RESEARCH PAPER

Diagnosing Health Of Industrial Areas Of Nagpur District

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***Abstract*—** In developing countries, government spending on industrial land significantly drives economic growth and employment generation. Nonetheless, the true productivity and spatial effectiveness of these investments are rarely evaluated beyond standard valuation measures. This research work aims to access the health of industrial zones in Nagpur district, Maharashtra, by presenting two new indices- the Simple Aggregate Price Index (SAPI) and Shop Rent Index (SRI)- that together reflect both the financial worth and productive efficiency of industrial land. The data were collected from the records of Maharashtra Industrial Development Corporation (MIDC) pertaining to 11 industrial estates in Nagpur district. The Simple Aggregate Price Index (SAPI) was calculated using Hingana as the reference point (index=100) to evaluate fluctuations in the land prices whereas the Shop Rent Index (SRI) measured the economic productivity per unit of developed land by combining land value with the quantity of units in the production. The calculated indicators like vacancy rate, allotment rate, and unit density were also determined to assess the spatial utilization. The examination shows notable differences among industrial estates. Although IT Parsodi and Hingana show significant land value and productivity, the regions such as Bhiwapur and Umred reveals extensive stretches of under-used lands and low economic activity, highlighting a productivity paradox regarding land acquisition and industrial efficiency. Spatial analysis of these variables reveals a geography of uneven industrial growth- ranging from thriving clusters to inactive outskirts. The result indicates that future industrial development in Nagpur district ought to concentrate on enhancing current estate instead of creating new ones. Enhancing infrastructure, encouraging equitable distribution, and utilizing empty sites can convert the existing industrial spread into areas of strategic efficiency. The suggested diagnostic framework provides policymakers a consistent and data informed methods for tracking, accessing, and enhancing the efficiency of industrial land use.

***Keywords*—** Simple Aggregate Price Index (SAPI), Shop Rent Index (SRI), Allotment Rate, Vacancy Rate, Unit Density, Industrial Land, Spatial Analysis.

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I. INTRODUCTION

Particularly in the developing nations like India, the strategic development of industrial land is essential for urbanization, job creation, and regional economic expansion[1]. To draw in investment and spur development, governments make significant investment in acquisition and development of industrial areas, with the goal of supplying serviced property for effective distribution and profitable industrial usage [2]. The productivity and worth of land, which are usually determined by market rates or aggregate price indexes, are frequently used to assess an area's success [3]. These measurements, however, may be static and frequently lacking because low costs may conceal areas of great efficiency or underutilization, while high land costs may be the result of speculation or location premiums. Economic efficiency of industrial land is not quantified by a standardized metrics in the literature [4]. Despite being used to residential and commercial properties, hedonic pricing methods and data envelope analysis have not been utilized to access the effectiveness of industrial land parcels as a unit of study[5].

The study makes the case that an industrial area's capacity to transform its land price into long-term economic activity is just as important to its success as its land prices. The shop rent index (SRI), a novel stand-in for land productivity, is introduced using data from the Nagpur District, which includes important metrics on the land acquisitions, development, and operating units.

A paradox of efficiency is revealed by the study: whereas smaller, more peripherally positioned places exhibit great efficiency, major industrial zones offer low returns on land

assets. Using a mixed-methods approach, the study combines sophisticated analytical approaches with descriptive indices.

By confirming the shop index method for evaluating industrial land performance and offering a diagnostic analysis of industrial regions for focused policy interventions, this study advances urban economics and regional land. It uses for a change in policy priorities from land development to maximizing the potential of resources for production.

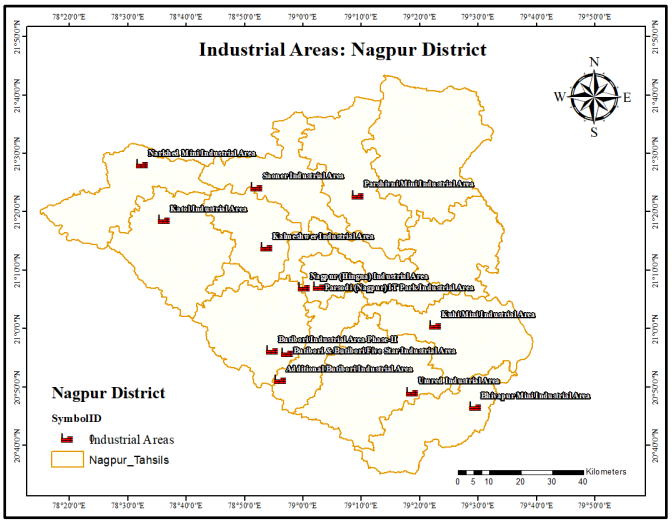
II. REVIEW OF LITERATURE:

