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Artificial Intelligence and the Gig Economy: Opportunities and Challenges for Informal Workers in India

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ABSTRACT

This paper analyzes the effect of Artificial Intelligence technologies in India's gig economy, with a detailed analysis of how the Artificial Intelligence-powered platforms redefine access to employment opportunities and the creation of new types of challenges, particularly for unorganized sector workers. This research work uses a mixed (quantitative and qualitative) methods approach of research design, utilizing both primary and secondary data sources for analysis. Secondary data have been taken from NITI Aayog, PLFS, ILOSTAT and industry reports as well as documents. Whereas primary data have been collected from gig workers in India's five major metropolitan cities, such as Mumbai, Delhi, Bengaluru, Hyderabad, and Kolkata, through survey and interview techniques. The findings of the study displayed that the Artificial Intelligence algorithms are instrumental in boosting access to employment opportunities for workers, not only by lowering entry restrictions but also by providing financial inclusion due to the digital payment systems through DBT mode. Again our study focuses upon AI-related issues like the pricing problems arising from dynamic pricing algorithms create jittery earnings; algorithmic management reduces worker autonomy and efficiency, rating-based systems determine job allocation without any transparency, and Artificial Intelligence-enabled surveillance leads to privacy and data rights issues; informal gig workers face income volatility and unpredictable incentives, and their grievance mechanisms are weak, all of which exacerbate their vulnerability; the digital divide acts as a barrier for people who lack of technological knowledge and skills. The study also finds that platform companies primarily absorb the productivity of Artificial Intelligence. These outcomes suggest the need for implementation of various policy reforms such as compulsory algorithmic transparency, minimum income earnings safeguards, inclusion of gig workers in national social security plans, data protection, and digital literacy initiatives programs. This research work also argues in favour of AI that has the potential to expand work opportunities and enhance the efficiency of the gig economy in India. However, without ethical principles and governance, fair platform practices, and regulatory measures, reducing the volatility of incomes and welfare of informal workers, then the promise of technological advancements will remain unfulfilled.

Keywords: Algorithmic Penalties, Digital Literacy, Gig Economy, Volatility

INTRODUCTION

The sudden hike in the field of artificial intelligence has significantly transformed labour markets worldwide. At the same time, digital platforms have become key mediators in the development of new work structures (Rosenblat and Stark, 2016). According to the NITI Aayog-2022 report, this change is significant in India since the majority of the workforce belongs to the unorganized sectors, lacking consistent employment opportunities, legal protections, and social security. The emergence of AI-driven online platforms, *viz.,* Ola, Uber, Zomato, Swiggy, Amazon, Flipkart, eBay, Meesho, Myntra, Lenskart, etc. have converted how informal workers find job options by providing real-time task distribution, automated payment processes, volatile pricing, and AI-enhanced

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rating, as well as monitoring their products (Lee *et al.*, 2015). These advancements in the field of technology have reduced traditional entry barriers in to the job market and established flexible work options to millions of workers.

Mateescu and Nguyen (2019) describe on the Artificial Intelligence systems, how to increase the efficiency level of the workers, generate new types of insecurity for workers who rely on platforms. The algorithmic decision-making process in India is lack of transparency as well as accountability, exposing workers to sudden adjustments, arbitrary ratings, automated punishments like reduction of salary of workers due to a small error, and loss of job (Mehrotra, 2021). Dynamic pricing algorithms systems that are designed to match the availability of supply of goods and services accordingly to consumers' demand for them, frequently result in fluctuating revenues, thereby making them highly vulnerable to income in the gig economy (ILO, 2021). Moore *et al*. (2018) argued that surveillance and performance monitoring systems enhanced by Artificial Intelligence also monitor workers' every movement, action, and interaction, leading to worries regarding their privacy and data rights.

