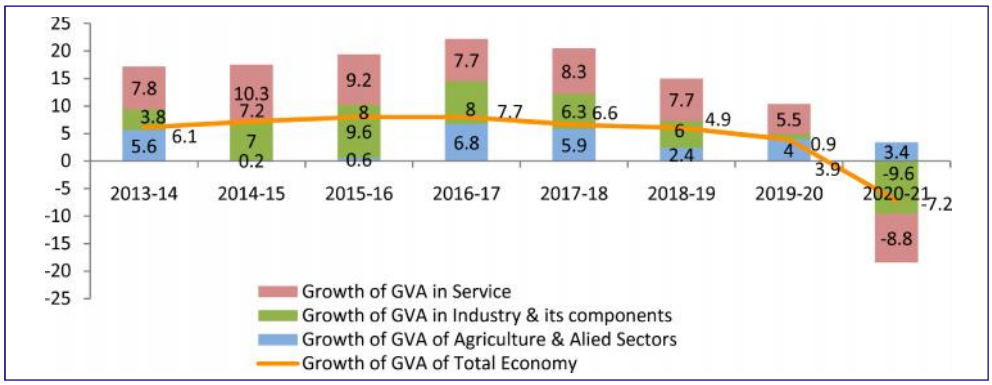
Source: MoSPI

Figure 4: Share of Components of GVA



Source: *Economic Survey of India 2020-21*

Figure 5: Sectoral Contribution to Overall GVA Growth (Percentages)



Source: MoSPI

Multiple Regression Analysis:

According to the First Law of Kaldor, the expansion of the manufacturing sector has a positive impact on GDP growth. In this context, multiple regression analysis is used to find out the relationship between single dependent variable (GVA of the economy) and other independent variables (sectoral GVAs).

Model Summary

S = 0.428517	R-Sq = 99.6%	R-Sq(adj) = 99.3%		
	Regression Coefficients			
Predictor	Coef	SE Coef	T	P-value
Constant	-0.0635	0.3667	-0.17	0.871
Growth of GVA of Agriculture & allied sectors	0.18606	0.06665	2.79	0.049
Growth of GVA in Industry & its Comp	0.36872	0.08910	4.14	0.014
Growth of GVA in Service	0.47061	0.0877	5.37	0.006

Analysis of Variance- Goodness of Fit (ANOVA)

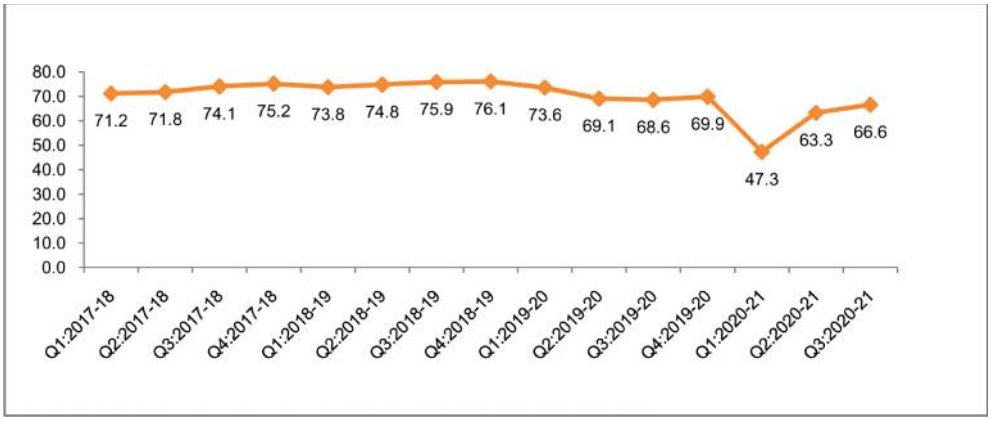
Source	DF	SS	MS	F	P
Regression	3	176.680	58.893	320.72	0.000
Residual Error	4	0.735	0.184		
Total	7	177.415			

The R^2-adjusted indicates that 99.3% of the variation in total economy is explained by the different sectors included in the model. The complete significance of model was tested by ANOVA. The F-statistics value of 320.72 ($P<0.05$) indicates that the various sectors are statistically significant together at the 5% level and the null hypothesis is rejected. According to the regression results, the model reveals a statistically significant relationship between GVA of the overall economy and GVA of industry (p value 0.014), GVA of agricultural (p value 0.049), and GVA of service (p value 0.006). As a result,

the GVAs of the industry, agriculture, and service sectors have a large impact on the whole economy's GVA (Sign <0.05).

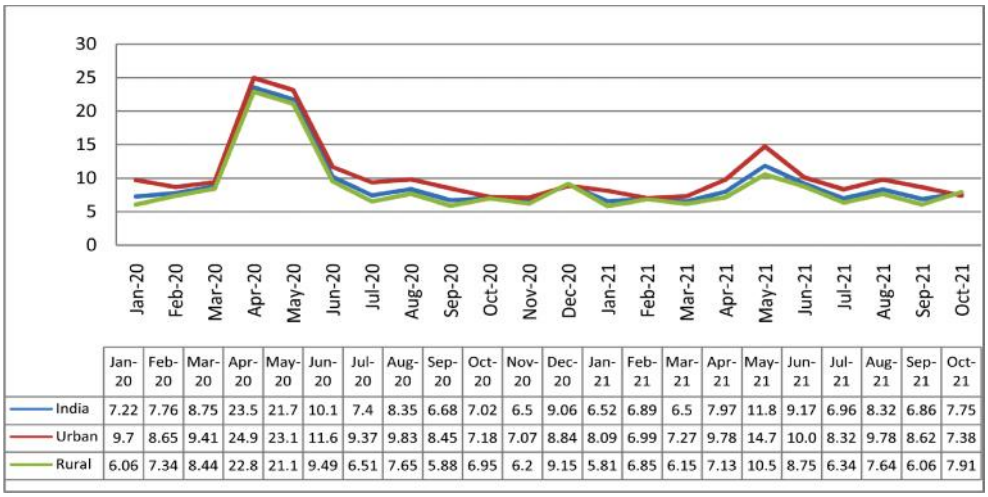
The industrial sectors had been severely impacted by the pandemic and were obligated to reduce their capacity as a result of the lockdown, enforcement of government restrictions, lack of manpower, and shortage of raw materials. In Q1 2020-21, capacity utilization was dramatically reduced to 47.3 percent and began to improve subsequently. From Q3: 2020-21, industry capacity utilization has improved, and production activities have increased.

Figure 6: Capacity Utilisation (Percentages)



Source: Reserve Bank of India

Figure 7: Unemployment Rate (Percentages)



	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21
India	7.22	7.76	8.75	23.5	21.7	10.1	7.4	8.35	6.68	7.02	6.5	9.06	6.52	6.89	6.5	7.97	11.8	9.17	6.96	8.32	6.86	7.75
Urban	9.7	8.65	9.41	24.9	23.1	11.6	9.37	9.83	8.45	7.18	7.07	8.84	8.09	6.99	7.27	9.78	14.7	10.0	8.32	9.78	8.62	7.38
Rural	6.06	7.34	8.44	22.8	21.1	9.49	6.51	7.65	5.88	6.95	6.2	9.15	5.81	6.85	6.15	7.13	10.5	8.75	6.34	7.64	6.06	7.91

Source: Centre for Monitoring Indian Economy Pvt. Ltd.

Concluding Observations

The pandemic has negatively affected the country's economic growth. Lack of working capital, disruption in supply chains and financial crunch have significantly influenced industrial sectors in terms of production processes, employment rates, and turnover. The sudden announcement of lockdown has impacted particularly for those working in unorganized or small sectors, who have been forced to migrate from their jobs and suffer from hunger. In 2020-21, real GDP and industrial contribution both reduce to -7.7 per cent and -8.4 per cent, respectively, the lowest levels in a decade. In October 2021, the unemployment rate was 7.75 per cent, which is slowly improving. Agriculture, service, and industry are all significant contributors to the total economy's GVA, according to multiple regression analysis.

According to the study, policy should be formulated to improve the real per capita income through employment generation as well as to improve the various sectors of the Indian economy by increasing capacity utilization. It is extremely difficult to get a conclusion on the pandemic's latter stages. As a result, the following steps are suggested for the restoration of industrial sectors and the reduction of inequalities.

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Article

Assessment of Linkages of School Dropout with Migration: Empirical Evidence from Ganjam District, Odisha

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Sabitribala Dash
Mrutyunjay Swain

Abstract

School dropout has been a major cause of concern in India, especially in poorer states like Odisha, resulting in many socioeconomic problems, such as illiteracy, poverty, and migration. In this paper, an attempt has been made to analyze the linkage of school dropout with migration. We examine the consequences of school dropout on the employment prospects of the dropouts in the Ganjam district of Odisha, which experiences a large flow of seasonal outmigration to various parts of the country. The findings indicate that financial constraint is an essential determinant for school dropout and migration, forcing the children of poor households to engage in small sectors and gadgetry to provide financial support to their families. Further, the study reveals that the unwillingness of parents or students in education, sibling care, and lack of supervision have contributed to an increase in school dropout rates.

Keywords: School dropouts, migration, financial constraints, education policy.

Sabitribala Dash, PhD Scholar, Department of Economics, Berhampur University, Berhampur, Odisha. Email: sabitribala1988@gmail.com

Mrutyunjay Swain, Associate Professor, Department of Economics, Berhampur University, Berhampur, Odisha. Email: mrutyunjay77@gmail.com

1. Introduction

Education is an essential tool for the development of society and the welfare of individuals. It propels the development of human capital and the growth of an economy. Universalization of Elementary Education (UEE) has set the objective of providing education to all, but it has remained a distant dream in many parts of the globe, including India. Developed countries like the USA have suffered a loss of income due to the dropout of students, approximately 329 billion dollars (Smink & Reimer, 2013). Since the beginning of the 21st century, it has been a non-negotiable goal to ensure covering all children of five to eight years under the formal schooling education system. Two critical obstacles in the UEE in India have been that there is discontinuity in studies before completing a stage of education, and secondly there is repetition in the same grades due to quality deficiencies (TNS Report, 2013). During the last five years, the country has prioritized primary education. However, providing the correct type of education to the right people in the proper manner has become the biggest challenge for our policy makers (Basumatary, 2012).

The right to free and compulsory elementary education has become a fundamental right under Article 21A of the Indian Constitution. Providing free and compulsory education for all children up to the age of 14 years is also a constitutional commitment. A recent survey by the National Statistical Office (NSO) has revealed that around 12.6 per cent of students dropped out of school in India, 19.8 per cent discontinued education at the secondary level, and 17.5 per cent dropped out at the upper primary level. According to the report of MHRD, Government of India, the national dropout rate is higher at the secondary level at 17.86 percent than at the primary level at 4.34 per cent in 2014-15 (*The Hindu*, 2016). It defines that some reasons, such as migration, early marriage, and low economic status families, act as fuel to fire, causing dropouts.

The Government of India has initiated several programs to achieve the goal of UEE, among which the Sarva Shiksha Abhiyan (SSA) is the prominent one. UEE is primarily dependent on the twin processes of enrolment and retention. The SSA envisages achieving universalization, i.e., achieving universal access, universal enrolment, universal retention, and universal quality of education and universal achievement in eight years of elementary education. With

sustained efforts through the interventions of SSA in Odisha, the enrolment of school children in various groups has increased substantially. However, quite a large number of children are still out of the ambit of schools, and more than 95 per cent of such children are those who prematurely dropped out of school (OSEPA, 2021). To enhance the retention rate, several attempts, such as the annual exercises for the District Information System for Education (DISE) and Child Tracking System (CTS) have been made to estimate and locate the dropouts. Besides, several small research projects have also been conducted to estimate the dropout rate and ascertain its reasons. As a result, the dropout rates in different districts have exhibited a downward trend after implementing various flagship programs. However, these estimates are crude dropout rates, and the reasons are more speculative.

The present study has been undertaken in Odisha's Ganjam district, a developing district with a moderate dropout rate. The central and state policies and programs are simultaneously implemented in this district following government guidelines. Despite efforts, the dropout rate is still high. Not only has the district implemented several educational schemes with proper coordination and direction of central and state governments, but the district administration has also been taking several steps to mainstream all children in formal schooling education. As per the OSEPA report (2021), in 2006-07, the dropout rate was 7.79 per cent in the primary and 16.95 per cent at the upper primary level in Ganjam district, which was the major challenge at that time for the district for its reduction. However, in 2011-12, the rates were 3.34 per cent, 3.55 per cent, and 20.03 per cent at primary, upper primary and secondary levels, respectively. Subsequently, the rate has fluctuated and came to 5.88 per cent at the primary, 5.14 per cent at the upper primary level, and 5.43 per cent at the secondary level in 2017-18, showing no more changes within the five years, which is the primary concern of this study.

This paper tries to determine the reasons for school dropout, how to engage them in productive work and dropout-linked migration from Ganjam by taking a sample of three blocks of the district with the highest dropout rates (two rural blocks and one urban). A few suggestions have been made to help policymakers address school dropout and migration issues.

2. An Overview of Literature

Over the years, emphasis has been given to identifying reasons and intricacies of the dropout phenomenon that has emerged in the relevant literature (Manandhar & Sthapit, 2012; Sampath, 2016; Moreira et al., 2018). Since the 1970s, determinants, and reasons for school dropout and low completion and transition rates have interested academics, researchers, and policy makers. Migration of families, child marriage, distance of schools, and lack of infrastructure such as drinking water, toilets, etc., are the significant causes of children dropping out of school (Sampath, 2016). Similarly, poverty, availability, and accessibility are the three big reasons for the dropout of a child (Soha Moitra of Child Rights) where the low economic status of families forcibly engages their children for earning purposes for which a child might drop out from the education system. In this context, Balfanz and Letgers (2004) reviewed the reasons for dropout and found a strong relationship between poverty and dropout rate.

Widespread illiteracy and lack of awareness among migrant families impacted the education of their children who had to take up the responsibilities of household work, sibling care, and child labor for earning purposes (Prakash et al., 2017). Mishra and Abdul (2014) observed that dropout at the primary and secondary levels happens due to factors such as illiteracy among parents, poor economic status and migration.

A study was by MDG-F (MDG Achievement Fund, 2011) found that children were dropping out due to low family income, lack of parental support, migration, etc. Mukherjee (2011) points to lack of awareness among parents and lack of educational facilities at schools as important factors. Children from financially constrained families has to work as child laborers.

An empirical study by Teneva (2017) analyzed the adverse factors leading to school dropout and the positive factors encouraging students to return to school. These include periodic migration, separation of parents, family disputes, low importance to education and financial constraints. Poor financial condition of the families increases students' dropouts, engaging them in different unskilled work. The positive factors encouraging students to continue education where

identified as improvement in school environment, better student-centric curricular activities, mid-day meal programs, conducting awareness and motivational programs for parents and students discussing the educational benefits to children, financial assistance to the poor students and improved cordial students-teachers relationship.

Basumatary (2012) illustrates that poverty, rural population, and illiteracy are positively related to the dropout rate. The concerned families lack interest in education and are thus unwilling to send their children to school. Even some non-migrating families have also shown disinterest in education due lack of awareness. A study by Govinda Raju and Venkatesan (2010) in rural Karnataka focused on various causes of school dropout, such as disinterest in education by parents, performing parenting responsibilities, leaving back children under the care of relatives or grandparents due to migration, poverty in the family and denying female children to continue in school. The dropout is found to be high at the secondary level compared to the elementary level due to low economic status of families. The educational expenditure creates a financial burden to the families, leading to their disinterest in education. While male children prefer to engage themselves in various unskilled work girls stayed at home for sibling care and household work (Amirtham & Kundupuzhakkal, 2013).

A study by Hussain et al. (2011) on causes of student dropout in Pakistan identified two main categories of factors that lead to dropout. The first category includes out-of-school factors as parents' poverty, lack of motivation and understanding of the value of education, the opportunity cost to parents by sending the child to school, migration of parents, and long distance of schools from home. Further, in-school factors include lack of facilities in schools, defective textbooks, and curricula that are beyond the comprehension level of students, and the harsh attitude of teachers toward students. The out-of-school factors are mostly responsible for dropouts.

