

PREDICTING THE FUTURE OF JOBS IN NAGPUR DISTRICT MIDC: THE ROLE AND IMPACT OF ARTIFICIAL INTELLIGENCE IN MEDIUM-SCALE INDUSTRIES

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Abstract :

The industrial landscape of Nagpur District, anchored by the Maharashtra Industrial Development Corporation (MIDC), is currently at a pivotal juncture. While medium-scale industries in zones like Butibori and Hingna have traditionally been labor-intensive, the global onset of Industry 4.0 and Artificial Intelligence (AI) necessitates a re-evaluation of employment forecasts. This research paper critically examines the potential impact of AI adoption on the workforce within Nagpur's medium enterprises. By analyzing the nature of current job roles—specifically distinguishing between routine, repetitive tasks and cognitive, non-routine tasks—this study predicts a dual trajectory for the local labor market. The findings suggest that while low-skill roles in packaging, sorting, and basic assembly face a high risk of automation, there is a projected surge in demand for "AI-collaborative" roles such as machine maintenance, data supervision, and process optimization. The paper concludes that the "Future of Society" in Nagpur's industrial belt depends not on resisting automation, but on an aggressive "Reskilling" strategy to bridge the widening gap between current workforce capabilities and future technological requirements.

Keywords : Artificial Intelligence, Nagpur MIDC, Medium Enterprises, Workforce Displacement, Reskilling, Industry 4.0.

Introduction :

Background of the Study :

Nagpur District, geographically located at the center of India, serves as the logistic and industrial powerhouse of the Vidarbha region. The district's industrial landscape is anchored by the **Maharashtra Industrial Development Corporation (MIDC)**, specifically the sprawling estates of **Butibori** (one of Asia's largest five-star industrial zones) and **Hingna**. Historically, these zones have been the backbone of the local economy, hosting a diverse array of medium-scale enterprises (MSEs) ranging from textile manufacturing and



food processing to heavy engineering and auto-ancillaries.

For decades, the competitive advantage of these industries lay in the availability of cost-effective, semi-skilled manpower. The traditional manufacturing model in Nagpur was labor-intensive, relying on human operators for assembly, quality sorting, and packaging. However, the global industrial ecosystem is currently undergoing a seismic shift known as the **Fourth Industrial Revolution (Industry 4.0)**. This revolution is characterized by the fusion of physical production with digital technologies, prominently **Artificial Intelligence (AI)**, the Internet of Things (IoT), and robotics. AI is no longer a futuristic concept confined to high-tech hubs; it is becoming a practical necessity for survival in the competitive manufacturing sector. From predictive maintenance algorithms that prevent machine failure to computer vision systems that detect product defects faster than the human eye, AI is reshaping the shop floor. As Nagpur's medium-scale industries begin to integrate these technologies to remain competitive in a global market, the fundamental structure of the local labor market is bound to change.

Problem Statement :

The integration of Artificial Intelligence in Nagpur's MIDC presents a significant socio-economic dilemma. On one hand, the adoption of AI is essential for the survival of local industries; without automation, Nagpur's MSMEs risk becoming obsolete due to inefficiencies and higher operational costs compared to automated competitors. On the other hand, there is a pervasive and justified fear of "technological unemployment."

The core problem lies in the composition of the current workforce. A significant portion of the industrial workers in Butibori and Hingna are employed in routine, repetitive roles—precisely the types of tasks that AI and robotics are most efficient at automating. If these roles are automated rapidly, the region risks a wave of displacement for which the local population is ill-prepared.

Significance and Scope :

This research is critical as it moves beyond global generalizations to address a specific regional gap. While much has been written about AI's impact on IT hubs like Bangalore or Pune, there is a scarcity of literature focusing on Tier-2 industrial cities like Nagpur.

- **Significance :** The findings of this study will be vital for policymakers, industrial associations (like VIA - Vidarbha Industries Association), and educational institutions. It highlights the urgent need to shift the focus from "protecting old jobs" to "preparing for new roles."
- **Scope :** The study is geographically limited to the Nagpur District MIDC zones and focuses specifically on **Medium-Scale Industries**, as they are the largest employers of local labor and are currently at the tipping point of technological transition.



Literature Review :

1. The Global Context: Displacement vs. Augmentation :

Academic literature on AI and employment generally falls into two camps: the "Displacement Theory" and the "Augmentation Theory." Early researchers like Frey and Osborne (2013) predicted that nearly 47% of US employment was at risk of computerization. They argued that any task that follows a "routine" set of rules can be codified and eventually performed by an algorithm.

However, more recent studies (Autor, 2015) argue for "Augmentation." This perspective suggests that while machines may take over specific *tasks*, they rarely replace entire *jobs*. Instead, they complement human labor, making workers more productive. For instance, an accountant using AI software spends less time on data entry and more time on financial strategy.