The report of IWWAGE-2023 reveals that a major issue arises from India's ongoing digital platform that limits the Artificial Intelligence-driven job markets for those without digital knowledge, technical sound skills, smartphones, and stable internet connectivity. These major hindrances are particularly applicable to women, rural migrants, and low-income families. Additionally, no doubt that the advantages of AI-enhanced productivity are largely captured by platform companies. Similarly, its dangers include frequent changes in demand patterns, uncertainty for entrepreneurs due to fluctuating incentives, algorithmic biases, and job insecurity for workers (Rani and Furrer, 2021).

It is also important to mark the duality function of Artificial Intelligence for the gig workers who act as creators of employment opportunities, and at the same time act as destroyers of job stability. The current research aims to find out the impact of falling on the job accessibility, income, independence, and overall well-being of informal gig workers due to the Artificial Intelligence system. For examining the above aims, this research work employed a mixed-methods (*i.e.*, both qualitative and quantitative in nature) research approach, and for data analysis purposes, the study integrates both primary and secondary data sources. The study also furnishes some suggestions for necessary changes to technological advancements with employee well-being in the digital labour market of India.

The remainder of this paper is organized as follows. Section 2 relates to the study of the contemporary and traditional literature work on the field of Artificial Intelligence; Section 3 shows about the methodology and data collection plan, procedures; Section 4 presents the outcome and discussion; Section 5 concludes the study with policy suggestions and outlines the scope for future research.

Review of Literature:

Artificial intelligence is a basic element of digital labour platforms, which has transformed and reshaped the way work is allocated to workers and assessed throughout gig economies. Rosenblat and Stark (2016) showed that the Artificial Intelligence platforms have introduced novel principles related to organizations that significantly lean on automated matching, data information, decision-making, and algorithmic enhancements. These systems not only lower the cost of transactions but also reshape the connection between workers and Artificial Intelligence platforms. Lee *et al.* (2015) in their studies reveal that digital ecosystems promote a flexible workforce, while also establishing imbalanced power dynamics in which employees often lack a comprehensive understanding of the workings of algorithmic systems.

Algorithmic management has emerged as one of the most frequently discussed aspects of the work of the gig workers. Mateescu and Nguyen (2019) describe the characteristics of Artificial Intelligence, which, through automated oversight, assessment, distribution of labour, and algorithmic management, frequently diminishes the independence of workers and exposes them to unclear control mechanisms. Moore *et al.* (2018) in their research work show how to utilize Artificial Intelligence platforms to evaluate performance based on metrics such as response time, acceptance rate, customer reviews, and route optimization, all of which impact job distribution and income. The lack of transparency in AI systems leads to information imbalance, preventing workers from contesting unjust ratings from customers, penalties, as well as automated deactivations (Rosenblat, 2018). This situation leads to digital instability and diminishes the negotiating strength of the gig workers.

The crucial area of attention in literature is also

related to the income volatility due to algorithmically mediated work. Chen *et al*. (2019) pointed out that the fluctuating nature of pricing algorithms and the design to match supply according to demand for goods and services were major reasons for the unpredictable generation of income for gig workers. Several studies focus on how algorithmic incentive structures are frequently modified and also cause fluctuations in daily earnings and increasing financial uncertainty for gig workers (Rani and Furrer, 2021). The report of NITI Aayog -2022 proclaimed that platforms of the gig economy may provide short-term opportunities for earning income, but in the context of long-term income prospects, they remain volatile in nature due to commissions, inconsistent incentives, and rapidly changing platform policies. Further, this volatility is applied for informal workers who lack of access to savings, insurance policies, social security etc.

The literature also highlights increasing concerns about the surveillance in the workplace of gig workers in the platforms of Artificial Intelligence. Moore *et al.* (2018) find that digital monitoring tools used by AI platforms regularly collect vast amounts of information about gig workers (including their location, movement, behavioural patterns, and productivity indicators). Curchod *et al.* (2020) caution that digital monitoring practices often fuzziness the boundaries between efficiency and exploitation, loss of one's own privacy, and worker alienation. AI surveillance leads to the discipline of labour, as workers are continuously evaluated against algorithmic standards, with little negotiation or errors.