It is found that female students dropped out more asthey are engaged in household work and sibling care. The disinterest of parents in girls' education is also a cause of early marriage that acts as an obstacle to girls' education. Sometimes, the families' migration due to poverty also impacts the education

of girls, which creates disinterest in school education and difficulties in understanding portions taught due to irregular attendance.

Moreira et al. (2018) held that factors like migration, family income, and poverty are responsible for high dropout rates at the school level. The financial constraints of families impact their children's educational performance negatively. Adopting proper teaching methodologies and monitoring teachers daily can help reduce the dropout situation at the school level (Manandhar & Sthapit, 2012). The study found that over 45 per cent of the dropouts were engaged in household chores and only 14 per cent between the age group 6 and 15 were engaged in wage labour. This study also revealed that 38.5 per cent of children left school due to involvement in household work. Most of these children will look after their young siblings when their parents go to work. Christle et al. (2007) found that lack of interest of students or parents is one of the significant factors of academic failure and consequent school dropout. Such students are found to be poor achievers in school with low test scores. These students become indisciplined, which is directly related to the extent of school dropouts.

3. Objectives, Data and Methodology

The primary objectives of the study are:

i. To assess the linkages between school dropout and migration of households in rural and urban areas.

ii. To analyze the extent and reasons for school dropouts from migrant and non-migrant families.

iii. To examine the employment of dropout children of migrant families and non-migrant families.

3.1 Selection of Study Area and Sampling Technique

The present study is conducted in three blocks of Ganjam district with the highest dropout rate (two are rural blocks and one is urban) to determine the differences between rural and urban areas for school drop-out and migration and analyze the reasons for creating this problem. The detailed block-wise dropout data of rural and urban blocks are given in Tables 1 and 2, respectively.

Table 1: Dropouts in Rural Blocks of Ganjam

Block	No. of dropout students identified at				No. of dropouts not mainstreamed due to migration of families at			
	Primary	Upper Primary	Secondary	Total	Primary	Upper Primary	Secondary	Total
Aska			6	6				0
Beguniapada	7	24	91	122	7	24	91	122
Bellaguntha		6	30	36		6	30	36
Bhanjanagar	3	8	35	46	3	8	35	46
Buguda			49	49			49	49
Chatrapur	4	15	66	85			2	2
Chikiti	1	1	14	16				0
Dharakote		3	20	23		3	19	22
Digapahandi	2	4	22	28		4	20	24
Ganjam			16	16			5	5
Hinjilicut	1	2	33	36		1	23	24
Jaganathprasad		2	28	30		2	27	29
Kabisuryanagar	1		2	3	1		2	3
Khallikote	2	3	34	39	1	3	25	29
Kukudakhandi	1	5	36	42	1	2	31	34
Patrapur			52	52			52	52
Polasara	2	13	62	77	2	13	62	77
Purusotampur		9	34	43		9	34	43
Rangeilunda			3	3				0
Sanakhemundi			2	2			2	2
Sheragada	2	12	74	88		3	44	47
Grand Total	26	107	709	842	15	78	553	646

Source: OSEPA (2021)

Table 2: Number of Dropouts in Urban Blocks (NAC) of Ganjam

Urban Block /NAC	No. of dropouts identified				No. of dropouts not mainstreamed due to migration of families			
	Primary	Upper Primary	Secondary	Total	Primary	Upper Primary	Secondary	Total
Aska			11	11				0
Bellaguntha	1	5	6	12	1	5	6	12
Bhanjanagar	4	2	4	10	4	2	4	10
Berhampur		1	4	5		1	4	5
Buguda			7	7			7	7
Chatrapur		2	5	7				0
Chikiti			8	8				0
Gopalapur	1		2	3			1	1
Hinjilicut		1	3	4			3	3
Polasara		13	30	43		13	30	43
Kodala	2	3	4	9	2	3	4	9
Grand Total	8	27	84	119	7	24	59	90

Source: Same as Table 1.

From Tables 1 and 2, two rural blocks (Beguniapada and Sheragada) and the urban block (Polasara NAC) have been selected as these have higher dropouts. The cluster-wise dropout data of the two selected blocks are presented in Table 3 for more clarity.

Table 3: Cluster-wise Number of Dropout Students in the Two Selected Blocks of Ganjam District

Beguniapada Block		Sheragada Block	
Cluster	Total Dropout students identified	Cluster	Total Dropout students identified
Chingudikhol	8	Sheragada	2
Deuliapada	12	Bandhaguda	13
Digapada	12	Baramundali	14

K Barida	16	Dhanantara	2
K Jagilipadar	15	Dhenkisala	23
Kandasara	1	Karadakana	14
M Berhampur	6	Kulagada	5
Mardamekha	29	Takarada	15
Sandhamula	13	Total	88
Sumandal	10		
Total	122		

Source: Same as Table 1.

The differences between the cluster-wise dropouts of the two sample rural blocks may be seen in Table 3. A total of 10 clusters (5 clusters each from the two rural blocks) and the whole of the urban block were chosen. From each cluster, six households (2 HHs from each level of age groups such as 6+ to 10+, 11 to 13+, and 14+ to 15+) totaling 66 households were surveyed to assess reasons for migration and dropout of their children at the primary, upper primary and secondary levels. Similarly, 66 dropout students were also surveyed. The summary of the sample distribution is presented in Table 4. Thus, a total of 132 respondents were covered in the study.

Table 4: Sample Distribution

Block	No. of clusters selected	No. of households (@ 6 HHs of dropout dropout students per cluster)	No. of dropout students @ 6 students (PS-2, UP-2, HS-2) per cluster	Total respondents covered
Beguniapada	5	30	30	60
Sheragada	5	30	30	60
Polosara NAC	1	6	6	12
Total	11	66	66	132

Source: Own compilation

3.2 Methods of Data Collection and Analysis

The present study is based on both primary and secondary data. Secondary data was used to select rural and urban areas for the survey. The field survey was conducted on relevant variables such as socio-economic characteristics, the extent of dropout concerning gender, location (rural or urban), migration, and the causal factors of school dropout. Analysis of data on migrant/non-migrant families linked with school dropout was carried out using simple statistical tools.

4. Results and Discussion

4.1 Linkages between School Dropout and Migration of Households

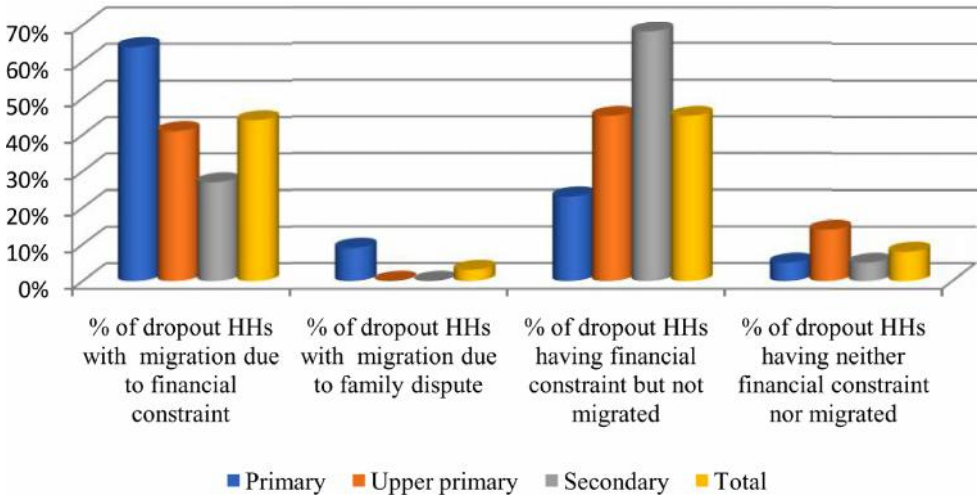
The survey was carried out on 66 households of dropout children to identify the linkages between school dropout and migration of households (Table 5 and Figure 1). It is observed that the extent of dropout with migration due to financial constraints is the highest (64%) at the primary school level. In contrast, the extent of dropout due to financial constraints who have not migrated is highest (68%) at the secondary school level.

Table 5. Linkages of School Dropouts with Migration

Level of school dropout	No. of dropouts Households covered under the survey	Percentage of dropout HHs with migration due to financial constraint	Percentage of dropout HHs with migration due to family dispute	Percentage of dropout HHs have financial constraints but have not migrated	Percentage of dropout HHs having neither financial constraints nor migrated
Primary	22	64	9	23	5
Upper Primary	22	41	0	45	14
Secondary	22	27	0	68	5
Total	66	44	3	45	8

Source: Field Survey

Figure 1. School Level Wise Linkages of School Dropouts with Migration



Families with financial constraints migrate out of state for their livelihood as the wage rate and work opportunities are comparatively better at the destination. The extent of dropouts at different levels is observed to be higher in case of families having financial constraints both in migrant and non-migrant households. Children are leaving schools on their own will or obliged to do so to support their families financially.

It was found that migration due to family disputes has little impact on children's education. Only 9 per cent of children in primary education left school and were taken with their families for safety concerns, but elder children stayed in the maternal house to continue their education. Similarly, a tiny percentage of children (5% at primary, 14% at upper primary, and 5% at secondary level) dropped out belonged to families having no financial constraint due to disinterest in studies, illiteracy and lack of awareness.

4.2 Linkages of Dropout with Migration in Rural and Urban Areas

During the survey, it was observed that there were certain similarities and differences between rural and urban areas concerning the nature of school dropouts. In rural areas, children from migrant and non-migrant families having financial constraints (43% and 45%, respectively) had dropped out due to poor economic conditions and engaged themselves in different activities, such as child labour, providing financial support to their families (Figure 2).The instances

of school dropouts from migrant households due to family disputes (3%) and from non-migrant families having no financial constraint (8%) have been observed in rural areas, which are mainly due to lack of awareness, lack of supervision, disinterest in education, and illiteracy among parents.

However, in the case of urban areas, half of the sample households had children who had dropped out of school due to migration owing to financial constraints, and the rest had dropped out children due to financial constraints but without any migration (Figure 3). Children from families with financial constraints had dropped out due to families shifting outofstate. Such children are engaged in different sectors to support their families financially. It is good to notice that no migration case was found due to disputes within families in urban areas. Similarly, no dropout cases were found among families with sound financial positions.

Figure 2: Share of Households with School Dropouts and Migration in Rural Areas

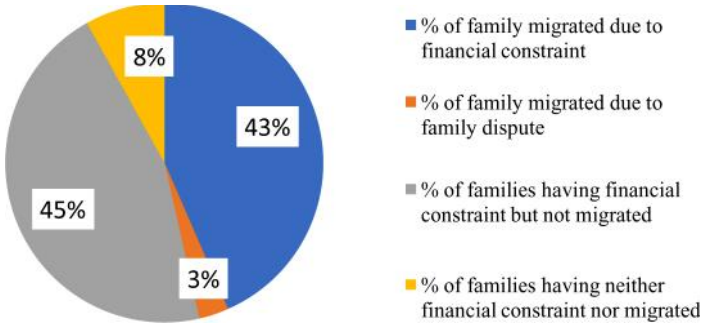
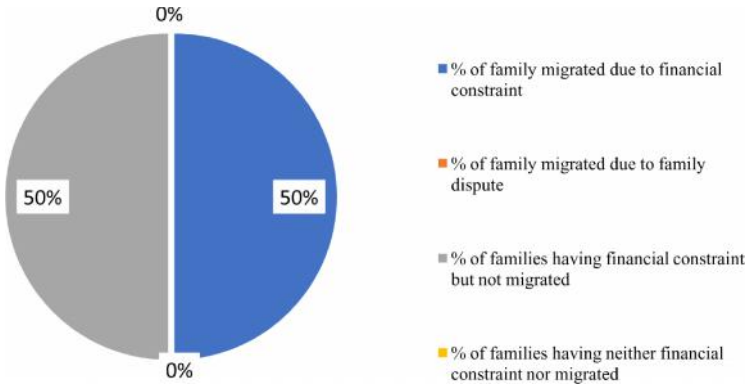


Figure 3: Share of Households with School Dropouts and Migration in Urban Areas



The rural-to-urban migration is found to be temporary. The migrants migrate during the off-season for six to eight months and return to their home district during the crop harvesting period. This short and medium-term out-migration is basically for better wage rates. As reported, they were getting more than Rs. 600 per head per day at their destination locations compared to a maximum wage of Rs. 300 to 400 at their native localities.

Due to out-migration, education of children of all categories (primary, upper primary, and secondary) has been badly affected. The girl children of the 11+ to 15+ age group stayed at home to care for their younger siblings, and the male children used to engage as child laborers. After returning to their villages, the children were reluctant to go to school due to fears and school phobia. These absentee children were not ready to cope with further education and failed to maintain good relationship with their friends.

Moreover, around 45 per cent of the dropout children belonging to families with financial constraints who had not migrated stayed in their villages and engaged themselves in agricultural and other labor-intensive work receiving meagre wage rates. The children of families (both migrant/and non-migrant) with financial constraints have engaged themselves in their household jobs, shops, medical stores, vegetable vending, hotels, and other wage work. This has been the case with upper primary and secondary boys (adolescent group) and girls have been engaged in household work/sibling care in the absence of their mothers. However, the primary-level children stayed home, showing unwillingness to study by seeing their dropped-out elders. Children have also dropped out due to ignorance and lack of awareness among parents on educational benefits.

4.3 Employment of School Dropouts of Migrant and Non-migrant Households

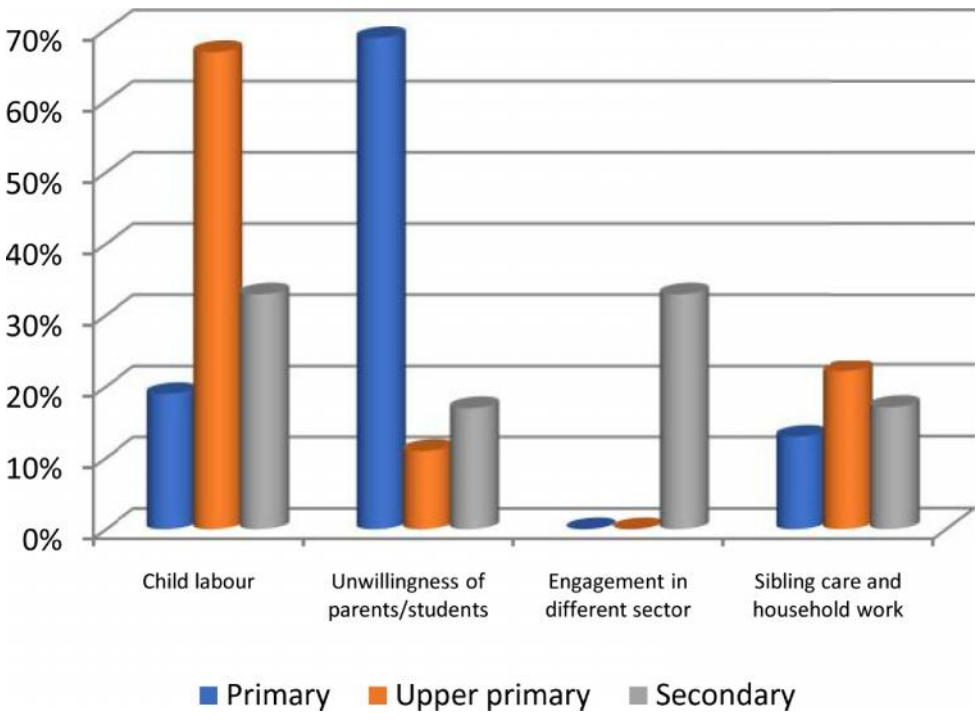
The consequence of dropping out from school is observed in their engagement in various low-profile jobs such as child labour, sibling care, and other household work (Table 6 and Figure 4).

