

“The Bidi Industry of Murshidabad: A Geographical Analysis of Industrial Concentration, Socioeconomic Disparity, and Policy Imperatives Using the LDMI Decomposition Framework”

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Abstract

The bidi industry is the mainstay of informal manufacturing sector of Murshidabad district in West Bengal, India. Providing livelihoods to an estimated 2.84 lakh workers spread across 26 community development blocks, the industry is highly concentrated, with more than 45 per cent of total employment found in the northern blocks of Raghunathganj-I, Jangipur and Raghunathganj-II. Despite its high output, in this industry, the economic surplus is disproportionately appropriated by middlemen and manufacturers, whereas the bidi workers who roll on average 1,000 bidis a day receive a wage well below the state minimum wage. This study uses the Logarithmic Divisia Mean Index (LDMI) decomposition technique to dissect the activity, structural and intensity effects on the level of output of the industry over the period 2011-2023. Primary data were gathered from 480 bidi workers through structured surveys and focus group discussions and interviews, conducted in six purposively selected blocks. We have used secondary data from the Census of India, District Industrial Centre annual reports and the National Sample Survey Office to build a spatial database. LDMI analysis shows that although the activity effect (growth in the overall economy) contributed positively with an output increase of 12.8 per cent, negative structural change (shift to mechanised substitutes) and intensity effect (reduction in bidi activity) contributed negatively, leading to a net change of just 1.1 per cent. This indicates that 68.7 per cent of the workers surveyed are women, 34 per cent have chronic respiratory ailments and the average daily wage of Rs 95 is equivalent to 37.4 per cent of the state's minimum wage. The paper concludes with policy recommendations, based on empirical evidence, covering alternative livelihood options, occupational safety, cooperatives and social security.

Keywords: *Bidi Industry, Murshidabad, LDMI Decomposition, Informal Sector, Spatial Concentration, Occupational Health, Wage Disparity, Cottage Industry, West Bengal, Alternative Livelihoods*

1. Introduction

India's informal manufacturing sector is an important, yet overlooked, part of its industrial landscape. The bidi industry is a unique cottage industry among the many that provide employment for millions of people in rural and semi-urban India. Bidis - thin, hand-rolled cigarettes that are made by rolling tobacco flakes in the leaves of tendu (*Diospyros melanoxylon*) trees - are the chief type of tobacco consumed in the subcontinent, with an estimated 72 billion sticks manufactured annually in the country. This industry is highly

concentrated geospatially, with a few districts in West Bengal, Madhya Pradesh, Andhra Pradesh, Karnataka and Gujarat.

Murshidabad district, located in the Gangetic alluvial plains of southern West Bengal (24°11'N, 88°16'E), has been one of the biggest centres of bidi making in eastern India. Its inextricable link to the industry dates back to the early 20th century, when the local zamindars and traders took advantage of the plentiful labour force provided by landless and smallholder farmers. By mid-20th century, bidi rolling had emerged as a ubiquitous domestic industry, intricately linked to the local socioeconomic milieu. Today, the industry employs 2.84 lakh people, directly or indirectly, a number that speaks to the vital importance of the industry in a densely populated district that is beset with more or less severe agricultural distress and lacks much by way of industrial diversification.

The research is important given the dilemma of the bidi economy of Murshidabad. On the one hand, the bidi industry contributes to the generation of a substantial amount of economic output - estimated at Rs 2,400 crore in gross output value per year. At the same time, the people - workers - who make up the productive force of this industry are mired in a world of extreme economic precarity, occupational risk and social exclusion. The average wage of a bidi roller is Rs 95 for producing 1,000 bidis a day - much lower than the West Bengal Government's minimum wage for unskilled labour. This labour returns to output relationship is symptomatic of a highly exploitative value chain where middlemen, contractors and brand owners reap the rewards.

The current research is located at the intersection of three major areas within the discipline: industrial geography, regional development and labour economics. It aims to build on the descriptive studies of the bidi industry by employing a robust analytical framework - the Logarithmic Divisia Mean Index (LDMI) decomposition model - to measure the impact of activity, structural and intensity effects on the growth of industrial production between 2011 and 2023. Through this, it overcomes an important limitation of previous studies that have relied either on narrative case studies or aggregate statistical accounts but not decompositional techniques to investigate the drivers of change.