- (Nichols et al., 2010): This research paper constructs land price indexes for 23 Metropolitan Statistical Areas (MSAs) across the United States using a national dataset of land sales. The study aims to provide transaction-based land price index addressing limitations of prior studies that inferred land price as residential from real estates and construction costs. The data is sourced from the CoStar Group, Inc.'s "COMPS" database, which includes over 1,70,000 land transactions in 23 MSA's from the mid-1990s to mid-2009. The author construct price indexes by estimating hedonic regressions, controlling for spatial price patterns, and polling and aggregating data across all 23MSAs. The key findings show a dramatic increase in both commercial and residential land prices several years prior to their peak in 2006-07, followed by a steep descent. The study confirms the "Plattage Effect", where the price of land parcel rises less than proportionally with its size. The study also highlights the importance of locational effects, with distance from the central business districts significantly affecting land values. The paper concludes that its results are essential findings and plans future research to analyses source of land price movements, including financing, leverage, supply and demand fundamentals, and broader economic conditions[6].
- (Huang & Hewings, 2021): The study explores the Impact of physical attribute of land, specifically its slope, on the land values. It aims to determine if land slope decreases land prices add its role in creating reliable constant quality land price indices and aggregate house price indices. The findings show that while Land slopes decrease the price for unit of land, it has a minor impact on quality adjusted land price indices in specific neighbourhoods of Auckland, New Zealand, where sloped terrain is common. The study concludes that land slope reduces per unit land prices but has minimal influence on quality adjusted land price indices[7].

III. STUDY AREA:

The industrially vital district of Maharashtra, Nagpur is the focused area of this research study. It is economic hub of country and exemplifies the growing urbanization and industrial policy that are prevalent in this region. As a Microcosm of larger economic trajectory of India, this analysis focuses on 11 carefully chosen Industrial areas (Figure 1) created by Maharashtra Industrial Development Corporation. Together these regions- from the upscale, technology focused IT-Parsodi to the expansive sweeping Butibori estate and the more compact, Peri-urban Industrial Areas like Bhiwapur and Parshivani- represents the entire range of industrial growth stages, geographic benefits and economic results. Investigating the key factors that determine industrial land productivity and efficiency is made easier by this gradient, which runs from highly efficient cores to underutilized peripheries. The choice of this research regions represents a special chance to gain transferable knowledge about the difficulties with the land economics, the efficiency of policies, and sustainable industrial planning- not only for Maharashtra, but for the growing economies elsewhere.

Figure 1: Industrial Areas- Nagpur District



Source: Author-Self

IV. RESEARCH OBJECTIVES:

- To compare land prices across industrial areas.
- To compare industrial land productivity.
- To find allotment and vacancy rates along with unit density of industrial plots.

V. DATA COLLECTION:

To fulfill the objectives of this research, a secondary source of quantitative data has been gathered as shown in the Table No.1 from a report titled Brief Industrial Profile of Nagpur District 2015-16 prepare by MSME (Micro, Small, and Medium Enterprises) development institute, Ministry of MSME, Government of India.

