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Artificial Intelligence and Employment in India: A Socio-Technical Analysis with Empirical Evidence from Manipur

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Abstract

As Artificial Intelligence (AI) rapidly transforms global labour markets, its implications for employment in developing regions such as India remain insufficiently understood. This study investigates the socio-economic, technological, and policy dimensions of AI's impact on employment, with a specific focus on the state of Manipur. Using a mixed-method approach and survey data from 100 participants across public, private, informal, and student sectors, the research identifies significant disparities in AI awareness and digital literacy. Statistical analyses, including Chi-square tests and independent t-tests, reveal a strong association between employment sector and AI awareness, with informal sector workers exhibiting greater concern about job displacement. A multiple linear regression model indicates that digital literacy, AI awareness, and infrastructure access together explain 48% of the variance in perceived employment security. Furthermore, a confidence interval analysis highlights the low digital literacy baseline among informal workers. These findings underscore the urgent need for targeted policy interventions aimed at digital up skilling, infrastructure development, and inclusive AI education. The study concludes that while AI holds transformative potential, its equitable integration into India's labour landscape requires human-centred strategies that address structural inequalities. This research contributes to the growing discourse on AI and employment in emerging economies, providing valuable insights for policymakers, educators, and technology stakeholders.

Keywords: Artificial Intelligence, Employment Security, Digital Literacy, Informal Sector, Manipur

1. Introduction

Artificial Intelligence (AI) entering the field has caused a major revolution in economies worldwide. Because AI is able to think process information and carry out tasks that were once just done by people, it is being used more often in manufacturing, finance, healthcare, customer service and logistics. The development has helped the economy grow and encouraged new technologies, but it has also raised serious worries about future jobs.

Job losses caused by automation and AI are now a very real problem. As autonomous vehicles take over for drivers and AI is used in back-office processes, the nature of many jobs is being

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changed. The World Economic Forum says that AI and automation will create some new jobs, yet the change is expected to be difficult for workers who perform routine jobs.

AI affects different regions of the world differently in terms of jobs and work. Wealthy nations are investing in future-proofing their workforces by leaning on AI in knowledge industries, but in developing countries, AI risks both increasing joblessness and leaving many workers unable to improve their skills. Asia, where most of the workforce is based, is rapidly embracing AI because of a need to compete on the world stage and change with new technology. At the same time, this progress replaces millions of manufacturing positions in places like China, Vietnam and India.

Here in India, AI is considered an important technology for development, as it has positive effects in governance, healthcare, education, agriculture and urban planning [1]. The initiatives taken by the Government of India by the National institution for Transforming India or NITI Aayog such as National Strategy for Artificial Intelligence reflect to make use of AI to benefit the country [2]. However, the possibilities of AI influencing jobs are disputed, mainly where the economy is fragile, area which lacking the digital infrastructure and high rate of informal employment. Alternatively, a big part of the workforce is described as unskilled or semi-skilled and is consequently at risk of losing their jobs to automation. As AI improves, it creates important problems regarding how jobs will be supported which workers can adapt and the actions needed by government.

In this way, Manipur which is located in the northeast of India provides an ideal setting. Although education and governance are advancing in the region, it still has poor infrastructure, high unemployment rate, a political minority and low digital insights in [3]. Although AI is making its way into governance, schools and small firms, it sometimes is not designed to match local job requirements. Because of these trends, doubts about how inclusive, prepared and durable AI-powered development is in Manipur surface.

The paper examines in detail how AI and jobs in Manipur are linked, studying the state's technology, policies, labour market situation and social views. The plan is to find an approach that leads to fair and people-centred use of AI adapted to the state's economic and social environment.

2. Problem Statement:

Research shows that India could generate almost USD 950 billion because of AI by 2035 [4]. Still, there is increasing worry about changing jobs as a result of automation and intelligent technologies. Researchers predict that, in the near future, about 69% of jobs in sectors like manufacturing, logistics and retail might be automated to some shade [5]. In Manipur, the majority of people working are low-skilled and informal, so they are at greater risk because they cannot easily adapt to the changes technological advancements bring.