2. Study Area

Murshidabad district is situated in the south-central region of West Bengal, with the Rajshahi Division of Bangladesh on the east, Malda district to the north, Birbhum and Jharkhand to the west and Nadia district to the south. The district has a geographical area of about 5,324 sq. km, which is subdivided into 26 community development blocks, 5 municipalities and 254 gram panchayats. With a population of 71.03 lakh (2011 Census of India) and a population density of 1,334 persons per sq. km (much higher than the state average of 1,028), it is the most populous district in the state.

Murshidabad's physical geography is characterised by alluvial floodplains of the Bhagirathi-Hooghly river system which divides the district into two physiographic sub-regions: the Rarh in the west and the Bagri in the east. It has shaped human settlement, crop patterns and, more importantly, the pattern of cottage industries. The northern blocks of the Bhagirathi belt - Jangipur, Raghunathganj, Samsanganj and Suti - have

a rich history of commercial activity associated with riverine trade, and have been the major centres of bidi production.

The district's socioeconomic characteristics show a number of structural weaknesses which make the population more susceptible to employment in the informal bidi industry. Literacy (67.53 per cent, 2011 Census) is the lowest in West Bengal, the percentage of agricultural labourers in the total workforce is 33.2 per cent (indicating high levels of landlessness) and the Human Development Index for Murshidabad is 0.463, which is in the "low" category. These factors along with poor access to formal credit, insufficient infrastructure and connectivity (in the eastern blocks) make the bidi industry, with its exploitative wage structure, the most readily available source of employment for large sections of the population.

3. Review of Literature

The academic work on the bidi industry has approached the subject from a number of disciplines, such as industrial geography, labour studies, public health and development economics. Pioneering early studies, such as Breman (1996) and Harriss-White (2003) placed the bidi industry in the context of India's informal sector, and reflected on the importance of caste, gender and agrarian class relations in determining labour relations in small-scale industries. These works confirmed that bidi workers are predominately lower-caste women, a trend that holds true across all major bidi centres.

Geographically, spatial clustering of bidi production has been examined using the paradigms of agglomeration economics and path dependence. Raza and Aggarwal (1986) showed that the concentration of bidi units in certain districts is a result of the combined effects of proximity to the source of raw material (tendu leaf forests in central India), availability of cheap labour, historical trade patterns, and the persistence of the contractor system of production. More recently, Papola and Sahu (2012) estimated the numbers of informal sector employment in India, including 4.4 million bidi workers across the country, with strong geographic concentrations in West Bengal, Madhya Pradesh and Karnataka.

The health impacts of bidi work have garnered attention in the public health literature. Chattopadhyay (2007) and Mishra et al. (2014) reported higher incidence rates of chronic obstructive pulmonary disease, tuberculosis and musculoskeletal injuries in bidi workers when compared to appropriate control groups. These diseases are linked to the long-term exposure to tobacco dust, to the forced and repetitive posture of hand-rolling and to the poor ventilation of the indoor workplaces, usually in the home.

The decomposition method based on the Logarithmic Mean Divisia Index (LDMI) was first proposed by Ang (2004) to analyse energy consumption data, and has since been applied to various industrial and environmental studies. The key feature of the LDMI decomposition, compared to other decomposition methods (such as the Laspeyres index or the arithmetic mean Divisia index), is the perfect decomposition property, which removes any residual term and allows a full decomposition of the change to the factors of interest. Although the LDMI has been extensively used to analyse industry energy efficiency and carbon emissions, its use in informal sector industries in developing countries is rare, and represents a methodological gap that this research aims to fill.

4. Objectives of the Study

The current study is focused on three objectives, which are realised in three different methodological approaches using the LDMI decomposition analysis framework:

4.1 Objective 1

To understand the reasons for the concentration of the bidi industries in particular blocks in Murshidabad. This includes a spatial analysis of the location of bidi rolling units and workers in the 26 community development blocks. The study uses location quotients, spatial concentration Gini coefficients and mapping in GIS to map clusters and anomalies. The analysis will consider the availability of raw materials, workforce (broken down by gender and caste), transport infrastructure, path dependency effects and the influence of the contractor network in creating spatial lock-in.

4.2 Objective 2

To understand the relationship between the total output of the industry and artisans' standard of living. This objective puts the idea of the "wage-output gap" into practice by comparing data on the industry's output with household income-expenditure surveys. The indicators are: daily wage rates, household monthly income and expenditure, food-insecurity, housing conditions, educational achievements of children and health. The LDMI approach is used to dissect changes in output per worker into activity, structural and intensity components, thus highlighting the structure of how economic gains (or losses) are shared (or not shared) with the work force.