Table 1: Existing Status of Industrial Areas in the Nagpur District

S. No	Name of Ind. Area	Land Acquired (In hectare)	Land Developed (In hectare)	Prevailing Rate Per Sq. m. (In Rs.)	No of Plots	No of allotted Plots	No of Vacant Plots	No. of Units in Production
1	Hingana	745.83	745.83	1000/-	1253	1253	0	1266
2	Butibori	2420.62	2420.62	400/-	1264	1151	113	722
3	Kalmeshwar	110.5	110.5	350/-	165	164	0	112
4	IT Parsodi	11.66	11.66	2200/-	46	46	0	26
5	Umred	326.01	326.01	200/-	217	133	46	9
6	Katol	138.44	138.44	75/-	83	82	1	16
7	Saoner	73.95	73.95	75/-	72	71	0	27
8	Narkhed	20.59	20.59	30/-	16	16	0	2
9	Bhiwapur	12.68	12.68	30/-	46	8	38	1
10	Kuhi	15.55	15.55	30/-	37	37	0	2
11	Parshivani	12	12	30/-	40	38	1	12
Total District		3887.83	3887.83		3239	2999	199	2195

Source: [8]

VI. RESEARCH METHODOLOGY:

For the research purpose following research techniques have been demarcated:

- Simple Aggregate Price Index (SAPI): The index was used to compare land prices across industrial areas, with Hingana as the base (Index = 100) due to its well-developed status and high land value[9].

$$\text{Simple Aggregate Price Index (SAPI)} = \frac{\text{Price Per Square Metre In The Area}}{\text{Price Per Square Metre In Base Area}} \times 100$$

- Shop Rent Index (SRI): A proxy for land productivity, measures economic output and efficiency per unit of developed land by combining land value and economic activity.

$$\text{Shop Rent Index (SRI)} = \frac{\text{No.of Units in Production} \times \text{Prevailing Rate Per Sq.m.(In Rs.)}}{\text{Land Developed (Sq.m.)}}$$

- Derived variables:

1) $\text{Vacancy rate} = \frac{\text{No of Vacant Plots}}{\text{Total No of Plots}} \times 100$

2) $\text{Allotment rate} = \frac{\text{No of Allotted Plots}}{\text{Total No of Plots}} \times 100$

3) $\text{Unit Density} = \frac{\text{No.of Units in Production}}{\text{Land Developed (Sq.m.)}} \times 100$

VII. RESULTS:

The result gathered after applying research techniques with the help of Microsoft Excel on the data displayed in table 1 is as shown in the table no 2 below:

Table 1: Variables and Construction of Indices

S. No	Name of Ind. Area	Simple Aggregate Price Index	Shop Rent Index (SRI)	Allotment Rate	Vacancy Rate	Unit Density
1	Hingana	100	0.1697	100.0000	0.0000	1.6974
2	Butibori	40	0.0119	91.0601	8.9399	0.2983
3	Kalmeshwar	35	0.0355	99.3939	0.6061	1.0136
4	IT Parsodi	220	0.4906	100.0000	0.0000	2.2298
5	Umred	20	0.0006	61.2903	38.7097	0.0276
6	Katol	7.5	0.0009	98.7952	1.2048	0.1156
7	Saoner	7.5	0.0027	98.6111	1.3889	0.3651
8	Narkhed	3	0.0003	100.0000	0.0000	0.0971
9	Bhiwapur	3	0.0002	17.3913	82.6087	0.0789
10	Kuhi	3	0.0004	100.0000	0.0000	0.1286
11	Parshivani	3	0.0030	95.0000	5.0000	1.0000
Total District		**7.5**	**0.0042**	**92.5903**	**7.40969**	**0.5646**

Source: Author-Self

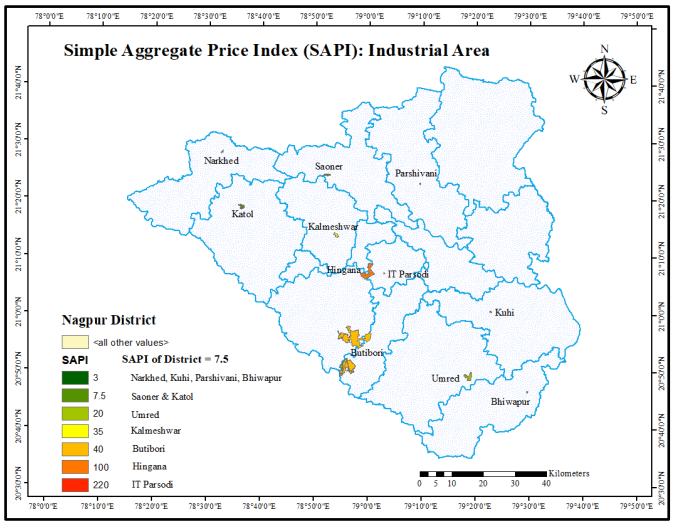
- To compare the land prices across industrial areas the Simple Aggregate Price Index (SAPI) has been calculated for each industrial areas by considering Hingana as a base and resulted values are ranging from 3 (lowest) to 220 (highest) showing variations in the development status.
- To compare the productivity of industrial areas the Shop Rent Index (SRI) has been computed by considering the Units under Production and Land Developed along with their Prevailing Rates. The quantified result varies from 0.4906 (highest) to 0.0002 (lowest) disclosing disparities in the economic productivity.
- The ratio of number of Allotted Plots to total number of Plots has been calculated to find allotment rate and the ratio of Number of Vacant Plots to total number of Plots has been calculated to find vacancy rates.