ILO reported in 2021 that developing countries are suffering inequality of digital platforms for gig workers due to limited access to smartphones, low digital literacy, a deficiency of technological skills, and inadequate internet connectivity, which leads to excluding many informal gig workers from participating fully in the AI platform-based labour markets. According to the report of IWWAGE-2023, women, rural migrants, and low-income groups face disproportionate disadvantage due to socio-economic gaps in the field of digital infrastructure. These inequalities decreased the potential of the gig economy to serve as an inclusive employment generator.

Literature is also gaining attention to regulating the relationship between Artificial Intelligence platforms and gig workers. De Stefano and Aloisi (2019) focused on recent developments such as the European Union's Platform Work Directive and debates around employee classification in the United States, which have given importance to the need for transparency, accountability, and formal social protection for AI-platform-based gig workers. Mehrotra (2021) argued about the absence of institutional safeguards for the informal gig workforce and suggested the need for stronger legal frameworks, transparency, accountability, data protection, earnings stability, and social welfare schemes for gig workers.

The literature overall reveals a dual narrative, with the first narrative associated with the technology that enhances efficiency, flexibility, and access to work, whereas the second narrative is related to producing new dimensions of precarity, surveillance, and inequality. Our study builds upon to examine how Artificial Intelligence platforms shape the lived experiences of informal gig workers in India and to identify necessary policy mechanisms to protect their rights and livelihoods.

METHODOLOGY

Our research work carries forward by using a mixed-method (i.*e.,* both quantitative and qualitative in nature) research approach to examine the impact of Artificial platforms on the gig workforce in the Indian economy. A mixed-method research design is assumed to be important here because AI-enabled platforms have two prospects: first, prospects related to quantitative measurement, such as income fluctuations or job possibilities; and second, prospects associated with the qualitative phenomenon, such as autonomy and control perceptions. Therefore, combining data collection procedures such as qualitative and quantitative research methods is followed to explore both the qualitative and quantitative aspects of the gig workers.

Secondary data sources include information derived from research studies, publications, industry white papers, and company policy documents related to gig economy platforms. Secondary data sources also include information from the India Gig and Platform Economy Report, the Periodic Labor and Force Survey, and data from various sources such as ILOSTAT, research studies, industry white papers, and publications related to gig economy platforms.

Data collection was conducted through a well-structured survey and semi-structured in-depth interviews with gig workers in major metropolitan cities in India (including Mumbai, Delhi, Bengaluru, Hyderabad, and

Kolkata). These cities have the highest concentration of platform-based labour and reflect diverse AI-driven management practices. A stratified random sampling (SRS) technique is conducted to ensure the representativeness of different categories of gig work, including ride-hailing, food delivery, domestic services, logistics, and digital freelancing. Each category of gig work was treated as a stratum, and workers from each stratum were randomly selected in proportion to their numbers in the urban gig workforce. This reduces sampling bias and ensures that heterogeneity within the gig economy is correctly captured.

The sample size for the quantitative survey was determined using Cochran's formula for large populations, as the exact number of gig workers in Indian metropolitan cities is fluid and constantly changing. The formula is:

$$n_0 = \frac{Z_2 \cdot p \cdot q}{e^2}$$

where:

- Z= Z-value for 95% confidence level (1.96),
- p= estimated proportion of the population (set at 0.5 to maximize sample size),
- q = 1 - p = 0.05,
- e= allowable margin of error (0.05).

Substituting these values:

$$n_0 = \frac{(1.96)^2 \cdot (0.5) \cdot (0.5)}{(0.05)^2} = 384.16$$

Therefore, the minimum number of required samples for the study would be 384. To account for non-response and partially completed questionnaires, the researcher increased the sample size to 420 gig workers. To gain qualitative perspectives for the study, the researcher hand-selected 35 gig workers for in-depth interviews based on well-articulated criteria, including platform use, levels of experience, and familiarity with algorithmic management.