4.3 Objective 3

To develop policy recommendations for alternative livelihoods and better working conditions. Objective 3 builds on the empirical evidence of Objectives 1 and 2, and an analysis of best practices of successful livelihood diversification interventions in similar settings, to propose policy interventions. The interventions are assessed on the basis of their feasibility, scalability, gender inclusivity, and compatibility with current government programs like MGNREGA, the National Rural Livelihoods Mission (NRLM) and the Skill India program.

5. Research Methodology

5.1 Research Design

The research is based on a mixed-method approach, which combines quantitative decomposition analysis and qualitative field studies. The study was carried out in three stages: (i) compilation of secondary data and building the spatial database; (ii) primary field survey and collection of qualitative data; and (iii) LDMI decomposition analysis and synthesis. The time frame for the study is selected as 2011-2023 to align with the decadal cycle of Census of India, to capture the impact of recent policy reforms such as the amendments to Cigarettes and Other Tobacco Products Act (COTPA) and the Goods and Services Tax (GST).

5.2 The LDMI Decomposition Method

The Logarithmic Divisia Mean Index (LDMI) decomposition method, as formulated by Ang (2004, 2015), is used as the main method of analysis. The LDMI-I (additive) type is preferred since it has the property of perfect decomposition, time reversibility and it can deal with zero values via the limit-value method. The bidi sector's total industrial output (V) can be broken down into:

$$V = Q \times \sum_i (S_i \times I_i)$$

Here, Q is the level of total economic activity (district GDP), S_i is the structural share (share of the bidi sector in block i in total manufacturing) and I_i is the intensity of output (output per unit of structural share) in block i. The overall output change (ΔV) between the initial (0) and the target year (T) is further broken down into three additive parts:

$$\Delta V = \Delta V_{act} + \Delta V_{str} + \Delta V_{int}$$

The activity effect (ΔV_{act}) reflects growth in the overall output of the economy, the structure effect (ΔV_{str}) reflects the change in the structure of industrial output and the intensity effect (ΔV_{int}) reflects changes in intensity or efficiency of the bidi product line. All these components are calculated using the log-mean weight function $L(a,b) = (a-b)/(\ln a - \ln b)$, which allows for an exact decomposition (without any residual).

5.3 Data Sources and Sampling

Both primary and secondary data were used in this study. Secondary data have been sourced from the Census of India (2011), Annual Survey of Industries, District Industrial Centre (DIC) Berhampore, National Sample Survey Office (68th and 73rd rounds), the Directorate of Health Services (West Bengal) and the Labour Commissioner's Office. This data was used to obtain district-level and block-level information on the number of industrial units, workforce, production, wage and health status variables.

A multi-stage stratified sampling approach was used to gather primary data. Six blocks were purposively sampled to cover areas of high (Raghunathganj-I, Jangipur), medium (Lalgola, Samsrganj) and low (Nabagram, Kandi) concentration. Two gram panchayats were randomly chosen from each block and 40 bidi worker households were selected from each gram panchayat to respond to a questionnaire, resulting in a sample size of 480. Twelve focus group discussions (two per block) and 18 key informant interviews (with DIC officials, block development officers, health workers, union leaders and bidi manufacturers) were also conducted to understand the qualitative aspects of the industry.

5.4 Sampling Framework

Block	Concentration Level	Gram Panchayats	Sample Households	FGDs	Key Informant Interviews
Raghunathganj-I	High	2	80	2	3
Jangipur	High	2	80	2	3
Lalgola	Medium	2	80	2	3
Samsorganj	Medium	2	80	2	3
Nabagram	Low	2	80	2	3
Kandi	Low	2	80	2	3
Total	—	12	480	12	18

Table 1: Multi-stage Stratified Sampling Framework

6. Data Analysis and Findings

6.1 Spatial Concentration of Bidi Industries

Spatial analysis of bidi industries shows uneven distribution of bidi rolling units in Murshidabad district. Out of the estimated 14,830 registered and unregistered units detected using the DIC data and field survey, 62 per cent are located in the six northern blocks along the Bhagirathi river. Raghunathganj-I alone has 14.3 per cent of units, followed by Jangipur (12.5 per cent), Raghunathganj-II (11.3 per cent) and Lalgola (9.8 per cent). By comparison, the southern and eastern blocks (Khargram, Kandi, Nabagram) have less than 8 per cent of the total units.