- The Number of units in Production and Land Developed in the industrial areas has been considered to compute the unit density of industrial plots.

VIII. ANALYSIS:

- Simple Aggregate Price Index (SAPI): With a core periphery concept, where value is concentrated in particular nuclei and rapidly evaporates with distance, the SAPI demonstrates a distinct economic hierarchy throughout the industrial landscape in Figure No 2. Since Hingana has a high rent (₹1000/-), it is used as the base area and serves as the standard for rent levels. With a land value index of 220, IT Parsodi is the epicentre, demonstrating its standing as a high-end, specialized hub. It has a rent index that is 120% higher than Hingana, although Butibori and Kalmeshwar have mid-range rentals that are 60 to 65% inexpensive. The cost of rent is 92.5% cheaper in Katol and Saoner than in Hingana. The other four industrial areas including Narkhed, Bhiwapur, Kuhi, Parshivani are the cheapest with rents 97% lower than the base. Hingana and Kalmeshwar constitute a secondary group of premium pricing zones, but Butibori is mid-value, indicating its size has not yielded premium rates. The large low-value belt, including regions such as Umred, Saoner, Narkhed, Bhiwapur, Kuhi, Parshivani is the frontier of industrial advanced, valuing land for potential rather than present economic output.

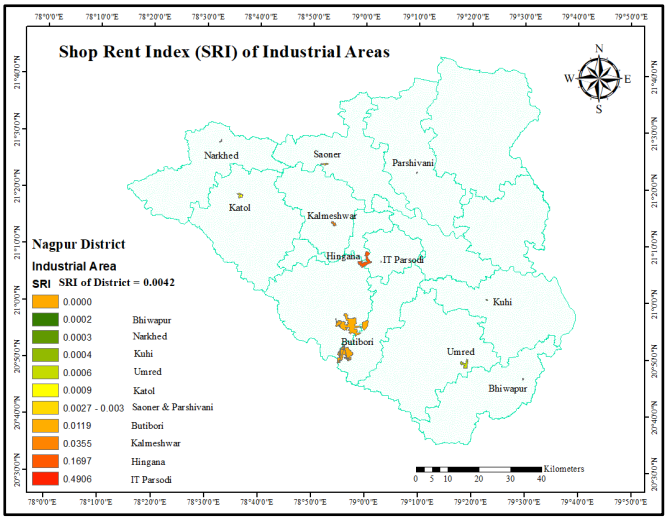
Figure 2: Simple Aggregate Price Index (SAPI): Industrial Area



Source: Author-Self

- Shop Rent Index (SRI): A spatial efficiency paradox is revealed by the shop rent index (SRI) map in Figure No 3, which shows a discrepancy between land cost and economic production. Being a high-performance cluster with a high SRI, IT Parsodi stands out for having outstanding economic production per square meter to meet its premium land cost. Nevertheless, Butibori has a low SRI, which suggests significant underutilization and inefficiency, despite its premium location and sizeable developed area. This points to problems with low density utilization, lower-value industries, or unoccupied plots. On the other hand, the SRI map indicates pockets of high efficiency where a where the most economic value is produced from cheap land. In places like Bhiwapur and Parshivani SRI is significantly outperformed their low land costs, revealing hidden gems of efficiency within the low-value periphery. This implies niche specialization or prosperous local industrial ecosystems. A compiling narrative is produced by this visual contrast: the landscape is not monolithic. It is made up of a patchwork of underperformers (poor output on large /moderately priced land), balanced performer (high output on pricey land), and over performers (high output on inexpensive land).