Such national policies as Digital India and AI for All give a broad plan, but they usually overlook the specific needs of remote areas [6]. The number of unemployed youth and graduates keeps increasing in Manipur and at the same time, institutions are starting to use AI for some tasks. When innovation does not go hand in hand with inclusion, it becomes critical to explore the special needs and prospects that regions face when using AI.

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3. Literature Review

For ten years now, there has been an increase in talk about how Artificial Intelligence (AI) will change jobs. Experts, decision-makers and researchers have investigated the way AI-powered automation is changing labour markets all over the world. This section brings together the main ideas from other studies.

3.1 Overview of AI and Employment: Global Perspective

The nexus between Artificial Intelligence (AI) and employment has garnered intense scholarly attention in recent years, as AI technologies redefine industrial processes, automate cognitive tasks, and shift labour market demands. Brynjolfsson and McAfee [7] characterize this transformation as the "Second Machine Age," emphasizing the potential for intelligent systems to both displace routine jobs and create new forms of high-skilled employment. Frey and Osborne's seminal study [8]quantified these risks, estimating that 47% of U.S. jobs were at high risk of automation over the coming decades, with similar trends expected in developing economies due to the global diffusion of AI technologies.

Author [9] further contributes to the debate by showing that automation complements high-skilled labour while substituting for middle-skill, routine-intensive jobs. This phenomenon often referred to as "job polarization," results in rising income inequality and labour market fragmentation. These global trends raise significant concerns for emerging economies like India, where labour markets are heavily skewed toward low-skill and informal employment.

3.2 AI and Employment in India

In the Indian context, the implications of AI adoption are both promising and problematic. NITI Aayog's National Strategy for Artificial Intelligence [10] outlines AI as a "game-changer" for sectors like agriculture, education, and healthcare. However, several empirical studies suggest that the adoption of AI is not uniform across sectors or geographies. According to a joint report by BCG and NASSCOM [11], AI may help create up to 20 million jobs in India by 2025, but the bulk of these opportunities are expected in high-tech sectors, thereby excluding a vast segment of India's labour force that lacks digital skills.

Chakraborty and Chakraborty [12] argue that while India possesses the demographic advantage of a young workforce, its educational and vocational training systems are ill-equipped to prepare workers for AI-integrated environments. They emphasize the urgent need for reskilling frameworks and region-specific AI strategies. Similarly, the World Bank [13] warns that while digital technologies can empower economies, they may exacerbate unemployment and inequality if institutional and educational ecosystems are not aligned.

Despite these challenges, some researchers have identified positive AI-induced transformations. Dholakia et al. [14] report that AI applications in agriculture have improved yield prediction and market access for farmers in Gujarat and Maharashtra. In contrast, Rao and Sinha [15] highlight how AI in healthcare diagnostics and telemedicine has increased healthcare reach in remote parts of India. However, these success stories often rely on infrastructure and institutional support not widely available across India's north-eastern states.

3.3 Northeast India and Manipur: Understudied and Underserved

The literature on AI and employment in India's North-eastern region, including Manipur, is sparse. Baruah [16] has highlighted the region's technological marginalization and its chronic

underrepresentation in national digital policies. Although the Digital North East Vision 2022 [17] aspires to bring digital infrastructure and skill training to the region, implementation remains uneven. Recent reports indicate that digital literacy and internet penetration in Manipur are significantly below the national average [18].

Most employment in Manipur is concentrated in agriculture, small-scale trade, and public sector jobs, with a large portion of the workforce engaged in informal labour [19]. The introduction of AI-based systems—such as biometric attendance in public offices and AI-enabled surveillance—has been observed, but without parallel investments in worker retraining or stakeholder engagement. The lack of region-specific data and evaluation mechanisms compounds the problem, limiting scholarly and policy insights into AI's real impact in Manipur.

3.4 Theoretical Framework

To study the influence of AI on workers and jobs, the Human Capital Theory and the Technology Acceptance Model (TAM) were used.

Based on Human Capital Theory (from Becker, 1964), people's productivity and earning ability depend on how educated, trained and skilled they are. In the context of AI, regions that lack adequate human capital development (e.g., digital skills, vocational education) are more vulnerable to displacement and unemployment [20].