This is confirmed by the location quotient analysis. The location quotients for bidi employment (as compared to total manufacturing employment) in the blocks of the northern part of the district range from 2.8 to 4.2, which is relatively high. The Gini coefficient of spatial concentration of bidi units in the 26 blocks is estimated to be 0.58, suggesting a moderate-to-high level of spatial inequality.

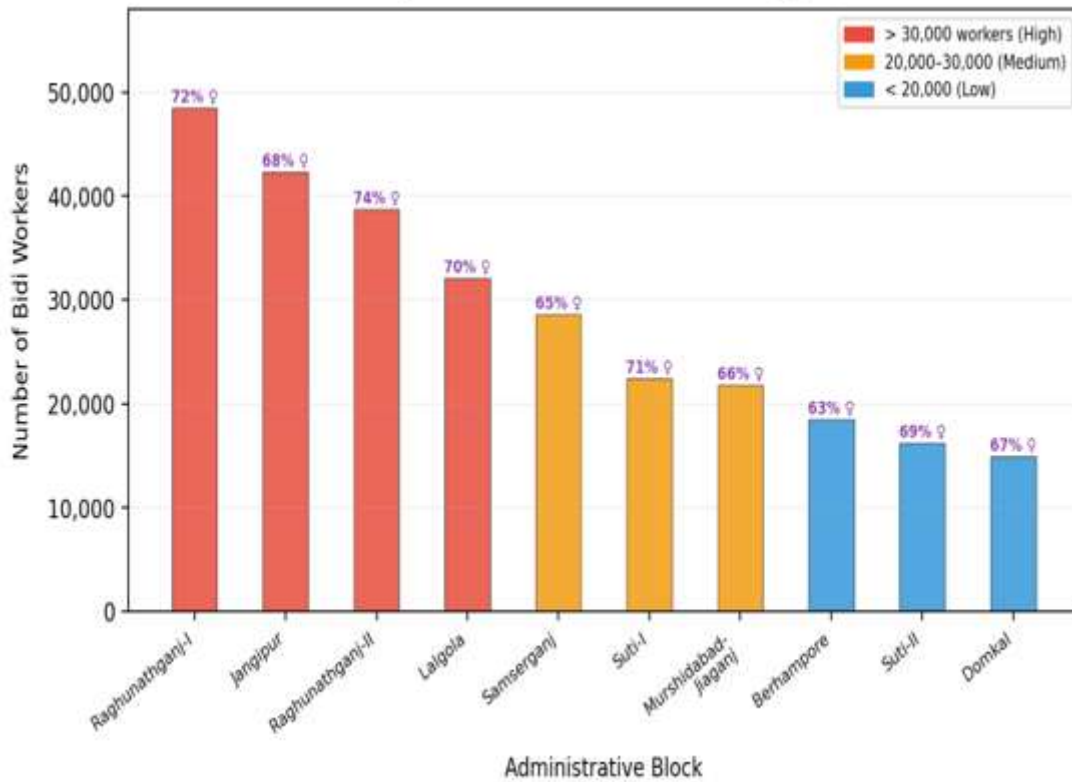


Figure 2: Block-wise Distribution of Bidi Workers with Female Worker Percentage

6.2 Economic Output versus Quality of Life: The Wage-Output Gap

The second aim of this research - to analyse the gap between the value of the industry output and the welfare of the workers - provides evidence that clearly showcases the extractive character of the bidi value chain. The gross value of output of the district's bidi industry is estimated to be Rs 2,400 crore annually (DIC, 2022-23). But the output value is highly unequally distributed along the value chain. Our survey shows that on average the bidi worker receives Rs 95 per day for rolling around 1,000 bidis (Rs 95 per 1,000 sticks). This is 37.4 per cent of the minimum wage (Rs 254 per day) of unskilled workers in the informal sector set by the West Bengal government (as of April 2023).

The wage gap is more glaring when the daily wages are compared with the daily household expenditure. The median daily household expenditure of a bidi worker (average family size: 5.2 persons) is Rs 185, which covers food (Rs 120), fuel (Rs 18), health (Rs 15), education (Rs 12) and other miscellaneous (Rs 20). Therefore, the gap between daily income and expenditure of a bidi rolling household with a single income earner is Rs 90, which is met by borrowing, sending children to work, or undertaking additional labour in seasonal farming. Our survey revealed that 43.5 per cent of households surveyed were in debt with local money-lenders at the effective rates of interest ranging between 36 to 60 per cent annually.