Figure 3: Shop Rent Index (SRI) of Industrial Area

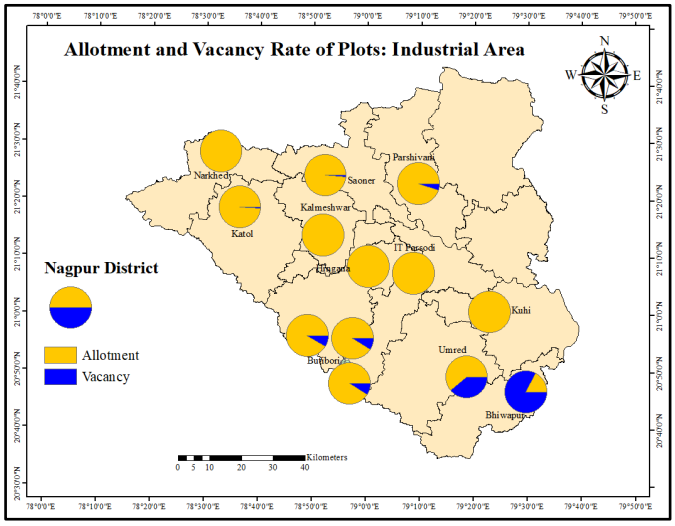


Source: Author-Self

- Allotment and Vacancy Rate of Industrial Plots: The Industrial Health map shows how space is utilized, with pie charts showing the areas of underutilized giant and full absorption (Figure No 4). The well-known cores- IT Parasodi, Kalmeshwar, Narkhed and Kuhi shows 100%

allocation rate and 0% vacancy, demonstrating strong demand and effective administration. Value-added manufacturing or vertical intensification inside current units must be the source of future growth. However, there are significant openings in two places: Bhiwapur and Umred. The 83% vacancy rate in Bhiwapur suggest that a significant amount of public investment is sitting unused. This can be the result of inadequate promotions, poor connectivity, or a lack of infrastructure. Due to its 39% vacancy rate, Umred is unable to reach its full economic potential. These areas are underutilized and need to be addressed for growth. Healthy allocation rate of over 95% and low vacancy rates of 1% to 5% are found in developing peripherals like Katol, Saoner, and Parshivani. These shows that good plot management and marketing can result in near to full absorption, which is an essential first step towards future economic output. However, despite its around 91% allocation rate and 9% vacancy rate of Butibori, it is concerning on a larger scale. Although it has a generally successful area status, this vacancy is the main cause of its poor SRI, showing that marginal vacancy at scale can have a substantial impact on regional economic output.

Figure 5: Allotment and Vacancy Rate of Industrial Plots



Source: Author-Self

- Unit density: Economic intensity is measured by unit density, which calculates the number of operational units per square meter of developed land (Table No. 2). By dividing heavily populated areas from those that are rarely used, it pinpoints the dynamic centers of the industrial ecosystem. IT Parsodi has the highest unit density (2.23), which suggests that high value industries like electronics and information technology use space quite intensively. Following with densities of 1.70 and 1.01 respectively, Hingana and Kalmeshwar exhibits a developed, sturdy arrangement of various manufacturing and processing facilities, reaffirming their position as Central, High activity zones. Parshivani, a low value location with a unit density of 1.00, makes the most of its scare resources by being extremely effective and high heavily used. Butibori, the most developed location has the second lowest unit density 0.30, which suggest that there is little industrial activity over broad area of land. This is a spatial crisis of scale, when vast potential is diffused throughout a vast, sparsely populated terrain, rather than merely underuse. Additionally, dormant zones such as Umred, Katol and Narkhed have low unit densities, suggesting that they struggle to draw and maintain industrial activity. Regional development organizations may face a great deal of difficulty in these areas.

As a result, these maps go beyond mere description to create a strategic cartography that suggests the economic well-being of every industrial region and suggests focused, spatially explicit policy actions to address the inefficiencies and highlight the achievements that are found there.