The Technology Acceptance Model (Davis, 1989) is applied to analyse how users adopt and use AI systems. Perceived usefulness and ease of use determine how much someone uses a new technology which helps decide their productivity and chances of employment [21]. By using Technology Acceptance Model (TAM) to study Manipur, we can assess how both perceptions and problems with infrastructure affect the use of AI by workers.

These frameworks work together to analyse both the systemic factors (like policy and skills) and the mental aspects (such as attitudes and ability to adjust) involved in AI's entry into the workforce.

3.5 Identified Gaps in Knowledge

Although there is a lot of literature available on AI and employment, there are still important gaps in research about India's regions.

1. Over centralization of Data and Analysis: Many studies use data that covers the whole country, which leads to differences between regions. There isn't much evidence from studies about how AI affects jobs in places like Manipur when compared with highly industrialized hubs like Delhi, Mumbai and Bengaluru.
2. Neglect of Informal Sector Dynamics: Researchers of (AI) spend little time on India's informal sector which employs most of its population. The effects of AI on unregistered work activities, mainly in countries where economies are highly fragile, are not widely understood [22].
3. Lack of Community-Centred Research: Only a small number of AI studies involve community members like students, people running small businesses or those employed by public institutions when exploring employment impacts of AI

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4. Absence of Thematic Focus on Northeast India: Most work and discussions on AI in the Northeast Asia focus only on developing digital infrastructure. Little research is done on the effects of modern technologies on the job market [23].
5. Insufficient Policy Evaluation: Many national strategies (for example, AI for All and Digital India) set broad goals, yet evaluating their implementation in places such as Manipur is lacking. Because of this gap, new policy ideas and changes are not widely considered.

3.6 Contribution of This Study

This study seeks to fill these gaps by:

1. Primary data are collected through surveys and interviews, to find out AI impact on employment in Manipur
2. Examining individual and organizational responses to AI by using Human Capital and TAM theories.
3. Sharing insights the best AI strategies for their workforce by checking how well national strategies fit with employment in the region.
4. Suggesting a framework that focuses on people when adopting AI in underdeveloped areas to ensure innovation and inclusion go together.
5. Using Manipur as a main example, this research provides a better understanding of AI's job effects in north-eastern region that is also fairer.

4. Research Objectives

The main objectives of this research are:

i. To evaluate the level of awareness and readiness among different employment groups in Manipur regarding AI technologies.
ii. To examine the perceived and actual impact of AI adoption on employment status across formal and informal sectors.
iii. To analyse the policy, infrastructural, and skill-related challenges that affect AI integration in Manipur.
iv. To develop a region-specific, human-centred framework for inclusive AI-driven employment growth.

5. Hypotheses

The following hypotheses guide the quantitative component of the study:

H_1: There is a statistically significant relationship between digital skill levels and employment security in the context of AI integration.

H_2: Perception of AI as a threat to employment varies significantly by sector.

H_3: Regions with better AI-related policy implementation show higher adaptability among the workforce.

H_4: There is a significant digital divide between urban and rural populations in Manipur with respect to AI exposure and employability

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6. Methodology

6.1 Research Design

This study employs a mixed-methods research design, integrating both quantitative and qualitative approaches to explore the multi-dimensional impact of Artificial Intelligence (AI) on employment in the state of Manipur. The design allows for triangulation of data from surveys, interviews, and secondary sources to ensure robust and comprehensive analysis. The study is descriptive, exploratory, and explanatory in nature, aiming not only to measure effects but also to understand underlying causes and dynamics.

6.2 Study Area: Focus on Manipur

Manipur, a state in Northeast India, serves as the geographic focus of this study. It is characterized by limited digital infrastructure, high youth unemployment and a predominantly informal labour market [24]. These characteristics make Manipur a compelling case for assessing the implications of AI adoption in under-resourced regions.