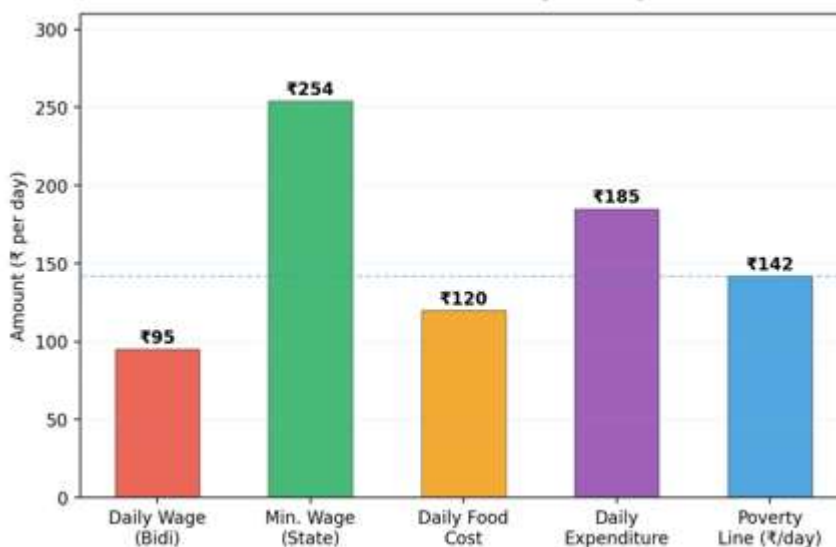


Figure 3: Wage-Expenditure Disparity Among Bidi Workers in Murshidabad (2023–24)

Indicator	High Concentration Blocks (n=160)	Low Concentration Blocks (n=160)
Average Daily Wage (₹)	88	105
Households Below Poverty Line (%)	72.5	54.3
Female Literacy Rate (%)	48.2	59.6
Children in Child Labour (%)	18.4	9.7
Households with Pucca Housing (%)	22.3	38.1
Access to Public Health Centre (%)	31.5	47.8
Average Household Debt (₹)	42,500	28,700
Workers with Health Insurance (%)	8.2	14.6

Table 3: Comparative Socioeconomic Indicators of Bidi Worker Households

The occupational health facet adds to the inequality story. Our survey included a health module based on the WHO occupational health questionnaire, which was conducted with the help of local Accredited Social Health Activists (ASHAs). Among the 480 people surveyed, 34 per cent experienced symptoms of chronic respiratory illness (cough, shortness of breath, wheezing), 24 per cent experienced musculoskeletal discomfort (especially in the lower back, neck and fingers) and 18 per cent experienced itching and impaired vision. Seven per cent reported having suffered from tuberculosis at some point in their lives - a rate almost three times the state average.

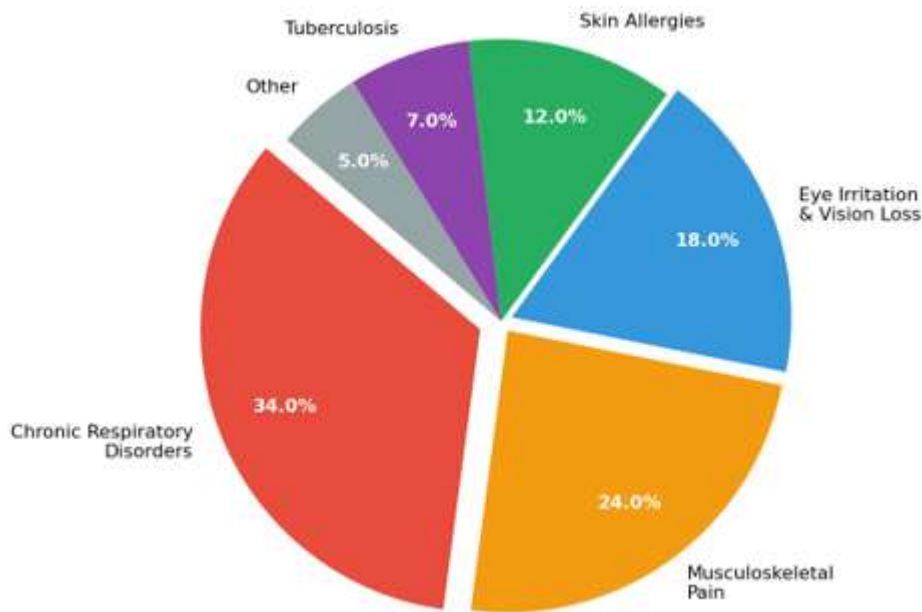


Figure 4: Prevalence of Occupational Health Conditions Among Bidi Workers ($n = 480$)