Demographic profiles, digital tool usage, work experience, income patterns, rating systems for assigning tasks, incentive and penalty schemes in algorithms, and perceptions about fairness in AI systems were some of the aspects that the survey form sought to gather data about. Prior to actual field testing, the instrument was pre-tested among 25 individuals, and certain aspects were refined to reduce ambiguity in the survey.

The quantitative data of gig workers were analyzed through descriptive statistics. The chi-square (χ^2) test and the Pearson Correlation Coefficient were also employed to analyze the relationship between variables, including digital literacy, score, and work opportunities. Whereas the process involved the use of thematic coding techniques to systematically identify patterns related to privacy, autonomy, volatility, and the impact of Artificial Intelligence decisions for the qualitative analysis of data in this research work.

RESULTS AND DISCUSSION

In this study data have been collected from 420 respondents which is exceeding the minimum requirement of 384 respondents (derived using Cochran's sample formula). Increasing the sample size ensured our robustness against non-response and missing data. The qualitative subsample was purposively selected to capture gig workers experiences regarding ride-hailing, delivery, logistics, and home-service. These collection of data enriched the interpretation of statistical findings particularly with respect to algorithmic surveillance, autonomy loss, and income instability, which are recognized challenges in gig economies (Rosenblat and Stark, 2016; Wood *et al.*, 2019).

Regression Model Specification:

To empirically test the relationship between AI-mediated mechanisms and gig workers' earnings, an Ordinary Least Squares (OLS) model was estimated. The functional model is:

$$\text{Earning}S_i = \alpha + \beta_1 \text{AI\_Rating}_i + \beta_2 \text{Digital\_Literacy}_i + \mu_i$$

where:

- Earnings = average monthly income (INR)
- AI Rating = platform rating score (2–5 scale)
- Digital Literacy = self-assessed level (1–5 scale)
- μ_i= error term

Regression Results:

Although the expanded sample helps achieve a more precise estimate, the results from the regression analysis show that AI Rating is positively related and insignificant, whereas Digital Literacy is related and insignificant (Table 1). These results contradict the hypothesis that a greater platform rating or greater digital literacy abilities would positively impact earnings outcomes in AI-mediated gig work. The results confirm the apprehensions regarding opacity and a lack of linkages between performance and

Table 1 : Regression Output for Determinants of Gig Worker Earnings

Variable	Coefficient	Std. Error	t-Statistic	p-Value
Constant	15096.91	1111.67	13.58	0.000***
AI Rating	97.75	281.36	0.34	0.728
Digital Literacy	-175.83	168.66	-1.04	0.298

Source: Authors' Computation

pay that have been found in previous research regarding AI-mediated platform work (ILO, 2021).

Model Fit:

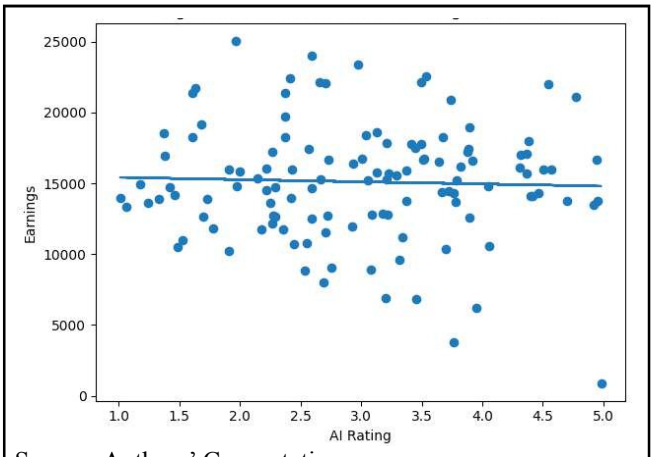
- $R^2 = 0.02$
- F-statistic ($p > 0.10$) – insignificant

Low R^2 indicates that the chosen variables related to AI explain just 2% of the variation in the variable' income,' emphasizing the fact that the earnings in the AI-mediated gig environment are driven more by the platform-level algorithms (dynamic pricing and penalty frameworks rather than the workers' attributes). This confirms the fact that the platforms capture the productivity gap while risk is transferred to workers (Prassl, 2018).