Table 6. Employment of School Dropouts of Migrant and Non-Migrant Households

Level of school dropout	Child labour	The unwillingness of parents/ students	Engagement in different sector	Sibling care and household work	Child labour	The unwillingness of parents/ students	Engagement in different sector	Sibling care and household work
	Migrant				Non-Migrant			
Primary	19%	69%	0%	13%	17%	17%	0%	67%
Upper Primary	67% 15%	11%	0%	22%	15%	23%	46%	
Secondary	33%	17%	33%	17%	13%	19%	38%	31%

Source: Field survey

Figure 4. School Level-wise Engagement of School Dropouts of Migrant Households



The children (6 to10 years) of migrant families were engaged in labour work (19%), and majority of them (69%) stayed with their parents who had no interest in sending their children toschools for safety and security concerns in new working sites. Only 13 per cent of children were engaged in household work and sibling care when their parents were going outside for wage work.

In case of the upper primary level, children (11 to 13 years) of the migrant families were engaged in child labor (67%) in the brick kiln area, and 11 per cent of children were not interested in studies. Similarly, 22 per cent of children stayed home for household work and sibling care, more than that at the primary level. In case of secondary-level children (14 to 15 years), 33 per cent worked as child labour, and another 33 per cent worked in other activities when their parents worked elsewhere. In case of non-migrant households, 17 per cent of children stayed for household work or sibling care, and another 17 per cent neither worked nor studied due to disinterest in education. It is seen that more than 60 per cent of children (11 to 15 years) were engaged in different activities to provide financial support to their families.

The nature of employment of dropout children from migrant and non-migrant families is presented in Figures 5 and 6. Firstly, 35 per cent of children worked as child laborers in migrant families instead of only 14 per cent in non-migrant families. This is because when parents migrated with their children, they did not hesitate to engage them in wage work to generate additional income. Secondly**,** in migrant families, around 42 per cent of dropout children showed disinterest in studies compared to 20 per cent in non-migrant families. It is because the children left schools due to the unwillingness of parents, moved with them to a new environment with the unavailability of suitable schools in their local language, and engaged themselves in different work, thus showing disinterest in studies.

Figure 5. Distribution of Activities of Dropout Children of Migrant Households

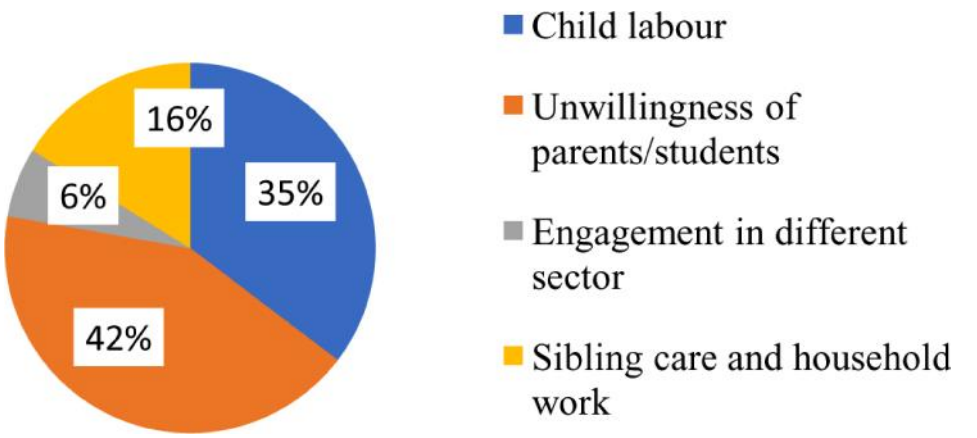
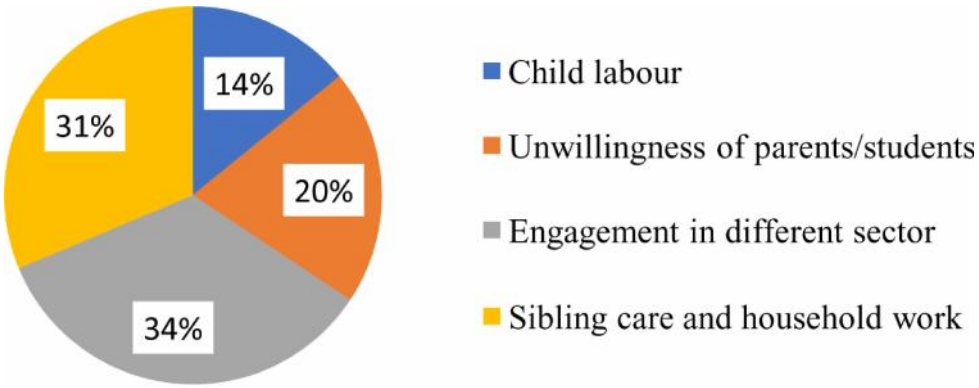


Figure 6. Distribution of Activities of Dropout Children of Non-migrant Households



Thirdly, 34 per cent of children of non-migrant families were engaged in different activities compared to 6 per cent of migrant families. The trust factor, adjusting to new places, and new languages at the destination reduced prospects and quality of employability of the children who moved there. Finally, around 31 per cent of children in non-migrant families were engaged in household work/sibling care compared to 16 per cent in migrant families. This is because the children were mostly accompanied by their parents to the workplaces of migrant families. Thus, fewer children were left at their homes at the destination of the migrant families. In case of non-migrant families, more children were staying at home in their native places. Thus, the children of non-migrant

households had more responsibility towards sibling care than those of migrant households.

5. Conclusion

Migration has been a regular phenomenon in households in rural and urban areas of the Ganjam district of Odisha. The large outmigration has significantly affected the education of concerned children. It has been observed that parents with financial constraints engaged their children in wage work, especially at migration sites. Also, children of non-migrant families were found working in hotels, shops, etc., to provide financial support to their families. The district administration should be more vigilant through the involvement of the line departments, including Child Development Project Officers, Anganwadis workers, sarpanchas, village workers to check the exploitation of child labour.

Due to the unavailability of accurate data, it was difficult to estimate how many families have migrated out of the district. We suggest that the district administration maintain proper records of unemployed persons, and necessary steps may be taken in consultation with different departments to address issues concerning migration. Both migrant and non-migrant families with financial constraints should be provided with better employment opportunities under MGNREGS or other development schemes.

Creating awareness through sensitization programs on educational facilities and future benefits among parents and students is vital in motivating themto continue education and prevent child labor. Rising educational expenses burden financially poor families, resulting in discontinuation of education at the secondary level than at the upper primary level. Implementing free provision of education at the secondary level and funds for supplementary materials can also help the children continue with their studies, move to higher levels, and reduce their families' financial burden finally. However, the children of migrant families face more instances of school dropout since the parents do not wish to leave their children in strange places because of safety concerns. Children of migrants can benefit more from these boarding facilities. At the school or village level, the concerned school authorities may be directed to take follow-up action to cover children, who drop out for family needs, under the umbrella of free and compulsory education.

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Article

Uncovering Educational Inequalities: Trends and Patterns

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Tanusree Dash
Ananya Ghosh Dastidar

Abstract

Despite the critical role of education in economic growth, the distributional aspect of education in India has not received sufficient attention. The main aim of the paper is to examine how educational inequality has changed after the enactment of the Right to Education (RTE) Act in India. The current study has used direct and indirect methods to measure inequality in educational attainment. The study uses the 64th, 71st and 75th rounds of NSSO survey data relating to schedule 25.2, on Household Social Consumption: Education, to examine the effect of the RTE Act on education inequality in India. The paper finds that based on average years of schooling, the top five States/UTs are Chandigarh, Delhi, Daman Diu, Puducherry and Goa. When the Education Gini is calculated between the 64th and 75th rounds, it has declined in all states/UTs except Nagaland.

Keywords: Education inequality, Education Gini, Right to Education

Tanusree Dash, Research Scholar, Department of Finance and Business Economics, University of Delhi South Campus, New Delhi. Email: dash.tanusree@gmail.com

Ananya Ghosh Dastidar, Professor, Department of Finance and Business Economics, University of Delhi South Campus, New Delhi. Email: agdastidar@south.du.ac.in

I. Introduction

Human capital combines knowledge, skills, and health that people acquire throughout their lives to achieve their full potential as productive members of society (World Bank, 2021). Investment in human capital has a significant positive effect on economic growth (Viswanath et al., 2009). Education improves human capital and growth (Lucas, 1988). Since education affects current and future incomes, inequalities in education are of grave concern to the economy. If an economy has a skewed distribution of education, human capital will be underutilised, resulting in substantialwelfare losses (Thomas et al., 2001).

Educational inequality is defined as 'systematic variations in several aspects of educational attainment structured by assigned traits of students such as gender, ethnicity, immigrant background and class (axes of inequality)' (Gross, Meyer & Hadjar, 2016: 12). Reduction in the extent of inequality in educational attainment is desirable and necessary to improve the quality and productivity of the workforce and ensure socioeconomic well-being (Ram,1990).

One of the primary goals of the Indian education systemis to make sure that all children have access to school education, irrespective of their socio-economic and demographic backgrounds. Landmark initiatives, such as the Sarva Shiksha Abhiyan (SSA) and the Right to Education Act, have enabled remarkable progress in achieving school enrolments. The SSA was initiated in November 2001 to guarantee the universalisation of elementary education and reduce gender and social gaps. Later, the Parliament of India enacted the RTE Act on the 4th of August 2009, providing free and compulsory education for children aged 6 to 14. With the implementation of the Act on 1st April 2010, education has now been declared a fundamental right for all children in India, making it one of the 135 countries that have done this so far. As a fundamental human right, the right to education aims to eliminate educational disparities and ensure that everyone has equal access to quality education. The legislative effort endeavours to bridge educational inequalities across various population subgroups by ensuring access to free and compulsory education.Further, the National Education Policy (NEP) 2020 recognises the need to promote literacy and has set a target of 100 per cent literacy by 2030. The primary objective of this policy is to ensure that all children have access to quality education.

A large body of literature analyses access to education by various groups in India regarding enrolments and literacy rates, but the distributional aspects of

education have not received ample attention. A reduction in educational inequality imparts excellentcredence to the inclusive policies undertaken by the government. In this context, a pertinent question is, has there been an improvement in the status of educational inequality after all the initiatives taken by the government to improve access to education for children? This paper explores precisely this issue.

This paper explores recent changes in educational inequalities across various States and Union Territories (UTs) of India. It is organised as follows: first, there is a review of existing literature on educational inequality both in international and Indian contexts (Section II), followed by an outline of data and methodology (Section III), discussion of results (Section IV) and finally, conclusion and policy prescriptions (Section V).

II. Literature Review

Indian education policies,shaped by equality and non-discrimination principles, aim to eliminate educational inequalities by ensuring that all students acquire quality education irrespective of their socio-economic and demographic backgrounds. Firstly, studies on education inequality across various countries are reviewed, followed by a discussion on the literature in the context of India.

Educational Inequality in International Context

Educational inequality has been studied across countries around the globe. Investing in education and improving the status of equality are critical factors in the economic development of a nation – this is shown by Lopez et al. (1998) using data from 12 Asian and Latin American countries (including India) from 1970 to 1994. However, inequality in education in most countries (including India) has come down over time and was negatively related to average years of schooling. This was found in an analysis of educational inequality based on a Gini index (for a population above 15 years of age) for 85 countries from 1960 to 1990 (Thomas et al., 2001). Castello and Domenech (2002) also used human capital Gini coefficients (for 108 countries from 1960 to 2000) and found reduced inequality in human capital distribution across most countries. According to this study, the variability of human capital inequality across countries was greater than that within each country.

Mesa (2007) also found a decrease in education Gini coefficients and a rise in average years of schooling between 1980 and 2000 in a study one ducation

inequality in 16 regions and 78 provinces of the Philippines. However, for Indonesia, it was found that while the education Gini coefficient decreased from 0.35 to 0.32 between 1999 and 2005 (Digdowiseiso, 2010), education inequality in rural areas remained higher than in urban areas. In the case of Latin American countries, a significant increase in overall levels of human capital was found between 1990 and 2000 (Cruces et al., 2011) based on empirical analysis using indicators like the education quintile gap and Gini coefficients. The study showed that the educational Gini had fallen for all the countries, whereas the education quintile gap increased or remained unchanged for most of the countries; overall, the increase in education in the 2000s seemed to have had an equalising impact on income. A cross-country study of 15 countries ofthe MENA (Middle East and North Africa) region finds a decrease in educational inequality between 1970 and 2010 in all countries across gender and age groups and that educational inequality is relatively lower in higher-income countries (Ibourk & Amaghouss, 2013). The study uses educational Gini coefficients and an empirical approach based on Kuznets curve analysis to measure the extent of education inequality in these countries. Notably, Gini coefficients and Lorenz curves are the commonly used methodologies in this body of literature.

Educational Inequality in India

For India, there has been an improvement in educational *attainment* between 1983 and 2004, as shown by Asadullah and Yalonetzky (2010), who used National Sample Survey Organisation (NSSO) data. However, the study finds persistent inter-regional variations, with Southern States having lower educational attainment inequality than the Northern States. Analyses also show an increase in the average years of education in rural and urban areas and a reduction of the rural-urban gap in educational attainment between 1993–1994 and 2011–2012 based on NSS data (Kundu & Pandey, 2020).

At the all-India level, evidence based on NSS data shows that between 2007 and 2018, there has been an improvement in average years of schooling and a fall in educational *inequality* (Garg et al., 2022). NSS data also shows significant variation in education inequality across 20 Indian States, although overall inequality is found to have declined between 1993 and 2009 (Agarwal, 2014). The study calculates the education Gini separately for the rural and urban sectors, decomposing overall inequality within and between sector components. It finds that intra-sector inequality has increased, but inter-sector inequality has declined

in these states. The education Gini also shows wide variation across States and an overall decline between 2001 and 2011 based on Census data (Shukla & Mishra, 2019). The study finds Kerala (0.332) has the lowest and Bihar (0.653) has the highest level of educational inequality.

The body of research on educational inequality in India is anything but voluminous, with a dearth of studies quantifying such inequality at the national and subnational levels using recent data. However, for evidence-based policymaking, such quantification is necessary in the first instance to demonstrate the sheer magnitude of the problem at hand. Thus, an in-depth study assessing the recent status of education inequality and any changes therein is the need of the hour – this would pave the way for State-specific policies aimed at reducing such inequities. Accordingly, this paper explores recent educational inequality changes across States and UTs of India.

III. Data and Methodology

This paper uses education Gini coefficients as the primary index to quantify the extent of education inequality in India following Thomas et al. (2000). The computation of the education Gini follows the principles used for calculating income Gini coefficients, i.e., anonymity principle, population principle, relative income principle and Dalton principle (Ray, 1998). It is calculated following the formula given below, using the concept of average years of schooling of the population, which measures the *stock* of educational attainment and is an essentialindicator of the level of human development (Psacharopoulos & Arriagada, 1986).

The primary objective of this study is to explore changes in educational inequality across States and UTs in India. Therefore, it employs data from the three recent NSS rounds (Survey on Social Consumption: Education)–the 64th Round (2007-08), the 71st Round (2014) and the 75th Round (2017-18). As such, this study covers the period 2007-08 to 2017-18. The NSSO has been conducting large-scale surveys on social consumption (education and health) since 1980, which classifies information on the educational attainment of an individual (general education) into 15 categories under the broad headings of Not literate, Literate without schooling, Literate without formal schooling and Literate with formal schooling.

This study categorises the educational attainment of the population into seven

categories (Aggarwal, 2014; Paranjape,2007; Kundu & Pandey, 2020) based on characteristics of India's education system, viz., illiterate, below primary, complete primary, middle, secondary, higher secondary, graduate and above. A discrete variable (y) is created, which assigns years of schooling for each of the seven categories so that yi takes exactly seven values:

y_1=0, y_2=2, y_3=5, y_4=8, y_5=10, y_6=12 and y_7=15.5.

An important point to note is that educational inequality is estimated in this study for the population aged 15 and above, corresponding to the working-age population or the labour force. This is done since 'educational attainment' is a term used to describe the highest level of education that an individual has *completed*. Educational attainment is defined as the percentage of the population (aged 15 or above) with a particular level of education. Therefore, the measure of human capital used in this study is the average years of education of the labour force, and educational inequality is measured by Gini coefficients derived from average years of education. Relevant estimates are all generated using sampling weights given in the NSS survey.