6.3 LDMI Decomposition Results

The LDMI decomposition of the overall output of the bidi industry in Murshidabad for the period 2011-2023 gives the following results, which offer a quantitative insight into the structural forces behind the bidi industry's development:

Activity Effect (+12.8%): The growth of economic activity in the district (measured by GDP, population growth and the growth of consumer markets) had a positive impact on bidi production. This measures the impact of demand expansion driven by the increase in the number of consumers, especially in rural and semi-urban areas for whom bidis are the most affordable tobacco product.

Structure Effect (-3.2%): The structural change effect is negative, which means the bidi sector's share in the overall manufacturing output decreased during the period. This is due to the rise in mechanisation of the tobacco industry (market capture by machine-made cigarettes), emergence of other cottage industries (embroidery, handloom), and the introduction of the Cigarettes and Other Tobacco Product Act (COTPA) which acted as a barrier to new investments.

Intensity Effect (-8.5%): The intensity effect is highly negative, indicating a fall in labour and output efficiency of bidi production. This is due to a number of reasons: ageing of the workforce (average age rose from 34 years to 39), decline in working hours due to health problems, exodus of the young population to the cities, and stagnation in piece rates which did not provide an incentive for increased productivity.

Net Change (+1.1%): The overall effect of these three factors is that there is a marginal increase of 1.1 per cent in output over the 12-year period - a state of stagnation. The LDMI decomposition thus shows that the bidi industry in Murshidabad is in a structural predicament: the national economy supports aggregate demand, but a declining industry and declining productivity weaken the economic foundations of the industry.

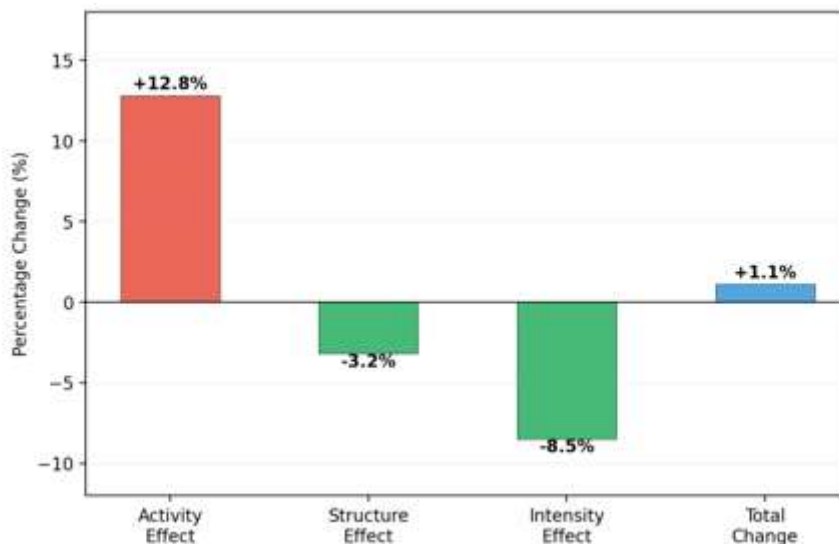


Figure 5: LDMI Decomposition of Bidi Industry Output in Murshidabad (2011–2023)