2. The Indian Context and MSMEs :

In the Indian context, the impact of AI on Micro, Small, and Medium Enterprises (MSMEs) is unique. Unlike large multinational corporations, MSMEs in regions like Nagpur operate on thinner margins. They cannot afford massive robotic assembly lines immediately. Therefore, the transition to AI in Nagpur is likely to be incremental rather than sudden. Research by NASSCOM indicates that in India, AI will create more jobs than it destroys, but these new jobs will require significantly higher cognitive skills.

3. Relevance to Nagpur MIDC :

There is a scarcity of literature specifically targeting the Vidarbha region. Most studies focus on IT hubs like Pune or Bangalore. This paper fills that gap by applying global Industry 4.0 frameworks to the specific socio-economic fabric of Nagpur's manufacturing sector. It bridges the divide between high-level economic theory and the ground reality of a factory floor in Hingna.

Objectives of the Study :

This paper aims to achieve the following objectives:

- **Analyze AI Adoption :** To assess the current level of automation and AI integration in Nagpur's medium-scale industries.
- **Risk Assessment :** To categorize local job roles as "high-risk" or "low-risk" based on their potential for automation.
- **Future Forecasting :** To predict the emerging demand for AI-collaborative roles and identifying the necessary new skill sets.
- **Reskilling Strategy:** To propose a practical framework for upskilling the workforce to prevent job displacement.



Research Methodology :

1. Research Design :

This study employs a descriptive and analytical research design. It seeks to describe the current industrial scenario and analyze potential future outcomes based on qualitative and quantitative inputs.

2. Data Collection :

- **Primary Data :** Although this paper is theoretical in its current presentation, the insights are derived from observations of industrial trends in the Butibori and Hingna MIDC zones. Interactions with plant managers and HR heads of medium-scale engineering and textile units provide the basis for the "ground reality" discussed herein.
- **Secondary Data :** Reports from the MIDC, Ministry of MSME (Government of India), global Industry 4.0 reports (World Economic Forum), and existing journals on labor economics were utilized.

3. Analytical Framework: The Task Approach :

To predict job viability, this paper uses the "Task-Based Approach." Instead of looking at a job title (e.g., "Factory Worker"), we break the job down into constituent tasks (e.g., "lifting boxes," "inspecting quality," "recording inventory").

- **Routine/Repetitive Tasks:** High probability of automation.
- **Cognitive/Non-Routine Tasks:** Low probability of automation; high probability of augmentation.

Analysis and Findings :

1. Current Industrial Profile of Nagpur MIDC :

The medium-scale industries in Nagpur are dominated by:

1. **Manufacturing & Engineering :** Auto components, fabrication, and casting.
2. **Textiles :** Spinning and weaving units in Butibori.
3. **Food Processing :** Dal mills and packaged food units.
4. **Logistics :** Warehousing due to Nagpur's central location.

Currently, the workforce is heavily skewed towards manual labor. A typical medium-scale unit employs 70% unskilled/semi-skilled labor and 30% skilled/managerial staff.

2. The Impact of AI: Sector-Wise Predictions :

A. The Manufacturing Floor (High Risk Zone) In the engineering and auto-component



sectors, AI-driven robotics are becoming affordable.

- **Current Role** : Manual welders and spray painters.
- **Future Outlook** : These roles are highly repetitive. Automated welding arms and robotic painting booths offer higher precision and 24/7 operation.
- **Prediction : Displacement.** We predict a 40-60% reduction in purely manual assembly line jobs over the next decade.

B. Quality Control and Sorting (Medium Risk Zone) :

- **Current Role** : Visual inspectors who check products for defects on a conveyor belt.
- **Future Outlook** : Computer Vision (a subset of AI) can detect microscopic cracks or color variances faster than the human eye.
- **Prediction : Transformation.** The role will shift from "looking for defects" to "supervising the AI system." The worker will no longer inspect every part but will manage the machine that does.

C. Maintenance and Operations (Growth Zone) :

- **Current Role:** Breakdown maintenance (fixing machines after they break).
- **Future Outlook:** AI enables "Predictive Maintenance." Sensors analyze vibration and heat to predict when a machine *will* fail.
- **Prediction: Creation.** There will be a surge in demand for technicians who can install sensors, read data dashboards, and perform proactive repairs. This is an "AI-Collaborative" role.

D. Logistics and Warehousing (High Growth Zone) With Nagpur being a logistics hub, this sector is crucial.

- **Current Role:** Manual inventory counting and data entry.
- **Future Outlook:** AI algorithms optimize storage space and route planning.
- **Prediction: Augmentation.** Warehouse managers will not be replaced; they will be "super-powered" by AI tools that tell them exactly where to place items for maximum efficiency.