The education Gini coefficient is computed using the following formula:

$$EDUGINI = \frac{1}{\mu}\sum_{i=2}^{n}\sum_{j=1}^{i-1} p_i|y_i - y_j|p_j$$

where, EDUGINI = Education Gini coefficient;

μ = average years of schooling for the concerned population and is calculated as

$$\mu = \sum_{i=1}^{7} p_i y_i$$

y_i, y_j are the years of schooling at different education attainment levels;
p_i, p_j are the proportions of the population with certain levels of education;
n is the number of levels of education attainment

The state/ UTs are ranked based on the values of Average years of education(i) and EDUGINI and the change in the values of the EDUGINI, respectively. The education Lorenz curve, which is the graphical counterpart of EDUGINI, is also constructed for the analysis. Since the level of schooling is a discrete

variable, it has a lower limit (zero) and an upper limit (around 15-20 years). Consequently, the Education Lorenz curve is a kinked line, and the number of kinks depends on the number of educational attainment categories. Apart from this, the education Lorenz Curve is truncated along the horizontal axis because of the economy's illiterate (no schooling) population. The method of calculating the cumulative proportion of schooling (shown on the y-axis) and the cumulative proportion of population at each education level (shown on the x-axis) are described below:

The cumulative proportion of schooling at each education level is as follows.
Illiterate: S1 $=(p_1y_1)/ ì$
Below Primary: S2 $= (p_1y_1 + p_2y_2)/ì$,
Primary S3 $= (p_1y_1 + p_2y_2 + p_3 y_3)/ ì$
Middle $= (p_1y_1 + p_2y_2 + p_3 y_3 + p_4y_4)/ ì$
Secondary $= (p_1y_1 + p_2y_2 + p_3 y_3 + p_4y_4 + p_5y_5)/ ì$
Higher secondary $= (p_1y_1 + p_2y_2 + p_3 y_3 + p_4y_4 + p_5y_5+ p_6y_6)/ ì$
Graduation and above $= (p_1y_1 + p_2y_2 + p_3 y_3 + p_4y_4 + p_5y_5+ p_6y_6 +p_7y_7)/ ì = ì / ì = 100$ %

The cumulative proportion of population at each education level is calculated as follows:
Illiterate= p_1
Below Primary $= p_1 + p_2$
Primary $= p_1 + p_2 + p_3$
Middle $= p_1 + p_2 + p_3 + p_4$
Secondary $= p_1 + p_2 + p_3 + p_4 + p_5$
Higher Secondary= $p_1 + p_2 + p_3 + p_4 + p_5 + p_6$
Graduation and above $= p_1 + p_2 + p_3 + p_4 + p_5 + p_6 + p_7 = 100$ %

The population proportion (pi=Pi/P) at each education level is also compared for all three NSSO rounds to evaluate the progress in the educational attainment of the population in the economy. Finally, this paper also examines the gross enrolment ratios at three levels, i.e., elementary, secondary and higher secondary levels, between 2009-10 and 2017-18 (as the landmark Right to Education Actwas implemented in 2010) to assess the progress in the access of education across states and UTs as will be evident from the discussion below.

IV. Results and Discussion

In what follows, the first part analyses enrolment status, while the second examines the status of education inequality at the national and sub-national levels. The analysis at the subnational level is done separately for states and UTs to gain a clearer understanding of emerging trends.

IV. 1 Trends in Enrolment

The Gross Enrolment Ratio (GER)[1] is aconventionalmeasure of participation in and access to education. The change in GER across States/UTs at the elementary, secondary and higher secondary levels between 2009-10 and 2017-18 is analysed below (Tables 1a and 1b).

At the national level, there was a marginal decline in the GER at the elementary level (from 101.5 to 97.22). In contrast, it increased at the secondary level (62.9 to 76.47) and higher secondary level (36.1 to 48.13) between 2009-10 and 2017-18. Overall, the substantial increase in enrolment at secondary and higher secondary levels portends well for the Indian education scenario.

At the sub-national level, the GER displays significant variations across States (Table 1a). At the elementary level, gross enrolments fell over the period 2009-10 to 2017-18 in all states, except for the following eight: Andhra Pradesh, Assam, Goa, Haryana, Karnataka, Maharashtra, Nagaland and Punjab. Meghalaya (137.91) had the highest, while Jammu and Kashmir (76.82) had the lowest GER at the elementary level. At the secondary level, the GER increased across all states except Jammu & Kashmir, Uttar Pradeshand Manipur. Himachal Pradesh(105.1) hadthe highest, and Jammu and Kashmir (59.34) had the lowest GER in 2017-18. At the higher secondary level, the GER increased in all States except for Haryana and Andhra Pradesh. In 2017-18, Himachal Pradesh (85.97) had the highest and Bihar (20.55) had the lowest GER at the higher secondary level.

[1] The gross enrolment rate is defined as percentage of students enrolled in a specific level of education, regardless of their age, to the total population at this level of education corresponding to the official age group.

Table1a: Gross Enrolment Ratio (GER) of Indian States

		2009-10			2017-18		
Sl. No.	States	Elementary	Secondary	Higher Secondary	Elementary	Secondary	Higher Secondary
1	Andhra Pradesh	90.1	67.2	44	90.99	76.44	40.14
2	Arunachal Pradesh	133.7	55.8	33.1	104.35	72.63	47.6
3	Assam	83.5	49.4	13.1	99.92	70.51	31.33
4	Bihar	93.7	35.2	15.5	92.12	59.69	20.55
5	Chhattisgarh	108.6	51.5	29.3	100.07	86.1	49.19
6	Goa	98.4	71	54.5	100.9	95.81	74.55
7	Gujarat	107.5	60.3	35.6	96.38	75.27	41.47
8	Haryana	85.7	65.4	59.7	100.31	92.69	55.25
9	Himachal Pradesh	109.8	89.1	69.3	102.73	102.97	85.97
10	Jammu & Kashmir	104.4	64.6	41.9	76.82	59.34	45.65
11	Jharkhand	120.6	33.9	7.4	96.31	62.52	41.2
12	Karnataka	98.7	72	42.5	101.42	80.93	45.04
13	Kerala	98	97.6	65	97.34	99.15	77
14	Madhya Pradesh	123.8	63.7	39.5	95.01	79.71	41.83
15	Maharashtra	98.1	72.8	55.3	102.34	91.63	68.06
16	Manipur	152.7	84.8	33.1	105.89	69.31	54.37
17	Meghalaya	142.9	42.4	13.5	137.91	74.36	38.91
18	Mizoram	142.4	75.9	41.7	115.1	84.29	46.46
19	Nagaland	82.4	30.4	19.2	84.08	59.76	31.4
20	Odisha	105.1	55.6	22.8	96.56	77.06	35.08
21	Punjab	77.3	54.9	35.4	106.03	90.88	66.13
22	Rajasthan	104.6	57.9	35.2	99.23	76.77	54.28
23	Sikkim	128.8	50.7	33.2	100.04	96.27	61.05
24	Tamil Nadu	114.1	82.1	49.6	98.29	89.43	74.42
25	Telangana				101.71	81.54	51.4
26	Tripura	127.7	73.4	27.4	104.66	92.09	39.19
27	Uttar Pradesh	95.4	72.4	33.8	94.13	65.9	46.9
28	Uttarakhand	107.9	83.8	55.9	105.73	86.49	68.51
29	West Bengal	108.9	54.9	27.8	98.31	81.63	50.56
	INDIA	101.5	62.9	36.1	97.22	76.47	48.13

Source: Statistics of School Education 2009 10, U-DISE: Flash Statistics 2017-18

For the UTs (Table 1b), at the elementary level, the GER increased in Chandigarh, Daman & Diu and Delhi between 2010-11 and 2017-18; in 2017-18, Delhi (120.66) had the highest GER and Lakshadweep (70.64) the lowest. Delhi (105.1) had the highest GER at the secondary level, and Daman & Diu was the lowest. At the higher secondary level, Chandigarh (91.68) had the highest GER and Daman & Diu (34.99) the lowest.

Table1b: Gross Enrolment Ratio of Indian UTs

		2009-10			2017-18		
Sl. No.	UTs	Elementary	Secondary	Higher Secondary	Elementary	Secondary	Higher Secondary
1	A&N Islands	87.5	75.6	54.7	84.26	78.77	66.48
2	Chandigarh	76.6	63.3	68.6	97.32	95.43	91.68
3	D&N Haveli	106.6	59.7	31.9	93.11	93.7	44.75
4	Daman & Diu	82	61.9	36.3	90.04	77.66	34.99
5	Delhi	116.3	80.8	58.7	120.66	105.1	72.96
6	Lakshadweep	82.2	78.8	86.2	70.64	83.59	78.12
7	Puducherry	104.7	94	62.5	88.97	87.1	66.88

Source: Statistics of School Education 2009 10, U-DISE: Flash Statistics 2017-18

IV. 2 Trends in Educational Inequality

In what follows, the status of inequality in educational attainment at the national level is discussed first. After that, educational inequality across states and UTs will be explored.

IV. 2.1 Inequality in Educational Attainment at the National level

Evidence from three rounds of NSS data (Table 2) clearly shows the significant but slow progress made by the Indian educational system. The illiteracy rate decreased steadily from 34 per cent in 2008, but over a quarter of the population remained illiterate in 2018. The population shareswith education levels in the below primary, primary and middle-level categories fell between 2008 and 2018, while those in the secondary, higher secondary and graduate and above categories increased. Despite progress at the upper end of the distribution, only 10.6 per cent of the population had completed graduation (and above) by 2018.

Table 2: Share of Population across Various Levels of Education: All India

Levels of education	NSSO 64th Round	NSSO 71st Round	NSSO 75th Round
Illiterate	34.03	28.81	26.12
Below Primary	8.76	8.13	6.52
Primary	15.25	12.75	12.41
Middle	16.51	16.76	16.2
Secondary	11.92	14.61	16.24
Higher Secondary	7.37	9.92	11.9
Graduate and above	6.14	9.01	10.6

Source: Authors' calculations based on 64th 71st 75th NSS Rounds

India's progress concerning improvements in the average years of education and inequality in educational attainment between 2007-08 and 2017-18 is borne out by the figures in Table 3. An increase in average years of education (from 5.2 in 2007-08 to 6.74 in 2017-18) was accompanied by a reduction in educational inequality,with the Gini coefficient falling from 0.52 to 0.44 over the same period.

Table 3: Average Years of Schooling (μ) and Education Gini (EGINI)

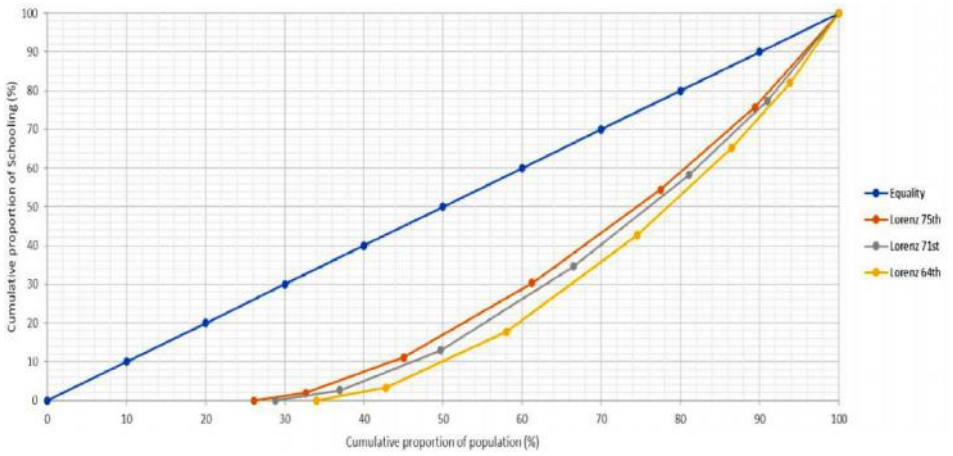
64th NSSO Round		71st NSSO Round		75th NSSO Round	
μ (64th)	EGINI	μ (71st)	EGINI	μ (75th)	EGINI
5.29	0.52	6.19	0.47	6.74	0.44

Source: Authors' calculations based on 64th 71st 75th NSS Rounds

The Lorenz Curve is a graphical representation of inequality in distribution across the population. Education Lorenz curves are constructed for India using the three rounds of NSSO data (64th, 71st, 75th) used for this analysis. In Figure 1, which shows the education Lorenz curve, the vertical axis plots the cumulative percentage of schooling years and the horizontal axis plots the cumulative percentage of population. The line of equality, at 45 degrees, denotes perfect educational equality. There is substantial educational inequality, as indicated by the Lorenz Curve based on the latest round of NSSO data; however,

on a positive note, the education Lorenz Curves have been shifting towards equality, indicating a gradual decline in educational inequality in India. In 2007-2008, 34 per cent of the population were illiterate, and this percentage fell to 28.8 per cent in 2014, which further fell to 26.12 per cent in 2017-18. Despite government initiatives, however, over a quarter of the population remained illiterate in 2017-18. At the upper end of the distribution, as the top 10 per cent of the population obtained nearly twenty-five per cent of the total cumulated years of schooling, the education Lorenz Curve became steeper. However, the most recent education Lorenz curve is still a considerable distance away from the line of educational equality.

Figure 1: Education Lorenz Curves of India



Source: Authors' construction based on 64th 71st 75th NSS Rounds

IV.2.2 Inequality in Educational Attainment across States and UTs

The status of educational inequality across States and UTs is presented in what follows, with findings on average years of education (Tables 4a and 4b) and inequality in educational attainment (Tables 5a and 5b) given separately for States and UTs.

The average number of years of schooling indicates the stock of human capital in the economy, and the data unveils much variation in the average number of schooling across the States (Table 4a). Based on this indicator, the average years of schooling in the top five States, Goa, Kerala, Manipur, Uttarakhand and Mizoram, is between 8 and 9 years; Bihar is at the bottom at 5.38 years. On average, a significant difference of around four years of schooling is observed

between Goa and Bihar. Among the States, Nagaland and Arunachal Pradesh experienced a fall in average years of schooling between the 71st and 75th NSS rounds; this is relatively more significant for the former.

Table 4a: Rank of Selected States based on Average Years of Schooling

State	μ (64th NSS Round)	μ (71st NSS Round)	μ (75th NSS Round)	Rank as per 75th NSS
Top 5 States				
Goa	7.11	8.46	9.44	1
Kerala	7.83	8.46	9.12	2
Manipur	6.84	8.77	8.94	3
Uttarakhand	6.12	7.89	8.75	4
Mizoram	7.14	7.80	8.42	5
Bottom 5 States				
Madhya Pradesh	4.69	5.55	5.93	25
Rajasthan	4.18	5.32	5.73	26
Jharkhand	4.23	5.31	5.56	27
Andhra Pradesh	4.59	5.27	5.49	28
Bihar	3.66	4.68	5.38	29

Source: Authors' calculations based on 64th 71st 75th NSS Rounds
Note: The results of the smaller states should be interpreted with caution as small sample sizes are a limitation of NSSO data for these states

Among the UTs (Table 4b), Chandigarh has performed the best, with average years of education at 10.6 years, while Dadra & Nagar Haveli has the lowest at 6.58 in 2017-18.

Table 4b: Rank of UTs based on Average Years of Schooling

UTs	μ (64th NSS Round)	μ (71st NSS Round)	μ (75th NSS Round)	Rank as per 75th NSS
Chandigarh	8.92	9.93	10.60	1
Delhi	8.07	9.63	9.59	2
Daman & Diu	8.82	8.52	9.45	3
Puducherry	6.96	8.50	9.44	4
Lakshadweep	6.56	7.61	8.71	5
A & N Islands	6.76	7.20	8.03	6
D & N Haveli	5.22	7.22	6.58	7

Source: Authors' calculations based on 64th 71st 75th NSS Rounds

Note: The results for the UTs should be interpreted with caution as small sample sizes are a limitation of NSSO data for the UTs

Inequalities in educational attainmentare measured using Gini coefficients, calculated based on the average years of schooling discussed above. The educational Gini coefficients (EDUGINI) also show wide variation across States and UTs. Educational inequality by this measure is lowest in Mizoram (EDUGINI = 0.22) and highest in Andhra Pradesh (EDUGINI = 0.54). Mizoram, Goa, Kerala, Manipur and Sikkim are the 5 States where educational inequality waslowest in 2017-18 (Table 5a). On the other hand, Madhya Pradesh, Jharkhand, Bihar, Rajasthan, and Andhra Pradesh are at the bottom with high levels of inequality, with values of their education Gini hovering around 0.5.