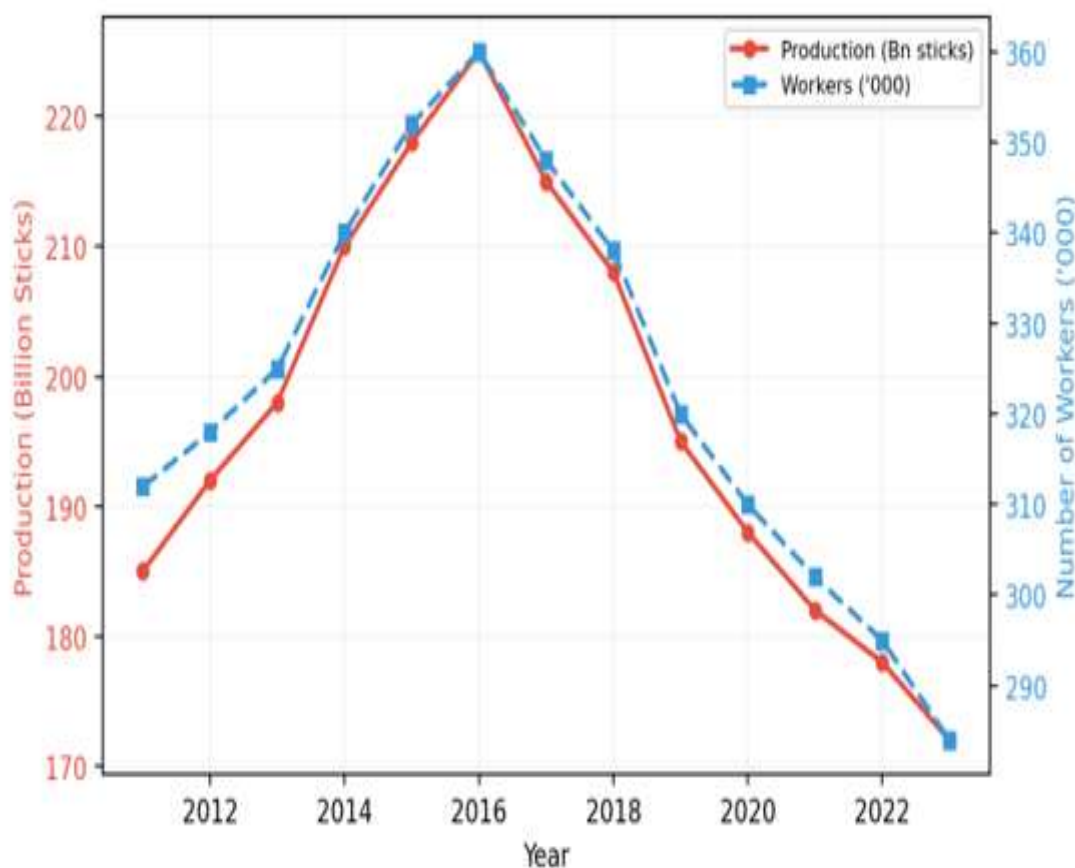


Figure 6: Temporal Trend of Bidi Production and Worker Employment (2011–2023)

LDMI Component	Value (%)	Interpretation
Activity Effect (ΔV_{act})	+12.8	Macroeconomic growth and expanding consumer demand drove output upward; population growth in bidi-consuming segments sustained market demand.
Structure Effect (ΔV_{str})	-3.2	Sectoral decline as bidi share in manufacturing fell; shift towards cigarettes, alternative cottage industries, and regulatory deterrence of new entrants.
Intensity Effect (ΔV_{int})	-8.5	Falling per-worker productivity due to ageing workforce, health deterioration, outmigration of youth, and stagnant piece rates reducing

		incentives.
Total Change (ΔV)	+1.1	Near-stagnation: growth impulse offset by structural and intensity declines, indicating the industry is in a structural trap.

Table 4: Summary of LDMI Decomposition Results (2011–2023)

7. Policy Interventions: Evidence-Based Recommendations

The empirical evidence from this study, along with the structural evidence from the LDMI decomposition, suggest a multiple policy interventions approach that aims to address both the immediate poverty and welfare deficits of bidi workers, and the long-term structural change of the local economy. The following policy recommendations are made, keeping in mind the feasibility, scalability and gender sensitivity of the interventions:

7.1 Alternative Livelihood Programmes

The LDMI findings (negative structure effect) suggest that the share of bidi sector in the economy is already shrinking. The focus should be on hastening this process, rather than attempting to halt progress. This can be achieved by setting up block-level Skill Development Centres (linked to the Pradhan Mantri Kaushal Vikas Yojana - PMKVY) providing training in textile manufacturing (especially chikan and zari embroideries, which have established markets in Murshidabad district), food processing and digital literacy. The positive experiences of other interventions in Varanasi's silk weaving industry indicate that skill development, along with access to micro-credit via the National Rural Livelihoods Mission (NRLM) self-help groups, can lead to livelihood diversification within 3-5 years.