Diagnostic Tests and Model Validation:

Residuals are normally distributed with a slight tail departure. This adds to the validity of the OLS regression analysis. To verify the reliability of the statistical analysis conclusions, a series of diagnostic tests has been conducted.

According to the analysis in Fig. 1, there is evidence of a slight positive correlation between the AI Rating and earnings. On the contrary, the regression line appears almost flat, thus visually confirming the insignificant coefficient obtained during the statistical analysis. Specifically, a greater AI Rating does not correspond to a better job assignment. This corresponds with evidence regarding unclear algorithm matching processes. Referring to Fig. 2, analysis of the residual graph indicates that there are no major issues concerning linearity. In particular, there are significant heterogeneities in gig work regarding factors such as time-dependent incentives, platform surges, or algorithmic penalties that were not observed during the analysis. Fig. 3 also demonstrates that there are slight tail departures from a normal distribution regarding residual points, thus verifying the conclusions obtained during the OLS assumptions.



Source: Authors' Computation

Fig. 1 : Scatter Plot with Fitted Regression Line

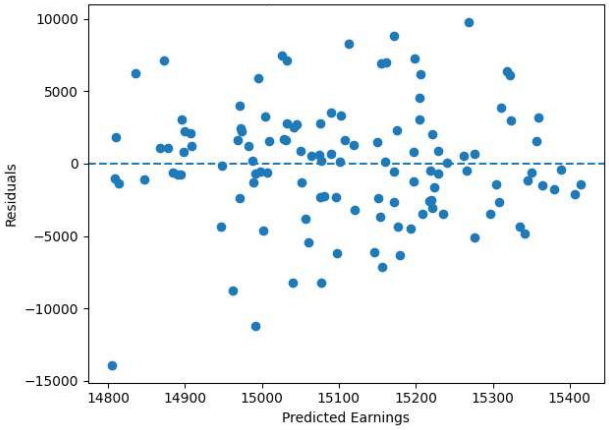


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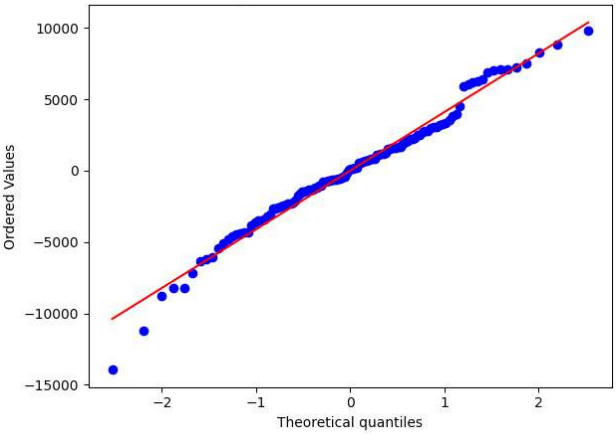
Fig. 2 : Residual Plot



Source: Authors' Computation

Fig. 3 : Q-Q Plot of Residuals

Integration with Qualitative Findings:

The qualitative interviews are crucial to understanding how AI Rating and Digital Literacy, the regression variables, failed to have any statistically significant effect on gig earnings. A common trend that emerged from these interviews was that ratings alone do not guarantee gig earners regular gig opportunities. Gig earners felt that, despite ratings being well above what platforms demanded, they are allocated tasks irregularly and to an extent that these tasks are substandard. This can be attributed to ratings being reward mechanisms and not something that earns gig earners what they get, beyond which it is entirely up to platform drive functionality and algorithmic systems, which are discretionary and opaque (Veen *et al.,* 2020).