Table 5a: Educational Gini Coefficients of Selected Indian States

State	EDUGINI (64th NSS Round)	EDUGINI 71st NSS Round)	EDUGINI (75th NSS Round)	Rank as per 75th NSS Round
Top 5 States				
Mizoram	0.28	0.26	0.22	1
Goa	0.38	0.28	0.24	2
Kerala	0.29	0.28	0.26	3
Manipur	0.38	0.29	0.28	4
Sikkim	0.46	0.38	0.32	5
Bottom 5 States				
Madhya Pradesh	0.55	0.51	0.48	25
Jharkhand	0.60	0.52	0.49	26
Bihar	0.65	0.57	0.52	27
Rajasthan	0.61	0.54	0.52	28
Andhra Pradesh	0.59	0.55	0.54	29

Source: Authors' calculations based on 64th 71st 75th NSS Rounds

Among UTs (Table 5b), in 2017-18,Chandigarh is at the top with the lowest value of education Gini (EDUGINI=0.25) and Dadra & Nagar Haveli (EDUGINI=0.41) at the bottom, reflecting the same ranking as for the average years of education above.

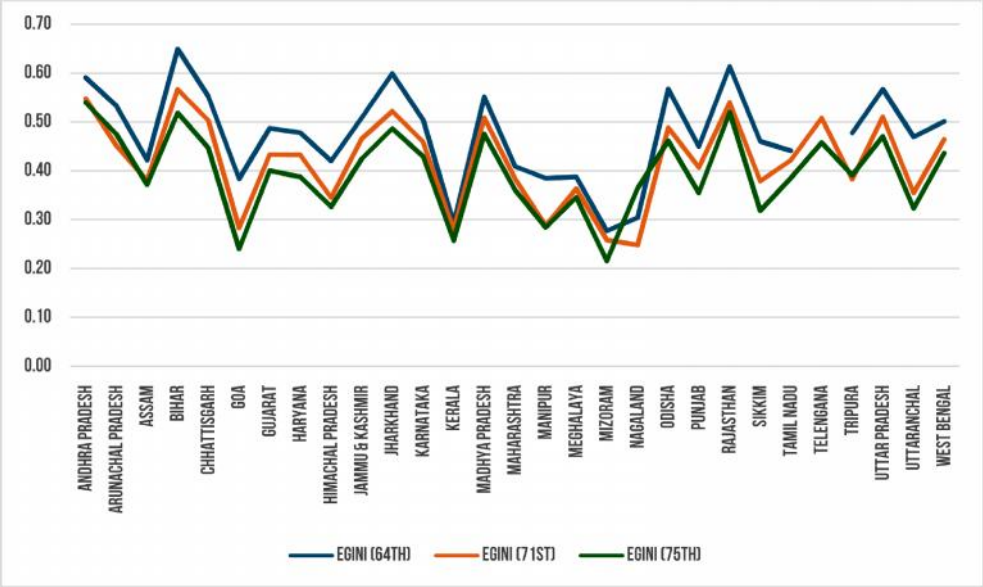
Table 5b: Educational Gini Coefficients of UTs

UTs	EDUGINI (64th)	EDUGINI (71st)	EDUGINI (75th)	Rank as per 75th NSSO
Chandigarh	0.36	0.26	0.25	1
Lakshadweep	0.33	0.31	0.26	2
Daman & Diu	0.29	0.32	0.27	3
Puducherry	0.38	0.35	0.28	4
Delhi	0.37	0.30	0.29	5
A & N Islands	0.37	0.37	0.34	6
D & N Haveli	0.48	0.43	0.41	7

Source: Authors' calculation based on 64th, 71st and 75th NSS Rounds

Figure 2 shows the lines depicting inequality in educational attainment for various Indian states using the data from the 64th,71st, and 75th NSS rounds. The lines depicting the values of the Gini coefficients of the States are seen to be shifting downwards, indicating a welcome trend of reduction in overall educational inequality over time.

Figure 2: Educational Gini Coefficients acrossIndian States:64th, 71st and 75th NSS Rounds



Source: Authors' construction based on 64th 71st 75th NSS Rounds

A comparison of educational Gini coefficients between the 64th and 75th rounds (Table 6a) shows that inequality has declined in all states except Nagaland, and Uttarakhand, Goa, Sikkim, Bihar, and Jharkhand experienced maximum reduction in inequality. Similarly, comparing the Gini coefficients based on the 71st and 75th NSS rounds shows a decline in inequality in all States other than Nagaland, Tripura, and Arunachal Pradesh. Kerala is among the States showing the slightest decline in the Gini coefficient (Table 6a), probably because inequality in educational attainment was already low to begin with, which limited the scope for further significant decline.

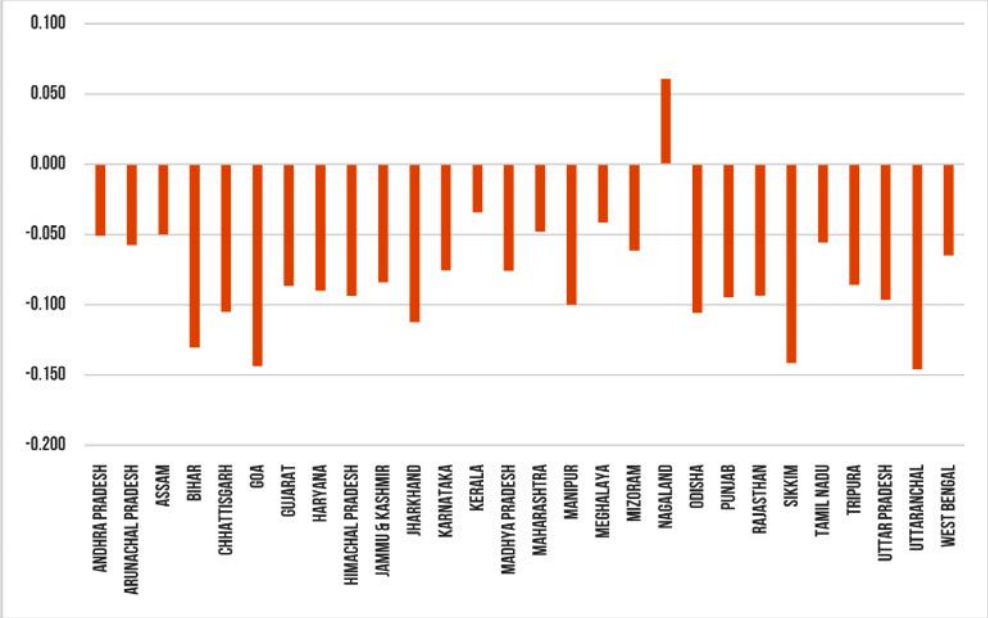
Table 6 a: Difference in Education Gini of States between 64th and 75th NSS Rounds

State	Difference in Education Gini between 64th & 75th Rounds	Rank
Top 5		
Uttarakhand	-0.146	1
Goa	-0.144	2
Sikkim	-0.141	3
Bihar	-0.131	4
Jharkhand	-0.112	5
Bottom 5		
Assam	-0.050	24
Maharashtra	-0.048	25
Meghalaya	-0.041	26
Kerala	-0.034	27
Nagaland	0.061	28

Source: Authors' calculation based on 64thand 75th NSS Rounds

Figure 3 depicts the difference in education inequality between 2007-08 and 2017-18 across Indian States. Clearly, except for Nagaland, all other States show a decrease in educational inequality over this period.

Figure 3: Difference in Education Gini of States between 64th and 75th NSS Rounds



Source- Authors' construction based on 64th and 75th NSS Rounds

A comparison of educational Gini coefficients based on the 64th and the 75th NSSO rounds for Indian UTs (Table 6b) shows Chandigarh is on the top of the list (with a - 0.110 fall in the value of the Gini coefficient) and Daman & Diu is at the bottom.

Table 6b: Difference in EDUGINI of UTs between 64th and 75th NSSO Rounds

UTs	Diff. in EDUGINI between (64^{th}&75^{th})	Rank
Chandigarh	-0.110	1
Puducherry	-0.105	2
Delhi	-0.081	3
D & N Haveli	-0.073	4
Lakshadweep	-0.071	5
A & N Islands	-0.037	6
Daman & Diu	-0.015	7

Source: Authors' calculations based on 64th & 75th NSS Rounds

V. Conclusion and Policy Implications

This paper attempts tocharacterise the State-level experience of progress in reducing educational inequality using three rounds of NSSO data spanning 2007-08 to 2017-18.

The major findings of the study can be summarised as follows:

Overall, in India, enrolment has improved at the secondary and higher secondary levels. However, a marginal fall in GER is observed at the elementary level in the reference period. Except for a few States/UTs, the GER has increased at secondary and higher secondary levels. At the secondary level, GER has increased across all states except Jammu & Kashmir, Uttar Pradesh and Manipur. The same trend is seen in GER of States at the higher secondary level. Other than Haryana and Andhra Pradesh, there is an increase in GER across all states at higher secondary level. Even though the country has made sizable progress in increasing access to education, there remains room for improvement, given the wide variation across states and UTs.

India has considerably improved in average years of education and the status of inequality in education attainment between 2007-08 and 2017-18. The average years increased from 5.2 to 6.74, whereas the educational Gini fell from 0.52 to 0.44 in the reference period. The Education Lorenz Curves of India are slowly moving upward towards the line of equality, indicating a decline in inequality in educational attainment. However, despite all the government initiatives, over a quarter share of the total population remained illiterate in 2017-18.

Average years of education have increased in the reference period for all the States and UTs. Again, the study finds much variation in average years of education across the States/UTs of India. With an average education of 9.44 years, Goa is at the top of the list of Indian States in 2017-18. Madhya Pradesh, Rajasthan, Jharkhand, Andhra Pradesh, and Bihar are at the bottom, with an average education of just around five years.

According to the 75th NSS round, Mizoram has the lowest inequality in education, followed by Goa and Kerala. Andhra Pradesh has the highest educational attainment inequality, with a high EDUGINI value of 0.54. When the difference in educational Ginis is calculated between the 64th and 75th rounds, inequality has declined in all States except Nagaland. Indeed, the EDUGINI is found to have declined in all the States between the 71st and 75th NSSO rounds, except for Nagaland, Tripura, and Arunachal Pradesh.

Poor states like Assam, Jharkhand, Bihar, Madhya Pradesh, and Uttar Pradesh have high levels of inequality in educational attainment. Kerala, Maharashtra, New Delhi, and Sikkim have high incomes and low levels of inequality in educational attainment. The top three states in terms of total literacy rate, i.e. Kerala, Mizoram and Goa, have the least inequality in educational attainment. Whereas the bottom five states- Andhra Pradesh, Jharkhand, Rajasthan, Arunachal Pradesh and Bihar in terms of total literacy rate are also found to be at the bottom of the list of states in terms of the value of EDUGINI.The same pattern is seen when female literacy is examined. The top three states in terms of female literacy are also among the top three states with the least education inequality.Lakshadweep, which has the highest total and female literacy, is found to have the lowest inequality among the UTs in India. Dadra and Nagar Haveli have the lowest total and female literacy and the highest educational attainment inequality.

Thus, the current study substantiates a reduction in inequality in educational attainment across most of the major States and UTs in the reference period supporting literature on the status of education inequality in India (Varughese & Bairagya, 2020; Garg et al., 2022). However, a great deal of variation in average years of education and inequality in educational attainment across States and UTs is also observed. This is an issue that requires urgent policy attention. For instance, the increase in educational inequality in Nagaland is a severe concern. State-specific policies should be adopted to improve the educational status of the States and UTs where inequality is relatively high.

This paper characterises the condition of educational inequality across various States. Further research is required to investigate the reasons for the existing trends and patterns presented here. In particular, innovative policies are needed to enhance the effectiveness of educational initiatives launched by the government to achieve more significant equity in educational outcomes. Formulating appropriate educational policies, especially targeting children from underprivileged backgrounds who lack primary access to education,will go a long way towards this goal.

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Article

Human Resource Information Systems and Organisational Performance: An Analysis

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Sonal Jain

Abstract

The Human Resource Information System (HRIS) is increasingly gaining prominence in today's evolving business landscape. This system plays a pivotal role within any organization's Human Resource Department. Serving as a versatile database, HRIS adeptly supports a range of HR activities such as Human Resource Planning, Personnel Cost Planning, Training & Development, and Performance Appraisal, among others. This study highlights the necessity, components, benefits, and functionality of HRIS.

Introduction

Information has been crucial in facilitating the transition of humanity from ancient times to the present. This current period is often referred to as the information age because to the significant role that information plays in many aspects of people's lives, particularly in the realm of economics. Advanced information systems within an organisation have been crucial for careful investment in order to provide precise results that may effectively fulfil the customers' requirements. Efforts are made to improve the efficiency of various components through better implementation and development of enterprise resource planning.

The human resources information systems (HRIS) design facilitates the quantification of the value of human resources (HR) in financial terms. It also

Sonal Jain, Assistant Professor, School of Social, Financial & Human Sciences, KIIT Deemed to be University, Bhubaneswar. Email: sonalhzbjain@gmail.com

aids in the strategic allocation of these resources within both the organization and the broader national context. This includes informing labour and employment policies as well as policies related to migration, compensation, promotions, and incentives, based on scientific analysis. Typically, in industrial and service projects HR assumes significance as it impacts the market value of these economic entities in banking and commercial activities. The manner in which HR practices contribute towards the economics of the tangible and intangible assets they possess, these can potentially influence the ongoing performance of these corporations. Consequently, prioritization of all forms of data concerning HR emerges an important task to ensure full leverage of their potential in areas where enhancement of performance is required.

The rising need to uphold strategic goals and the heightened emphasis on shareholder value have resulted in changes to both the work content and the expectations placed upon HR experts. One significant development was the modern use of information systems (IS) to assist in the human resource management (HRM) process. Furthermore, a meticulous examination revealed that greater use of HRIS resulted in enhanced professional competence, hence facilitating engagement in internal consulting tasks.

With the fast-changing technology in communications the human element in managing organisations has been a vital factor to focus on. Efforts are made to build additional capacities in the personnel not only to access and utilise new knowledge but also to apply those in the processes of cooperation and collaboration in fostering anticipated goals of the business. Empowerment through providing opportunities for learning requires the alert HRIS to determine core areas that need to be automated and streamlined for achieving higher productivity. The proficient utilization of these systems is instrumental in accomplishing the organization's goals and enhancing performance. While by effectively applying HRIS, the performance of the human resources function can be improved there have been concerns regarding the adaptability of these practices in an organisation depending upon its size, nature of business and technological readiness. The rather discrete information as generated through these systemsequip managers with essential insights into reorienting assignment of tasks through contraction or expansion as would be required to enhance the contribution of specific domains within the organisation. The growing emphasis on HRIS has been imperative in the face of intense competition in both the industrial and service sectors especially with fast globalisation. The necessity to identify competitive advantage of enterprises to increase the efficiency and

effectiveness of human resources, maximize the utilization of limited resources, and achieve higher output and satisfactory quality hinges upon how to control costs reduce wasteful expenditure.

Evolution of HRIS

The global recognition of the role and contribution of human resource planning and management in organizations to maintain a competitive edge could be seen during the 1960s and 1970s. However, it is during the last couple of decades that the technological interface of such practices has risen in importance. It has become essential for HRM to have access to accurate and up-to-date information on both present workers and future candidates in the job market. The advancement of information technology has led to the emergence of novel methods of both collecting and processing this data through HRIS which encompasses the integration of HRM and IT via systems and procedures. Enterprises often choose to deploy this information system after the successful integration of Enterprise Resource Planning (ERP) and Customer Relationship Management (CRM) systems, with the goal of enhancing the decision-making processes related to personnel. The use of HRIS software in firms, facilitated by information technology, has significantly enhanced efficiency in HRM, leading to overall improvement in operational efficiency.