IX. Discussion:

- The approach of this research work offers a diagnostic breakthrough for regional economic planning that goes beyond simple mapping. It has transitioned from observation to actionable intelligence by combining land value (SAPI), economic output (SRI), and production intensity (unit density), which has led to a landscape of sharp contrast and significant policy implications. An obvious efficiency paradox is the main finding: land value by itself is not a reliable indicator of economic health. Rather occupancy and operational intensity work together to produce real impulse of the productivity. IT Parsodi is the undeniable pinnacle, a gold standard where hyper-intensive, high value production validates the premium land value. It is the model that has to be examined and its teachings deliberately imitated.
- Contrary, Butibori is the biggest opportunity and challenge for policy. A crisis of emptiness- a disastrous confluence of unoccupied plots and extremely low operational density that stifles its potential output- betrays its huge extent. This is a strategic gap that begs for focused response, not an inefficiency. The efficient perimeter is the most promising finding. Zones like

Parshivani demonstrates that wise land management may take precedence over locational premium by achieving exceptional output density despite cheap land costs. They provide a road map for optimizing return on investment in developing fields, making them the unsung heroes of the sustainable development.

- The triple load of low value, poor production, and low activity characterizes the dormant zones. As per the computed results and analysis, this can be reflected by low industrial activity (low unit density), low economic output (low Shop Rent Index or SRI) and load land value (low Simple Aggregate Price Index or SAPI). It is evident that industrial areas of Umred, Katol, Saoner, Narkhed, Bhiwapur and Kuhi are classified as the dormant zones. These dormant zones convey a strong call for action. Restricted by a triple constraint-insignificant land value, low economic production, and a lack of industrial activity- these places require a thorough strategic reorganization and focused revitalization.
- This research essentially provides policymakers with a master key, converting arbitrary conjectures into an objective, spatial dashboards for decision making. It offers unmatched precisions on:
    - Replication benchmark (intensity of IT Parsodi)
    - investment frontier (vacancy capacity of Butibori)
    - paradigm in scaling (optimal density of Parshivani)
    - Zone of high priority urgency (the dormant periphery)

  This is a strategic blueprint for unleashing the dormant economic potential of region.

X. Conclusion:

The geography of fast fiscal revenue, unreleased job creation, and stunned regional growth is visualized by this research work, which goes beyond just mapping and displaying empty plots, it gives decision makers a list of strategic priorities that are crystal clear: In order to identify and address the reasons behind their high vacancy rates, Bhiwapur and Umred need prompt, focused study and actions. The low hanging fruit for a significant regional economic boost is Butibori's vacancy. An enormous absolute increase in output would result from a little percentage reduction in its vacancy. It is important to identify and formalize the tactics that resulted in complete occupancy in the outlying areas are based practice for regional development. The key indicator that shifts the focus of the analysis from vogue (financial value) to the concrete (physical activity) is unit density. According to this, creating the ideal environment for dense, intense and long-term industrial activity is more important for regional industrial development than simply distributing land or even luring initial investment. In expansive areas like Butibori, where even a small increase in unit density might generate a revolutionary boost in regional economic production, the policy focus needs to change from development to activation and densification.

XI. Further Scope of research:

The research offers a structure for accessing the productivity and spatial efficiency of industrial zones utilizing the simple aggregate Price Index (SAPI) and shop Rent Index (SRI). It emphasizes the potential for additional research, such as temporal analysis of industrial performance, remote sensing, and GIS analytics to enhance land-use mapping. Furthermore, incorporating environmental performance indicators could tackle sustainability in addition to economic productivity. A comparative analysis among different districts in Maharashtra could confirm the indices and highlight regional differences. Finally, adding primary survey data regarding employment and infrastructure would improve socio-economic evaluations, aiding policy makers in crafting focused industrial strategies for sustainable development.

Authors' contribution:

- Ankita Raju Khobragade: Designated the study plan, gathered and analyzed data, and oversaw the drafting of the research. Developed the process for combining industrial growth measures with Simple Aggregate Price Index (SAPI) and Shop Rent Index (SRI).
- Gaurav Raju Khobragade: Edited and reviewed the research work to make it more coherent and clearer, gave comments on the overall framework, and helped with the last proofreading and getting it ready for submission.

Conflict of interest:

The author declares no conflict of interest.

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