Another key qualitative finding has to do with digital literacy and its unintended outcomes. Though digital literacy is generally understood to positively improve levels of productivity and pay, several participants reflected that higher levels of familiarity with applications on the platform led to increased levels of work pressure, rather than pay stability. Digitally proficient workers found themselves under increased levels of performance metrics, notifications on the system, and levels of complex task allocation. This resulted in digitally proficient workers being subject to higher levels of work pressure, rather than economic benefits. This would explain the negative—though statistically insignificant—result found in the coefficient for digital literacy in the regression analysis, and that digital literacy by itself is not an empowerment strategy in the management of algorithmically driven labor markets (Rani and Furrer, 2021).

Income instability was one of the most dominating themes that arose in the course of the interviews. The workers reiterated that their incomes vary significantly due to surge pricing, the withdrawal of incentives at short notice, algorithmic penalties, and demand cycles. The algorithms used by the platforms entirely regulate the above pricing and incentive schemes. This implies that the skills possessed by users have a negligible effect on their income outcomes. The above qualitative evidence supports the regression analysis that yielded insignificant explanatory power.

Lastly, the interviews established that the use of AI-based monitoring systems significantly reduced workers' autonomy because they were constantly tracked through the use of GPS and were required to follow specific working and resting patterns that impeded the ability to choose the routes they wanted to use, the hours they worked, and the resting hours. Most workers were also constrained through monitoring systems they perceived were coercive rather than supportive, and were thus a cause for stress and fear of being punished or deactivated. Such a control system also further damages the effort and payoff correlation since the workers work within strict algorithmic lines. Such evidence supports the platform labor studies that prove the AI-based labour management systems favor the former over the latter (Rani and Furrer, 2021; Veen *et al.*, 2020).

In a nutshell, the qualitative data provide strong validation of the thesis argument that earnings in the gig economy are, to a great extent, decided by AI-based management systems rather than being pegged to an individual's capabilities or performance. The qualitative data discussed the regression analysis to highlight the structural constraints under which gig economy workers labour in the absence of transparency within opaque and highly surveilled algorithmic systems.

Conclusion:

In the research, the impact that AI platforms have on the gig workforce in India is examined through a mixed-method design. It was found that AI has brought about greater availability of jobs and better task assignment and online payment services; nonetheless, it has increased the vulnerability of workers.

The quantitative findings reveal that individual-level variables such as rating or digital literacy do not play any significant role in determining earnings. On the contrary, the area of income is dominated by the platform-based variables of dynamic pricing, allocation, and penalties. The qualitative findings supplement this fact by revealing that a rating is no guarantee of continued access to work opportunities; the development of digital skills increases pressure to deliver more work; and AI-based surveillance reduces the autonomy of workers.

Policy Implications:

The outcomes of this research work emphasize the need for designing regulatory tools that take into consideration the regulations of AI platforms and the welfare of gig workers. Governments should have the task of demanding transparency and simultaneously accountability in algorithm guidelines that may address concerns regarding fair distribution of job opportunities, pricing, and rating. Issues regarding the low quality of

the standard of living of gig workers may be improved by ensuring a minimum payment system and certain benefit guarantees, as well as extending social security, which will include medical schemes, accident, and pension plans. Secure data privacy and one-to-one secure legislation must be provided that addresses unreasonable data monitoring by gig workers. Formulating gig worker associations is an urgent undertaking that aims at balancing digital platforms and gig workers.

Scope for Future Research:

Future research may develop this analysis based on available data and widen data collection areas. More complex research can be conducted on the impact of AI platforms and gig workers when comparing with other nations and other platforms based on the differing levels of regulation that exist. Another area of research is to explore gender-based alterations, psychological effects, and changes created by Artificial Intelligence.

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