Emphasizes that the contemporary HR function extends beyond administrative tasks such as recruiting, personnel organization, and rights regulation, and plays a significant role in shaping company culture. With the introduction of the new environment, employees now have the ability to suggest, oversee, and implement planning choices. As a result, the development of the HR department has to adjust to meet these new demands. HRIS not only provides daily and operational information, but also offers strategic information management for the firm. The data gathered inside the HRIS serves as a tool to assist management in making informed decisions. By implementing effective HRM, firms may generate calculations that will have far-reaching implications for the whole organization. The calculations include health care expenses per employee, turnover rates and expenses, the duration needed to fill the suitable post, return on invested capital in HR, and the enhancement of human capital value.

A Brief Review of Literature

There exists a large body of research evidence that acknowledges the significance of HRIS systems in facilitating strategic decision making (Abuhantash, 2023). The rise in the application of HRIS systems in enterprises has been observed across the globe, especially in the industrialising economies. Undoubtedly, the use of HRIS systems has contributed to the promotion of sustainable growth, especially in firms where HR management does not have a strategic position. However, studies also have pointed to the fact of lack of awareness about HRIS at the enterprise level suggesting poor need assessment exercises undertaken as a precursor to pursuing the system (Krishnan & Singh, 2007).

As discussed in Singh (2002), there has been significant changes HR practices globally as reflected through the shifting from the traditional payroll and personnel administration systems to what is called an integrated human resource informationsystem (IHRIS). These are implemented at the initial stage of requirement-selection, then further implementation and post-implementation stages. Even as these often raise set-up costs the long-term benefits to the organisation has been high. For managers, these modifications involve fresh training and familiarising with IT tools so vital for the HRIS. In fact, as Shrivastava& Shaw (2003) would observe, organisations those opted for the technological initiative towards enablingand value-adding the HR function are likely to realize the full potential of the new investment. Despite the recognition of benefits, not all organisations find it easy to adopt. For instance, as Jahan (2014) argues, smaller corporate houses had limitations in shifting to these new approaches to HRIS. High costs and general lack of management commitment have been pointed as drags.

At least by the mid-1990s the special attributes of HRIS not only included 'high-tech wizadry' but a certain drifting away from mere collection and storage of data toward a fully functional decision-analysis mechanism (Kovach et al., 2002),. The HRIS has features far beyond the conventional demographic and skill related information collection and recording used for recruitment, performance evaluation, training, promotion and separation. At a slightly more sophisticated level, in order to render the HRIS amenable to unexpected changes caused due to external environment and also innovations not originally factored into planning, strategic human resource management (SHRM) is being discussed. In that sense, HRIS plays a crucial role in upgrading organisational

performance on a constant basis. Schuler et al (2001) point to the role played by SHRM in identifying strategic needs and also planning talent development to address competitive pressures faced by the organisations.

Of the several research studies undertaken in the sphere of innovations in HRIS, Mayfield et al (2003) attempts to develop a prototype that draws upon the interactions between each other for achieving better organisational outcomes. The areas of mutuality and interaction cover facets as "organizational vision, strategic integration, personnel development, communication and integration, records and compliance, knowledge management, HR analysis, and forecasting and planning" (Ibid: 139). In terms of case studies, with a focus on the hospitality sector, two articles have been considered here. Considering a small sized restaurant chain, it was established that the success of HRIS was dependent upon financial strength, cultural aspects and computer skills (Nuasair & Parsa, 2017). In another case study in Ghana (Sadri & Chatterjee, 2021), it was shown that adoption of HRIS significantly streamlined identification of personnel training needs, better recruitment, successor ranking and evaluation of training inputs enhancing the performance of the hospitality organisations.

Scope and Objectives of the Study

Drawing upon a primary survey, an attempt has been made to examine the use of HRIS and its influence on the processes related to human resources in organisations. The purpose has been to comprehend the timeframe of HRIS deployment, enhancements seen in HR procedures, reasons for adopting HRIS, and future objectives for HRIS utilisation. A survey questionnaire created to gather data that is relevant to the study goals. Data collected from a total of 40 organisations could be utilised for our analysis.

Data Analysis

Table 1 presents a comprehensive analysis of the duration of HRIS deployment in the firm, using data obtained from 40 participants. Over half of the participants, accounting for 52.50 per cent, said that they had successfully integrated HRIS for a duration exceeding 5 years. This demonstrates a notable degree of maturity and expertise in effectively leveraging HRIS functions inside these firms. Organizations that need long implementation timeframes are often equipped with highly interconnected systems and have likely gone through

numerous rounds of system upgrades and enhancements. The "3-5 years" group, which represents 30.00 per cent of responses, is the second-largest in the table. Organizations in this category possess a modest degree of expertise in HRIS deployment. This time frame indicates a period of transition, during which businesses may have overcome the early difficulties of implementing an HRIS system and are now experiencing the advantages of a well-established system. The group labeled as "1-3 years", which accounts for 12.50 per cent of the participants, pertains to firms that are in the first phases of implementing HRIS. This group is likely still in the process of completely integrating the system into their HR operations, encountering early obstacles and learning curves associated with the adoption of new technologies. Lastly, the group labelled "Less than 1 year" represents 5.00 per cent of the responses and indicates businesses that are in the early stages of implementing HRIS. These companies are probably in the early stages of investigating and implementing HRIS, facing the first challenges related to change management and system integration. To summarize, the table presents a thorough analysis of the duration of HRIS deployment in the studied firms. The different proportions in each category provide valuable information on the range of experiences, with a considerable number of businesses having adopted HRIS for longer durations, suggesting a tendency towards continued use and possible enhancement of HRIS capabilities over time.

Table 1: Tenure of the HRIS Implementation within the Organisation

Particulars	F	%
Less than 1 year	02	05.00
1-3 years	05	12.50
3-5 years	12	30.00
More than 5 years	21	52.50
Total	40	100.00

Source: Primary data

Table 2 illustrates the opinions of the participants on the future dependence on HRIS for strategic HR management in their respective firms. 87.50 per cent of the participants indicated a favourable attitude, indicating that their organization would increasingly depend on HRIS for strategic HR management in the future. The substantial number indicates a strong belief among enterprises

in the ongoing and increasing importance of HRIS as a strategic instrument. It indicates an anticipation that HRIS will have a crucial impact on creating corporate strategy, workforce planning, and talent management in the future. Only 12.50 per cent of respondents had a negative viewpoint, asserting that their organization would not increase its dependence on HRIS for strategic HR management in the future. Although the number is small, it indicates that some firms may have concerns or anticipate obstacles in the future when it comes to using HRIS to impact strategic HR decisions. Significantly, all of the respondents none stated absolute assurance about the future dependence on HRIS for strategic HR management. The lack of doubt indicates a strong belief among the participants, highlighting a distinct viewpoint on the changing function of HRIS in their enterprises. To summarize, Table 4 offers useful insights into the anticipated future direction of HRIS adoption for strategic HR management. The majority of respondents had a very favorable reaction, indicating a widespread conviction in the long-lasting and increasing significance of HRIS in influencing the strategic framework of human resource management in enterprises.

Table 2: Future Scope of HRIS in an Organisation

Particulars	F	%
Yes	35	87.50
No	05	12.50
Unsure	00	00.00
Total	40	100.00

Source: Primary data

Table 3 shows perception of respondents about the several ways in which HRIS affected the overall functioning of their organizations. The five possible responses were: Strongly Disagree (SD), Disagree (D), Some Times (ST), Agree (A), and Strongly Agree (SA). When it comes to the effectiveness of hiring procedures, 62.50 per cent of those who took the survey strongly agreed that HRIS helped make things go smoothly, while 5 per centwere unsure (SD). This indicates that most people see HRIS as a tool that may improve recruiting procedures. In addition, when asked about payroll administration, 50.00 per cent of respondents said that HRIS made things more efficient, while just 7.50 per cent opined the opposite (SD). This points to a generally favorable attitude on the effect of HRIS on payroll administration. In the third part, which is

about development and training programs, there was reasonable consensus (60.00 per cent) that HRIS made these better. There is strong evidence that HRIS is seen as a useful tool for enhancing training and development programs, since just a small proportion of respondents (5.00 per cent) disagree. Next, we have performance evaluation methods, where the results show a mixed bag. Although 45.0% of the participants agreed (A), 10 per cent strongly opposed (SD) that HRIS simplifies performance evaluation. It seems that there are those who disagree, even though most people agree that it has a favourable effect. As a conclusion, 55.00 per cent of those who took the survey agreed (A), while just 2.50 per cent disagreed (SD) that workforce planning should be improved. This points to the general consensus that HRIS helps with better workforce planning. In conclusion, when asked about the impact of HRIS on workforce planning, training and development initiatives, payroll administration, and the efficiency of the hiring process, the majority of respondents had a favourable impression. Perceptions of the effect of HRIS may rely on context or be impacted by unique organizational circumstances, while perspectives on simplified performance assessment systems are more diverse.

Table 3: Opinion on Effect of HRIS in Organisational Performance

Particulars		SD	D	ST	A	SA
Increased efficiency in recruitment processes	F	02	06	04	25	03
	%	05.00	15.00	10.00	62.50	07.50
Improved payroll management	F	02	03	10	20	05
	%	05.00	07.50	25.00	50.00	12.50
Enhanced training and development programs	F	00	02	05	24	09
	%	00.00	05.00	12.50	60.00	22.50
Streamlined performance appraisal processes	F	04	04	09	18	05
	%	10.00	10.00	22.50	45.00	12.50
Better workforce planning	F	01	04	07	22	06
	%	02.50	10.00	17.50	55.00	15.00

Sources:Primary data

Table 4 shows descriptive data for recruiting, payroll administration, training and development, performance assessment, and workforce planning. For "Increased efficiency in recruitment processes," the mean score is 3.525, showing modest efficiency gain, while the standard deviation is 1.01242, indicating considerable variability. The distribution has a modest left skewness

(-1.086), with greater responses to higher efficiency. Kurtosis of 0.442 suggests the distribution is platykurtic, with lighter tails than a normal distribution. For "Improved payroll management," the mean score is 3.575 and the standard deviation is 0.98417. Skewness (-0.899) shows a little left tilt, less than recruitment efficiency. The kurtosis of 0.859 implies a higher tail distribution than a normal distribution. In contrast, "Enhanced training and development programmes" had the greatest mean score of 4.000 and the lowest standard deviation of 0.75107, showing more consistency in replies. The negative skewness (-0.764) and kurtosis of 1.078 indicate a somewhat skewed distribution with heavier tails, suggesting some respondents evaluated this characteristic highly. A mean score of 3.400 for "Streamlined performance appraisal processes" indicates modest progress, while a standard deviation of 1.15025 indicates more response variability. A minor left skewness (-0.753) and close to zero kurtosis imply a near-normal distribution. Finally, "Better workforce planning" had a mean score of 3.700 and a standard deviation of 0.93918, indicating moderate to high improvement. The negative skewness (-0.911) and kurtosis of 0.812 indicate a distribution with somewhat heavier tails than a normal distribution. The data shows that training and development programmes improved the most, followed by personnel planning, payroll management, recruiting, and performance evaluation. However, response variability and skewness and kurtosis values reveal data distribution properties.

Table 4: Descriptive Testing

Descriptive Statistics							
	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Increased efficiency in recruitment processes	40	3.5250	1.01242	-1.086	.374	.442	.733
Improved payroll management	40	3.5750	.98417	-.899	.374	.859	.733
Enhanced training and development programs	40	4.0000	.75107	-.764	.374	1.078	.733
Streamlined performance appraisal processes	40	3.4000	1.15025	-.753	.374	-.112	.733
Better workforce planning	40	3.7000	.93918	-.911	.374	.812	.733
Valid N (listwise)	40						

Organizations use HRIS for a variety of purposes, as shown in Table 5. The associated percentages provide a numerical representation of the opinion distribution. To begin, most respondents (47.50 per cent) were in Strong Agreement (SA) about the need to improve employees' self-service skills, with just 5.00 per cent expressing disagreement (SD). It may be inferred from this that the desire to provide workers more agency via self-service options is a driving factor in HRIS adoption. Secondly, another important cause for HRIS adoption is the enhancement of data accessibility and accuracy. There is a substantial agreement on the necessity of HRIS in guaranteeing accurate and accessible data, as 35.00 per cent strongly agreed and an additional 35.00 per cent agreed. Finally, the goal of improving HR operations was well-received; 45.00 per cent were in agreement and 25.00 per cent were in strong agreement. Because of this, it seems like HRIS is being seen as a way for companies to streamline and improve their HR processes. Another important reason for using an HRIS is to aid in strategic HR planning. The perceived importance of HRIS in aiding strategy planning inside businesses was highlighted by a large 40.00 per cent who agreed (A) and 37.50 per cent who strongly agreed (SA). Furtner, 37.50 per cent agreed (A) and 30.00 per cent of the respondents strongly agreed (SA) that completing compliance requirements was a major factor driving HRIS adoption. This shows that HRIS is being acknowledged as a technology that helps firms stay in compliance with all the rules and regulations that are important to them. Organizations implement HRIS for a variety of reasons. However, according to Table 5, the most common ones include improving employee self-service capabilities, streamlining HR processes, supporting strategic HR planning, meeting compliance requirements, and improving data accuracy and accessibility. These results show that there is a multi-faceted comprehension of the ways in which HRIS may help businesses meet their many strategic and operational demands.

Table 5: Various Reasons for Adopting HRIS by Organisations

Particulars		SD	D	ST	A	SA
Enhancing employee self-service capabilities	F	02	02	12	19	05
	%	05.00	05.00	30.00	47.50	12.50
Improving data accuracy and accessibility	F	05	04	14	14	03
	%	12.50	10.00	35.00	35.00	07.50
Streamlining HR processes	F	00	02	10	18	10
	%	00.00	05.00	25.00	45.00	25.00

Supporting strategic HR planning	F	00	05	15	16	04
	%	00.00	12.50	37.50	40.00	10.00
Meeting compliance requirements	F	04	05	15	12	04
	%	10.00	12.50	37.50	30.00	10.00

Source: Primary data

Major reasons for adopting HRIS by organisations have been provided in Table 6. "Enhancing employee self-service capabilities" has a mean score of 3.575 and a standard deviation of 0.95776, indicating modest progress. The negative skewness (-0.870) and 1.119 kurtosis indicate a distribution with heavier tails than a normal distribution. A mean score of 3.150 for "Improving data accuracy and accessibility" indicates modest progress, while a standard deviation of 1.12204 indicates significant variability. Negative skewness (-0.539) indicates a little left skew and near-normal distribution with a low kurtosis. "Streamlining HR processes" had the highest mean score of 3.900 and a smaller standard deviation of 0.84124, indicating higher consistency in replies. A minor left skewness (-0.348) and close to zero kurtosis indicate a near-normal distribution. "Supporting strategic HR planning" had a mean score of 3.475 and a standard deviation of 0.84694, indicating modest support. A kurtosis of -0.497 and a skewness of -0.051 indicate a highly symmetric distribution with a flatter distribution than a normal distribution. "Meeting compliance requirements" had a typical score of 3.175 and a standard deviation of 1.10680, suggesting high response variability. A minor left skewness (-0.364) and near to zero kurtosis indicate a distribution with tails like a normal distribution. The research shows that simplifying HR procedures was the most recognised improvement, followed by boosting employee self-service, enabling strategic HR planning, satisfying regulatory requirements, and improving data integrity and accessibility. However, to understand data distribution, response variability, skewness, and kurtosis must be considered.