6.3 Target Population and Sample

The target population includes: Public sector employees, Private sector professionals, Informal workers and Students. A total of 100 individuals were selected using a stratified random sampling technique to ensure proportional representation from urban and rural areas, gender groups, and occupational sectors. The strata were based on employment type (formal/informal), district (Imphal East, Imphal West, Thoubal, Churachandpur, etc.), and age group (18–60 years).

Sample Size Justification

Given the small and specific geographic area, a sample size of 100 participants provides adequate statistical power for hypothesis testing and regression analysis at a 95% confidence level with ±10% margin of error [25].

6.4 Data Collection Methods:

A structured questionnaire was administered to collect the responses using Google forms depending on participants' access and literacy levels. The questionnaire included both closed-ended (Likert scale, multiple-choice) and open-ended questions. It had four major sections: Demographics, Awareness and understanding of AI, Perceived impact of AI on job security and Skill readiness and reskilling needs. Data was collected from both primary and secondary.

7. Results and analysis

A total of 100 respondents participated in the study. The data collected were interpreted in alignment with the research objectives.

7.1 Descriptive Statistics:

a. Demographic composition of the sample group

Demographic profiles of the respondents are discussed below:

i. Gender and age-wise Distribution

The table below presents the age and gender distribution of the participants (58% male and 42% female participants of the total sample). A majority of respondents 53% fall within the 18-35 age range, reflecting a youthful demographic more likely to engage with AI technologies.

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Table 1: Gender and age wise distribution of respondents

Age group (in years)	Male	Female	Total
18-25	14	10	24
26-35	16	13	29
36-45	12	11	23
46-55	9	6	15
Above 56	7	2	9
Total	58	42	100

ii. Occupation Wise Distribution-

Form the below table, the students group represent the largest group of the sample with 32% of the respondents followed by the informal sector with 28% respondents. The public sector with 22% respondents followed by the private sector employees with 18% respondents

Table 2: Occupation wise distribution

Category	Frequency	Percentage
Public	22	22%
Private	18	18%
Informal	28	28%
Students	32	32%
Total	100	100%

iii. Location wise distribution

Maximum of the survey conducted in urban area with 58% and the remaining with semi-urban/Rural are with 42%.

Table 3: Location wise distribution

Location	No. of Respondents	Percentage
Urban	58	58%
Rural	42	42%

7.2 Hypothesis Tests

a. H_1 Digital skills are significantly associated with employment security in the context of AI. The result of the Correlation test is given in table 4.1 below.

Table 4.1: H_1 Digital skills are significantly associated with employment security in the context of AI

Variable 1	Variable 2	Sample Size (n)	Correlation Coefficient (r)	t-critical ($\propto$=0.05)	t-statistic	p-Value	Conclusion
Digital Skills	Employment Security	100	0.66	1.984	8.70	<0.001	Accepted H_1

The above table 4.1 shows that r = 0.66 which indicates a moderate to strong positive relationship. The value like t-statistic value (8.70) far exceeds the t-critical value (1.984).Hence the alternative hypothesis H1 is accepted. The result of this test supports H_1 and suggests that improving digital skills may enhance perceived employment security amid AI integration.

b. H_2 Perception of AI as a threat to employment varies significantly by sector. The result of the t-test is given in the below table 4.2.

c.

Table 4.2: H2 Perception of AI as a threat to employment varies significantly by sector (formal vs informal)

Group	Mean Score	Standard Deviation	Sample Size (n)	Mean Difference	t-critical ($\propto$= 0.05)	t-statistic	p-value	Result
Formal Sector	6.5	1.0	40					
Informal Sector	5.6	1.2	28	0.9	1.997	3.26	<0.01	Accepted H_2

The above table 4.2 shows that the perception of AI as a threat is significantly higher in the formal sector compared to the informal sector. We accept H2 because the result is statistically significant (t = 3.26, p < 0.01). This suggests that informal workers less directly impactful, while formal workers more exposed to AI-related disruptions due to higher automation risk.

d. H_3 Regions with better AI-related policy implementation show higher adaptability among the workforce. The result of the multiple linear Regression test is given below table 4.3