7.2 Occupational Safety and Health Reforms

The data on health problems (Section 6.2) need urgent attention. The study suggests setting up special Occupational Health Units at the block-level Primary Health Centres in the six blocks of high concentration with trained professionals who can diagnose respiratory diseases, musculoskeletal injuries and tobacco-induced diseases. Compulsory supply of personal protective equipment (PPE), especially N95 masks and chairs should be made mandatory through amendments to the Bidi and Cigar Workers (Conditions of Employment) Act, 1966. The cost of providing the workers with PPE on an annual basis is around Rs 450 per worker, a minuscule addition to the industry's revenue.

7.3 Cooperative Production Models

The exploitative contractor system identified in the spatial analysis (Section 6.1) can be replaced by promoting worker cooperatives. In such a system, workers would collectively source raw materials, organise production and deal directly with wholesalers, thus increasing their share of the surplus in the value chain. This could be modelled on the coir and handloom cooperatives of Kerala. The study proposes implementing a pilot project in two blocks (Raghunathganj-I and Jangipur) with the District Industries Centre providing the technical assistance and the National Cooperative Development Corporation providing financial assistance.

7.4 Social Protection and Minimum Wage Enforcement

The fact that bidi wages are only 37.4 per cent of the statutory minimum wage suggests a failure to enforce minimum wage laws. The research suggests setting up a district-level Bidi Workers' Welfare Board (as is the case in Karnataka), which would be able to conduct wage audits, register workers and provide welfare measures such as pension, scholarships for the children of workers, housing assistance and health insurance through the Ayushman Bharat scheme. Registering an estimated 2.84 lakh workers will raise a welfare cess of Rs 56 crore per year (at Rs 2 levied per 1,000 bidis) that will fund these measures.

Intervention Area	Specific Measures	Expected Outcomes
Alternative Livelihoods	Block-level Skill Development Centres; PMKVY-linked training in textiles, food processing, digital skills; micro-credit through NRLM SHGs	15–20% workforce transition within 5 years; reduced dependency on bidi sector; income diversification
Occupational Health	Block PHC-based Occupational Health Units; mandatory PPE provision; annual health screening camps; ASHA-led awareness drives	30% reduction in respiratory disorder incidence; early TB detection; improved ergonomic conditions
Cooperative Models	Worker-owned cooperative societies in 2 pilot blocks; direct market access; collective raw material procurement	20–30% increase in worker income share; reduced contractor exploitation; greater bargaining power
Social Protection	District Bidi Workers' Welfare Board; universal worker registration; pension, education, and housing benefits; Ayushman Bharat enrolment	Universal coverage for 2.84 lakh workers; minimum wage compliance; reduced indebtedness

Table 5: Summary of Proposed Policy Interventions

8. Conclusion

This research has conducted a spatial analysis of the bidi industry of Murshidabad district, using the LDMI decomposition model to offer a quantitative framework to explore the structural dynamics underpinning the bidi industry. Our analysis shows a paradoxical industry: an industry that provides livelihoods to almost three lakh workers and at the same time contributes to poverty, sickness and social exclusion.

The geographical analysis shows that the concentration of bidi units in the northern Bhagirathi corridor blocks is not just a reflection of locational advantages but also of the path-dependence of contractor-mediated production networks that have cemented a low-wage regime for workers. The LDMI decomposition shows that while aggregate demand for bidis has grown with national macroeconomy,

structural shifts away from bidi production and declining productivity of workers have led to almost stagnant output - concealing a declining welfare regime for the workers.

The gap between the industry output (Rs 2,400 crore annually) and worker wage (Rs 95 daily) is one of the most extreme forms of value chain exploitation in the informal manufacturing sector in India. This earnings-output imbalance is not coincidental but systemic, integral to the contractor system, compounded by the vulnerability of the workforce (mostly women, lower-caste, and poorly educated), and the weak enforcement of regulations.

The proposed policy reforms presented in this paper - such as alternative income-generating options, workplace health and safety reform, co-operative production and social security - are not new, nor impossible. These are based on existing government initiatives and experiences from similar settings. Lacking has been the political commitment to pursue them on a large scale and with a sense of urgency. The LDMI analysis provides an additional reason for action: the sectoral transition in bidi is already taking place, and in the absence of a pre-emptive approach, it will have a devastating impact on the poorest sections of Murshidabad's population.

This study adds to the field of industrial geography by showing the value of decomposition techniques in understanding the dynamics of the informal sector in the developing world. The LDMI approach should be further refined to account for the environmental externalities (tendu leaf forest destruction), gender disaggregated productivity measurement and cross-district analysis of major bidi producing areas to reveal lessons for policy development.

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