Table 6: Reasons for Adopting HRIS

Descriptive Statistics							
	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Enhancing employee self-service capabilities	40	3.5750	.95776	-.870	.374	1.119	.733
Improving data accuracy and accessibility	40	3.1500	1.12204	-.539	.374	-.296	.733
Streamlining HR processes	40	3.9000	.84124	-.348	.374	-.423	.733
Supporting strategic HR planning	40	3.4750	.84694	-.051	.374	-.497	.733
Meeting compliance requirements	40	3.1750	1.10680	-.364	.374	-.276	.733
Valid N (listwise)	40						

Conclusion

As a result of the rising tide of managerial competition, an increasing number of companies are using HRIS systems, which combine human resources with information technology. In light of the above, it is reasonable to assume that HRIS may serve as a decision support system for the whole company, facilitating the accomplishment of strategic and operational goals. More and more companies are using HRIS, computerizing individual HR processes, and making use of the internet and intranet to make the most of their human resources in order to stay competitive in the market. When it comes to satisfying the demands of all parties involved, HRIS is like the backbone of the business. HRIS facilitates efficiency, effectiveness, and competitiveness in the business world. As a result, HRIS needs a clear strategic goal and should be built as an open system, where data may flow freely between different parts. As a result, the goals, values, and culture of a company are the engine that drives a successful and complete HRIS. The study has shed light on the strategic function and relevance of HRIS, particularly in relation to company competitiveness. Nevertheless, what constitutes a successful application of HRIS should be considered in future research.

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Research Note / Commentary

Rural Deprivation in Odisha: Patterns and Magnitude

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Sandhya Krishnan
Sanket Gharat
Prasanna Surathkal
Puja Guha
Neeraj Hatekar
Amalendu Jyotishi

Context

Odisha has been identified among the poor states in terms of poverty, literacy, health and several other indicators. In recent times, the claims that Odisha has become a middle-income state requires further scrutiny. Prima facie, increased mining activities and the resultant increase in revenue may have led to such claims. Odisha, being a state with a significant Scheduled Tribe population, large-scale mining and related activities confront the rural population dispossessing them from their resources and livelihoods. On the other hand, there are also counter claims that such high income provides enough revenue to the treasury that in turn is used for welfare of its population. In this contour of debate, it would be appropriate to understand how the rural amenities look

Sandhya Krishnan, Fellow, School of Development, Azim Premji University, Bengaluru. Email: sandhya.krishnan@apu.edu.in

Sanket Gharat, Research Associate, School of Development, Azim Premji University, Bengaluru. Email: sanket.gharat@apu.edu.in

Prasanna Surathkal, Research Associate, School of Development, Azim Premji University, Bengaluru. Email: prasanna.s@apu.edu.in

Puja Guha, Faculty, School of Development, Azim Premji University, Bengaluru. Email: puja.guha@apu.edu.in

Neeraj Hatekar, Faculty, School of Development, Azim Premji University, Bengaluru. Email: neeraj.hatekar@apu.edu.in

Amalendu Jyotishi, Faculty, School of Development, Azim Premji University, Bengaluru. Email: amalendu.jyotishi@apu.edu.in

like in Odisha. Afterall, availability of the amenities is a first step towards building further capabilities among the populace. While the basic provisioning of food, health, education is a first step towards enhancing the capabilities of the populace, especially those from vulnerable and marginalized social groups, the absence of these provisioning may compromise on the abilities of the same population leading to what Sen calls 'unfreedom' (Sen,1999).

Given the importance of infrastructure provisioning, an understanding of these basic deprivations across villages would help in the planning process. With a functional decentralized governance, the panchayat, district, as well as state planning can prioritize the amenities lacking in the villages for subsequent provisioning. Similarly, such data can be aggregated at legislative and parliamentary constituent levels to bring more accountability to the policymakers. Keeping these perspectives in mind, we delve into the characteristics and magnitude of rural amenities deprivation in Odisha.

Data

We use *Mission Antyodaya* data at village level which is available for India for the period 2019-20. Adopted in Union Budget 2017-18, *Mission Antyodaya* is a State-led initiative of creating a framework of *convergence and accountability* at the Gram Panchayat level, to monitor the use and management of resources allocated by 27 Ministries/ Department of the Government of India under various programmes for the development of rural areas (NIRDPR, 2018). Annual survey in Gram Panchayats across the country is an important aspect of *Mission Antyodaya* framework. *Mission Antyodaya* annually collates information across villages on several indicators. Of these, some indicators pertain to the amenities available at the village level and others include various schemes related beneficiaries. While the scheme related information is dynamic and can change over a short-term, the amenities are generally stable in the relatively short and medium terms. For example, *Mission Antyodaya* provides information if there is a primary school in the village or not and if not, is it available within 2, 5 or 10 kms distance from the village. Such information is fairly stable. Also, the planning and action required for provisioning is different from the quality of service delivery. For example, provisioning of a school building requires different set of planning vis-à-vis addressing the issues of enrolment or dropout in primary education. In this research note, we analyze the provisioning or availability of amenities, which is a first step before measuring the quality of utilization of the services.

Odisha has 53845 villages spread over 6798 *gram panchayats*[1]. Of this, *Mission Antyodaya* covers 49535 or about 92 per cent villages in the year 2019-20. In the absence of any other recent data, *Mission Antyodaya* therefore, is the single most important source for near census data providing information on the rural amenities.

Methodology

For developing a "multidimensional deprivation index" of the deficiency of rural amenities across the villages, we identified indicators of deprivations as described in Gharat et al (2024). For creating this index, we exclusively analysed the provisioning instead of outcomes. This is done for particularly two reasons. For one, we envisage the index to measure and mitigate poor provisioning at the village level. Secondly, the data on outcome variables unlike the provisioning variables, even though collected through a rigorous survey, is often likely to have a substantial degree of error and dynamicity. In all, we selected 22 indicators to measure the basic deprivations in the villages as provided in table 1. Once the indicators are identified, we classified them into three separate dimensions, namely, infrastructure, education, and healthcare. We then calculated the deprivation score for each of the three dimensions and average across each of the dimensions to get the composite deprivation score for each village.

Table 1: Indicators Used for Deprivation and Criteria Thereof

No.	Indicator	Deprivation of Criteria (1 if criteria fulfilled, 0 otherwise)	
1	Irrigation	All cultivated land is rain fed	Infrastructure
2	Roads	The village is not connected to an all-weather road	
3	Internal Roads	Village is not covered with internal pucca road	
4	Public Transport	No form of public transport (Bus/Van/Auto) is available	
5	Electricity	No electricity in the village	
6	Bank	Brick and mortar bank branch is farther than 10 kms	
7	ATM	Nearest ATM is farther than 10 kms	

[1] Referred https://panchayat.odisha.gov.in/about-us/demographic-profile last visited on January 27, 2024.

8	Telephone	No mobile or landline facility is available in the village	
9	Broadband	Broadband not available in the village	
10	Market	Nearest market (mandi/regular market/weekly market) is farther than 10 kms	
11	Ration Shop	Nearest Ration shop is farther than 10 kms	
12	Health Facilities	Primary Health Center/Sub-center/Community Health Center is farther than 10 kms	Health
13	Drainage	Lack of any drainage facilities in the village	
14	Anganwadi	Non-availability of Anganwadi center in the village	
15	Mother and Child Health	Nearest mother and child health facilities is farther than 10 kms	
16	Toilets	Village has home/homes without sanitary toilets	
17	Piped water	Village has no households with piped water	
18	Primary School	Nearest primary school is farther than 10 kms	Education
19	Middle school	Nearest Middle School is farther than 10 kms	
20	High School	Nearest High School is farther than 10 kms	
21	SSC School	Nearest SSC School is farther than 10 kms	
22	Vocational Training	Nearest vocational training center/ polytechnic/ ITI/RSETI/DDU_KY center is farther than 10 kms	

At this point, we can classify villages into those that are multidimensionally deprived and those that are not. We decided that villages that are deprived on any five or more indicators, based on Cumulative Density Function as describe in Gharat et al (2024) will be classified as 'multidimensionally deprived'. In other words, villages with a composite deprivation score of 0.23 or more are considered to be multidimensionally deprived. We further calculate the headcount ratio of multidimensional deprivation in a district/state as the ratio of the number of villages classified as multidimensionally deprived to the total number of villages in the district/state.

$$HR = \frac{\sum_{i=1}^{v} CD_i}{V}$$

where,

CD_i = 1 if village i is multidimensionally deprived and 0 otherwise

V is the total number of villages

While the headcount ratio gives us the breadth of deprivation, it does not tell us the depth, or intensity of deprivation in the deprived villages. Intensity of deprivation lets us know on an average on how many out of the 22 indicators the village is deprived of. We hence compute the intensity ratio as: $\text{Intensity}=\frac{\sum_{i=1}^{v1} c_i * CD_i}{V_1}$

where,

c_i is the composite deprivation score of village i

CD_i is as defined earlier

V_1 is the number of multidimensionally deprived villages

The product of the headcount and intensity ratios gives us the multidimensional deprivation index for a district or the state. Thus, the multidimensional deprivation index (RDI) is calculated as:

$$RDI = headcount\ ratio * Intensity\ ratio$$

One point to note here is that the deprivation indicators chosen here represent 'deep deprivations' as they denote some of the very basic provisioning. Hence 'multidimensionally deprived' villages are in fact *deeply* deprived. Based on this method, we calculate Odisha's multidimensional deprivation score by averaging deprivation scores across all the villages for which data is available in Odisha; identified how many villages in Odisha are deprived; and what is the intensity of deprivation in Odisha. The overall deprivation in Odisha is provided in Table 2.

Table 2: Intensity, Headcount and Multidimensional Rural Deprivation Index in Odisha

State	Intensity Ratio of Deprivation	Headcount Ratio of Rural Deprivation	RDI	Rank across 32 states and UTs
Odisha	0.40	0.665	0.266	24

Findings

Odisha's performance is poorer compared to all India average in almost all indicators as depicted in figure 1. Of these, irrigation, drainage, toilets, broadband facilities, and internal pucca roads in Odisha are doing poorly. In fact, market and transport facilities are the only two indicators on which Odisha fairs better than all India average. Availability of High School and PDS outlets are the two other indicators which are comparable with the national average.

Figure 1: Rural Amenities Deprivation in Odisha and All India

(as percentage of total number of villages, respectively)

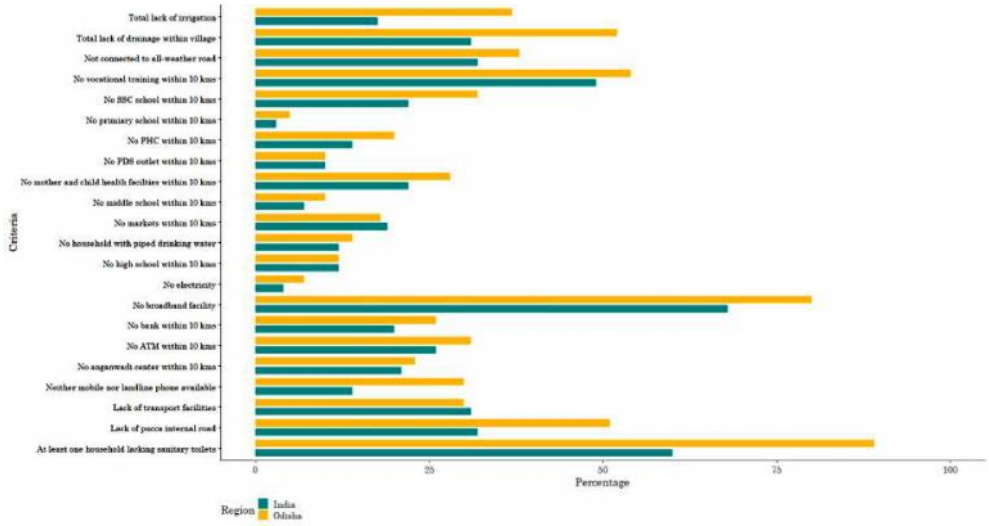


Figure 2 shows that performance of western Odisha in comparison to coastal Odisha is poorer in terms of headcount ratio of multidimensional deprivation. This is important because Odisha has a long standing debate, discourse, and movments comparing western Odisha with the coastal regions. Of these, the central and southern Odisha districts, predominantly tribal areas perform poorly. Malkangiri, Rayagada, Kandhamal, Sambalpur and Deogarh are the districts with the highest proportion of multidimensionally deprived villages.

Figure 2: Spatial Distribution of Headcount Ratio of Rural Deprivation across Districts of Odisha

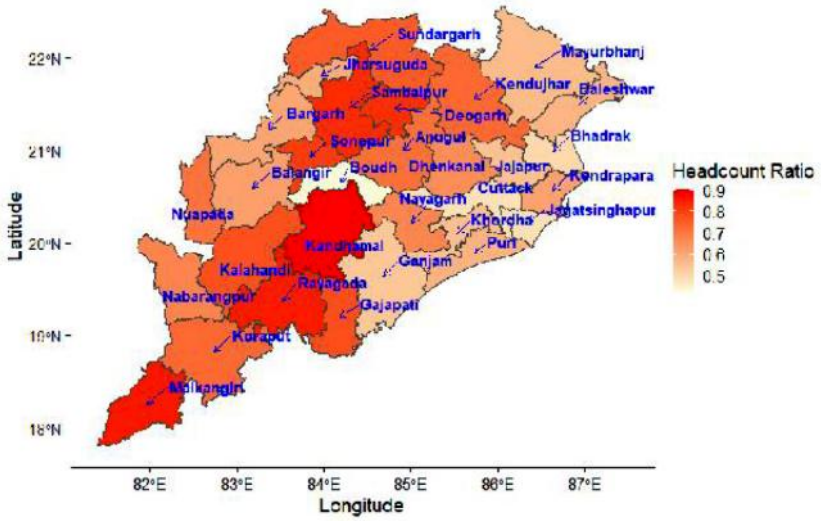


Figure 3 shows that in general, districts with a high ratio of deprived villages also have high levels of deprivation among those villages. Particularly, Malkangiri, Kandhamal and Rayagada have very high levels of deprivation among the villages that are deprived. Districts like Sambalpur and Deogarh, have relatively low intensity ratio, although they have a high headcount ratio of multidimensional deprivation. This means, in Sambalpur and Deogarh the deprivation is on lesser number of amenities as compared to the predominantly tribal districts of Malkangiri, Kandhamal, and Rayagada.

Figure 3: Spatial Distribution of Intensity of Rural Deprivation across the Districts of Odisha

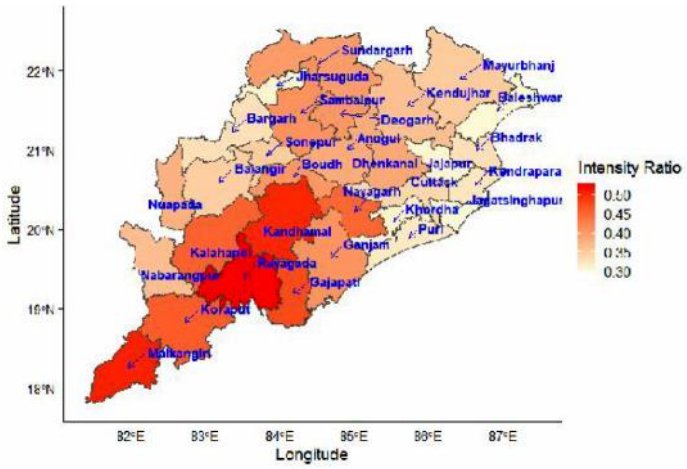
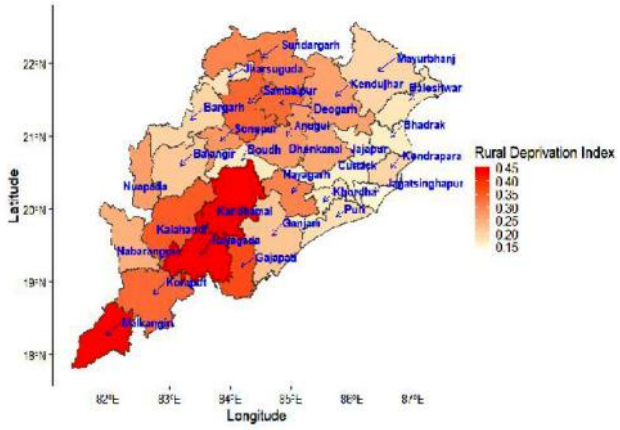


Figure 4 shows that overall, Malkangiri, Kandhamal, and Raygada are the most multidimensionally deprived districts in Odisha. Coastal districts such as Bhadrak, Jagatsinghpur, Kordha, Cuttack, etc. have the least deprivation.