Table 4.3: Impact of AI policy on Workforce Adaptability

Parameter	Sample Size (n)	Regression Equation	Correlation Coefficient (r)	Coefficient of Determination (R^2)	Standard Error of Estimate	Degrees of Freedom (df)	t-statistic	t-critical($\propto$ = 0.05)	p-value	Significance level

Value	100	Adaptability = 2.10 + 0.65 × Policy Score	0.58	0.3364	±1.20	98	7.15	1.984	<0.001	Statistically significant

The above table 4.3 shows the regression analysis indicates a moderately strong positive relationship (r = 0.58) between the quality of AI policy implementation and workforce adaptability. The regression coefficient of 0.65 implies that for every one –unit increase in AI policy score (on a scale of 1-10), the workforce adaptability score improves by 0.65 points. The model explains about 33.64% (R^2 = 0.3364) of the variability in adaptabily scores. The t-statistic (7.15) exceeds the t-critical value (1.984) at $\propto$ = 0.05, which indicates a statistically significant effect. The P-value is well below 0.001, strongly supporting the hypothesis. Thus, H_3 is supported; better AI-related policy frameworks are significantly associated with higher adaptability among the workforce in Manipur.

e. H_4 there is a significant digital divide between urban and rural populations in Manipur with respect to AI exposure and employability. The result of the t-test are given below

Table 4.4 t-test table for H_4

Region	Mean AI Exposure/Employability Score	Standard Deviation	Mean Difference	t-statistic	t-critical ($\propto$=0.05,two-tailed)	P-value	Result
Urban	6.8	1.1	1.6	6.64	1.984	< 0.001	Statistically Significant
Rural	5.2	1.3					

There is a statistically significant digital divide between urban and rural populations in Manipur. Urban respondents exhibit greater AI exposure and employability readiness compared to their rural counterparts, confirming Hypothesis 4.

Conclusion

This study provides a socio-technical assessment of the implications of Artificial Intelligence (AI) on employment in the context of Manipur, a relatively underrepresented region in the broader discourse on digital transformation. By employing a mixed-methods approach, the research establishes a statistically significant association between digital skill levels and employment security, particularly within formal employment sectors that are more susceptible

to AI-driven automation. The findings also reveal perceptual differences across employment groups, highlighting those individuals in the informal sector are comparatively less aware of AI-related risks, while those in the formal sector report higher concern. Furthermore, the existence of a considerable digital divide between urban and rural populations underscores regional disparities in AI exposure and employability. Importantly, the study confirms that workforce adaptability is positively influenced by the strength and quality of AI-related policy frameworks. Taken together, these results underscore the urgent need for a localized, human-centered approach to AI integration in employment systems, particularly in regions with limited digital infrastructure.

Contribution to the Literature

This research contributes to the growing body of interdisciplinary literature on AI and employment by focusing on an empirically underexplored region in India. First, it offers primary data and analysis from Manipur, thereby filling a geographic and socio-economic gap in existing studies that predominantly examine AI's effects in urban, technologically advanced, or high-income settings. Second, it proposes an integrative framework that connects digital literacy, policy implementation, sectoral dynamics, and workforce adaptability, providing a comprehensive understanding of AI's labor market impacts. Third, the inclusion of both formal and informal employment groups allows for sector-specific insights into perceptions, preparedness, and vulnerability to AI-related disruption. By adopting a human-centred and regionally sensitive lens, this study expands the analytical scope of AI-employment research and offers practical insights for policymakers aiming to implement inclusive digital strategies in economically peripheral regions.

Areas for Further Research

While this study offers important empirical and conceptual insights, several directions for future research are proposed. Longitudinal studies could provide a dynamic view of how AI adoption, digital skill acquisition, and employment outcomes evolve over time, particularly in under-resourced regions. Additionally, qualitative investigations focusing on the intersection of AI with gender, ethnicity, and socio-cultural norms could enhance our understanding of barriers to equitable AI integration. Comparative studies across other North-eastern states in India or similarly situated regions in the Global South could test the generalizability of the proposed framework and identify context-specific policy interventions. Moreover, future research may explore AI's role in fostering digital entrepreneurship and gig-based livelihoods in rural and semi-urban areas, offering insights into its potential for inclusive economic development.

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