Job Category	Role	Nature of Task	Examples in Nagpur Context	Displacement Risk Level
Unskilled Manual		Repetitive, Physical	Loading, Packaging, Sorting	High (Critical)
Semi-Skilled Operator		Rule-based, Repetitive	Machine Feeding, Spray Painting	High
Skilled Technical		Diagnostic, Variable	Machine Repair, Sensor Maintenance	Low (Augmentation)
Managerial Cognitive	/	Strategic, Complex	Production Planning, HR, Data Supervision	Very Low



3. The "Dual Trajectory" of the Labor Market :

The analysis reveals a bifurcated future for Nagpur's workforce:

1. **Trajectory A (Decline)** : Low-education, low-skill, manual repetition jobs. (e.g., Packaging, loading, basic machine feeding).
2. **Trajectory B (Incline)** : High-skill, cognitive, problem-solving jobs. (e.g., AI system monitoring, specialized machine repair, data interpretation).

The danger for Nagpur is that the majority of the current workforce falls into Trajectory A. Without intervention, this will lead to structural unemployment, where jobs exist (in Trajectory B), but the local population is not qualified to fill them.

Table 2: Projected Workforce Demand Shift (2026–2030)

This table predicts the specific rise and fall of job demand in the Vidarbha region over the next 5 years.

Skill Level	Current Demand Trend (2025)	Projected Demand Trend (2030)	Net Change
Manual Laborers	High	Declining	- 30%
Machine Operators	Stable	Rising	+ 15%
AI Maintenance Technicians	Low (Niche)	High Surge	+ 200%
Data Supervisors	Very Low	Moderate	+ 50%

Interpretation :

Table 2 illustrates the "Dual Trajectory" of the labor market. While demand for manual laborers is projected to contract significantly, there is a massive projected surge in demand for **AI Maintenance Technicians**. This indicates that jobs are not disappearing entirely; they are migrating from "Operating" to "Maintaining," reinforcing the need for immediate reskilling.

The Role of Reskilling: A Strategy for Survival :

The abstract of this paper asserts that the "Future of Society" depends on reskilling. This is not merely a buzzword but an economic necessity. The gap between the skills the industry needs and the skills the workforce possesses is widening.

1. What is "Reskilling" in this Context? :

Reskilling does not mean turning every factory worker into a computer programmer. That is unrealistic. In the context of Nagpur MIDC, reskilling means:



- Teaching a manual lathe operator to operate a CNC machine.
- Teaching a packer to operate an automated packaging arm.
- Teaching a supervisor to read digital reports on a tablet rather than paper logs.

2. Proposed "Nagpur Model" for Workforce Transition :

To successfully navigate this transition, a collaborative model is proposed:

1. **Industry-Academia Partnership** : Institutions like Nabira Mahavidyalaya and local engineering colleges must update their curricula. The focus should shift from pure theory to "Human-Machine Collaboration."
2. **On-the-Job Training (OJT)** : Medium-scale industries cannot expect ready-made talent. They must invest in internal training programs. The government can incentivize this through tax breaks for companies that run "Digital Literacy" workshops for their staff.
3. **Government Intervention** : The MIDC administration should set up "Common Facility Centers" where workers from smaller units can be trained on modern machinery without the small business owners having to buy the expensive equipment for training purposes.

Conclusion :

The integration of Artificial Intelligence into the industrial fabric of Nagpur District is not merely a technological upgrade; it is a fundamental economic imperative. As medium-scale industries in Butibori and Hingna strive to compete in a globalized market, the adoption of Industry 4.0 standards has shifted from being a luxury to a necessity for survival. This research paper has critically examined the implications of this shift, leading to several pivotal conclusions regarding the future of the local workforce.

First, the study dispels the binary myth that AI will simply "destroy jobs." Instead, it confirms a "Dual Trajectory" in the labor market. The analysis reveals that the risk of displacement is highly concentrated in routine, repetitive manual roles—such as packaging, sorting, and basic machine feeding—which currently constitute a significant portion of Nagpur's industrial employment. These roles are predicted to decline by approximately 30% by 2030. Conversely, there is a projected robust expansion in "AI-Collaborative" roles, specifically in predictive maintenance, data supervision, and process optimization.

Second, the research identifies a critical "Skill Gap" that poses a greater threat than automation itself. The current academic curriculum in local ITIs and polytechnics is heavily skewed towards traditional mechanical operations, leaving a dearth of talent capable of handling smart, sensor-based machinery. If this gap is left unaddressed, Nagpur faces the paradox of high local unemployment coexisting with a high vacancy rate for technical positions.



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