Figure 4: Spatial Distribution of the Rural Deprivation Index across Districts of Odisha



Figures 5 to 8 show the deprivation levels in the different dimensions and the overall deprivation in Odisha at a granular village level. Deep red dots and clusters show high level of deprivation whereas the lighter clusters are relatively less deprived on rural amenities. The figures show that Odisha's performance on the health dimensions is worst followed by relatively better performance on infrastructure and further better in education. The data also show the unevenness in the provisioning of these rural amenities which are biased against the tribal dominant regions of Odisha. These deprived regions also closely juxtapose with the forested tracks predominantly inhabited by Scheduled Tribe population. Therefore, social, and ecological aspects are strongly intertwined with rural deprivation indicators.

Figure 5: Infrastructure Deprivation across Odisha

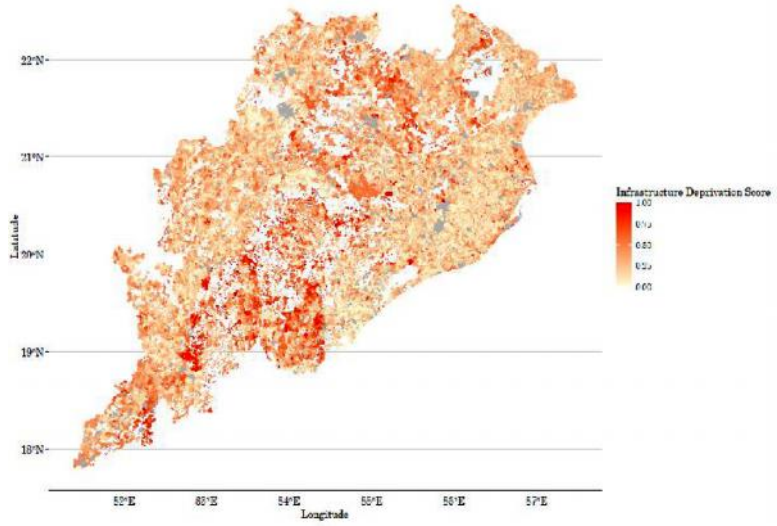


Figure 6: Health Deprivation score across Odisha

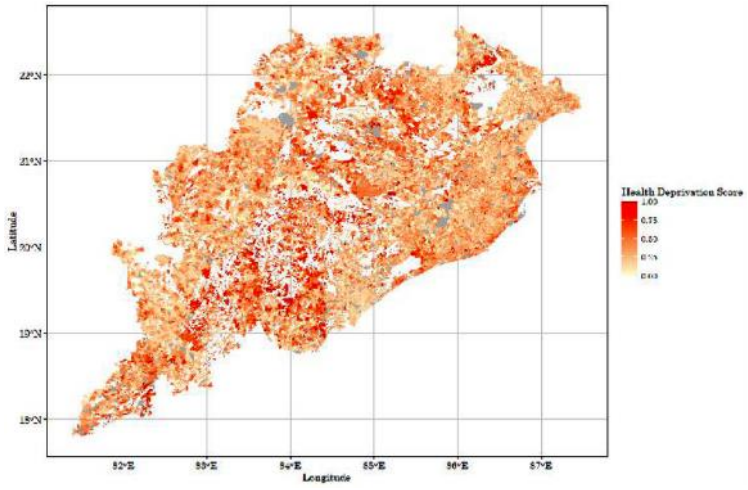


Figure 7: Education Deprivation across Odisha

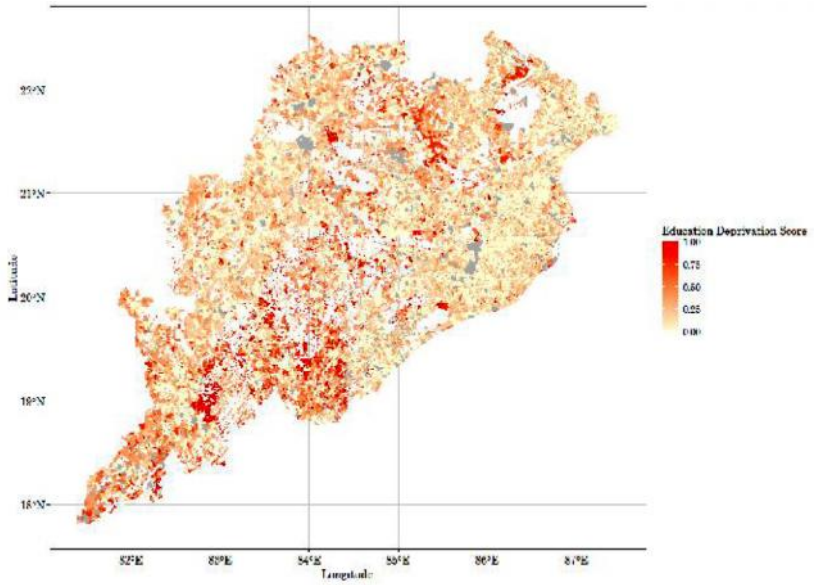
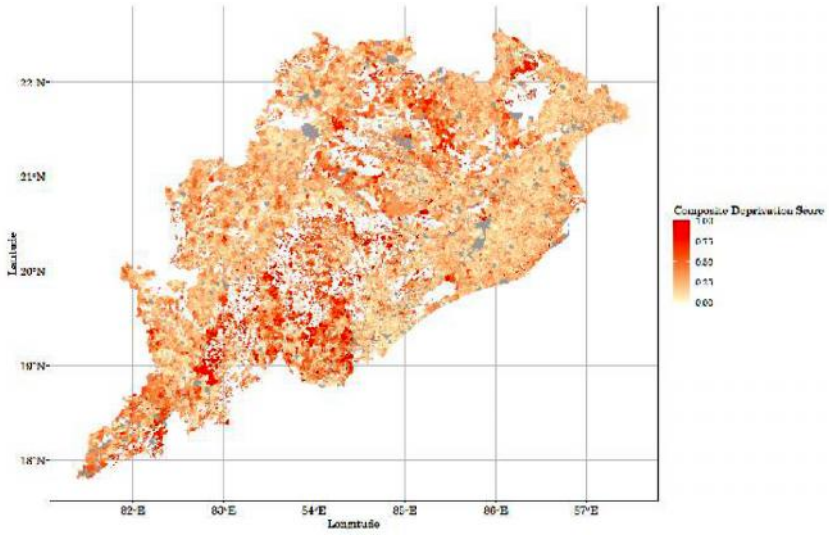


Figure 8: Composite Deprivation Score across Odisha



Conclusion

In the absence of more relevant alternative updated data, *Mission Antyodaya* data on rural amenities and schemes has become a singular data source to understand issues pertaining to rural development. Slowly, analysis and inferences based on this dataset is catching the attention among the academic community to draw meaningful conclusion. Though provisioning or availability of basic amenities are the first step

towards addressing deprivation and capability enhancement for overall human development, one must be mindful of drawing extreme conclusion from this. Access to amenities, quality of service delivery, and overall directionality of improvement are important indicators for which social, cultural, economic, and governance factors play a critical role. However, there is no denying that availability of basic provisioning is a first step towards the human development endeavor. Odisha, in this regard, continues to lag. A fallout of absence of these amenities, especially in the tribal dominated yet minerally rich region shows paradox of development. On the one side, the claim that Odisha has become a middle-income state does not juxtapose well with the deprivation. At the same time, the *Mission Antyodaya* data provides a better spatial understanding which, if used, can help in planning at Panchayat, District, and state level focusing on the specific deprivation indicators in specific villages in a time-bound manner. Future research can be carried out to understand how such rural deprivations explain numerous social, economic, and ecological patterns including outmigration, female labour force participation, health of and access to natural resources including forest, income, educational, and health outcomes.

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Declaration

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India's Agriculture and Food Exports: Opportunities and Challenges

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Dillip Kumar Muduli

India's agriculture sector has the potential to become largest exporter of agricultural products through more focus on private investments and exports. Agriculture Export Policy (AEP) 2018 aims to have an export oriented production in agriculture, which in turn is expected to result in doubling farmers' income by 2024. However, India needs to resolve some important issues related to food security, environment, trade openness, and tariff and non-tariff barriers with its trading partners. This book provides insights in to the global regime for agricultural trade and its impact on Indian farmers, free trade agreements (FTAs), non-tariff barriers as sanitary and phytosanitary measures, technical barriers to trade, agricultural export finance, agricultural export value chains, and management of food loss.

Chapter 1 by the editors highlights the contribution of India's agricultural sector to global exports and annual growth of agricultural exports between 2012-13 and 2012-22. It shows a fluctuating trend in annual growth. An export target of US$ 60 billion by 2022, laid out by the AEP 2018, seems impossible to achieve in the aftermath of the Covid-19 pandemic. Chapter 2 deals with the global regime for agricultural trade. The author has rightly pointed out that most developed countries provide high subsidies to agriculture sector, which tend to adversely affect developing countries and the majority of poor who draw their livelihood from agriculture in these countries. The chapter also presents tariff structure for agricultural goods for different countries during period 2006-20. The author has found that most developed countries have high tariff lines whereas developing countries have lower number of tariff lines. The chapter concludes that after more than a quarter of a century since the signing of the Agreement on Agriculture (AoA), agriculture sector in most developed countries has remained

Dillip Kumar Muduli, Lecturer in Economics, SVM Autonomous College, Jagatsinghpur, Odisha. Email: dillipmuduli6@gamil.com

subsidised making it extremely difficult for developing countries including India to access their markets.

Chapter 3 covers the trajectory of Indian agricultural exports with reference to competitiveness, diversification, and growth linkages. It identifies the structural breaks in the Indian agricultural exports from 1990-91 to 2019-20. Export competitiveness and export diversification of 17 agricultural commodities, namely the meat of bovine, crustaceans, molluscs, onions, tea, spices (pepper, fennel, coriander, cumin), rice, groundnuts, other oilseeds and oleaginous fruits, vegetable saps, extracts of fixed vegetable fats and oils, cane or beet sugar, cotton, cotton yarn, and cotton fabric have been studied. The revealed comparative advantage of agricultural commodities exhibited fennel, coriander, and cumin as the leading exported agricultural products which show a gradual increase in trade advantage. The study also attempted to examine the causal relationship between agricultural exports and economic growth. The author found that onion and fennel as well as coriander and cumin show bidirectional causality with economic growth. ELG hypothesis was supported in most of the agricultural exports including onion, pepper, rice, fennel, coriander, cumin and tea. Chapter 4 presents a short historical account and the current state of India's trade in agricultural commodities. The author found that India has been doing better in international trade in agriculture with a trade surplus since 1995.

Chapter 5 assesses the possible threats posed to Indian agriculture by the India–European Union (EU) free trade agreements. The authors point out that Indian agricultural products are likely to face both tariff escalation and non-tariff barriers in the event of a potential FTA with the EU. Further, the chapter identifies that agricultural products that may potentially face a threat from EU imports using a partial equilibrium trade model and found that top five agricultural products showing the highest possibility of import surge are beer made from malt, natural honey, wine of fresh grapes, frozen meat of swine and maize starch. Accordingly, India should exercise caution while negotiating with the EU over a significant number of products, even at the 8-digit level of product classification, as an increase in imports in the wake of tariff reductions could have an adverse impact on the jobs and livelihoods of a vulnerable section of the agricultural labour force.

Chapter 6 provides the status of the agro-food sector in India and the UK, highlighting key trends and developments. The authors also discuss the impact of high tariff rates and non-tariff barriers on export of agro-food products. The chapter provides some policy suggestions on three vital fronts: (i) tariff rationalisation, (ii) removal of non-tariff barriers which includes addressing sanitary and phyto sanitary requirement

barriers, improving testing and production methods, easing labelling and registration processes, and (iii) sharing of knowledge and cooperation to address the barriers and strengthen the bilateral trade between these two nations through an enhanced trade partnership.

Chapter 7 examines the trend of sanitary and phytosanitary barriers faced by India's food exports. This is a significant public policy issue as it affects the health of the importing country's consumers while also impacting the exporting country's producers. The authors found that between January 2020 and June 2021, 563 notifications were made on food and food contact material and 15 notifications were made for feed for products originating from India. Out of the total notifications made, around 86 per cent of the notifications made with respect to food and food contact material were marked under the serious category while 73 per cent of the notifications with respect to feeding were marked as serious. Further, reasons and impact of rejections were presented. The chapter also provided some policy recommendations which will help to reduce the chances of export rejection and improve export competitiveness. These recommendations are (i) implement and strengthen traceability using digital technologies, (ii) implement good agricultural practices and global best practices, (iii) review export control process, (iv) implement food safety regulations in the domestic market, and (v) establish world-class export infrastructure.

Chapter 8 talks about the need for a national level policy on food loss management with an objective of promoting agricultural exports. The author differentiates between food loss and food wastage and also highlights the magnitude of food loss for a few major crops such as cereals, pulses, oilseeds, fruits and vegetables, milk, meat, and poultry. The chapter concludes with three important policy suggestions: (i) addressing farm level operations to reduce the food loss, (ii) addressing storage level operations to reduce food loss, and (iii) promoting farmer producer organisations.

Chapter 9 discusses financing of India's agricultural exports. Traditionally, India's agricultural exports have been financed by commercial banks. However, there has been a declining trend in outstanding export credit to agriculture and allied sector by scheduled commercial banks. The author investigates the impact of export financing, agricultural production, and global import demand on agricultural exports from India through an Autoregressive Distributed Lag (ARDL) model. The results suggest that in the long run, a 1 per cent increase in agricultural export financing leads to a 0.5 per cent increase in the agricultural exports from India. Further, a 1 per cent increase in global demand leads to about 1.7 per cent increase in agricultural exports. In the short run, growth in agricultural production, growth global import demand, and growth export

financing have a positive impact on agricultural exports. The chapter outlines strategies required to improve financing for agricultural exports and emphasizes the significance of farmer cooperatives, factoring, commodity exchange-facilitated financing, and value chain financing as possible solutions in this context.

Chapter 10 presents an overview of agriculture and food exports through cluster development. The authors view that cluster-based approach is the need of the hour to boost agro-processing and exports. They elaborate the relevance of cluster-based approach for agricultural exports by considering five case studies such as Bombay Fruits and Vegetables Export, Jay Agro Exports, Om Gayatri Farmer Producer Company, Sahyadri Farmer Producer Company, and Shree Agro Krushi Farmer Producer Company. The authors find poor quality production, poor networking, lack of investments and limited market access are the root causes of poor agro-processed export.

Chapter 11, the last chapter, presents the way forward for India to attain the target of US$100 billion in agriculture and food exports. The authors outline agriculture export reforms, doubling farmers' income, agriculture marketing reforms, research and development for export promotion, agriculture advisory service, climate mitigation and adaptation for sustainable agricultural development and green trade, economic diplomacy and promotion of brand India, FTAs for the growth of agricultural exports, and fostering India's agricultural export competitiveness. The authors point out that agriculture export strategy should focus on the development of export-oriented value chains for dairy products, fisheries and marine products, processed cereals, fruits and vegetables, and organic foods considering only the production data on these variables. The chapter concludes that the agricultural export strategy should aim at the integration of value-added agri-produce with the global value chain, by adopting the best agricultural practices along with enhancing farmers' income.

The book is an illuminating read. However, the chapters do not follow a common structure; as some are written as research papers instead of chapters it makes for a jarring read. Some of the chapters are very well-articulated and well-informed, while some present data as narration without even citing the source. However, that aspect can be ignored considering that this book fills an important gap in the agricultural trade literature. Adopting policy measures and strategies that the authors suggest could significantly contribute to reaping the benefits of India's increased agricultural trade potential.

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