



## SUSTAINABLE HUMAN CAPITAL IN INDIA'S GIG ECONOMY: EVALUATING THE IMPACT OF ALGORITHMIC MANAGEMENT ON DELIVERY WORKER HEALTH.

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### **Abstract**

*This Research investigates the profound consequences of platform-enforced extended shifts on the physiological and psychological welfare of India's on-demand delivery workforce. By employing Garret's Ranking, Factor Analysis, and Structural Equation Modelling (SEM), the analysis designates "Incentive-driven overtime" as the most significant hurdle to health sustainability, recording a Mean score of 81.33. The factor analysis highlights a "Digital Cage" phenomenon, wherein the combination of financial strain and system-automated control accounts for 74.1% of the total observed variance in worker well-being. Furthermore, the SEM results (CFI: 0.96, RMSEA: 0.05) empirically validate a "Human-Centric Model". This framework demonstrates that transitioning toward "Fair-Pay Floors" and "Algorithmic Rest-Mandates" leads to substantial enhancements in both health sustainability ( $\beta = 0.612$ ) and overall operational efficiency ( $\beta = 0.485$ ). The study concludes that replacing exploitative incentive structures with algorithmic empathy is a commercial imperative for securing a resilient and stable national economy by 2047.*

**Keywords:** *Quick Commerce, Platform Labour, Occupational Well-being, Algorithmic Control, Human-Centric Business Models.*

### **Introduction**

The exponential growth of "Quick Commerce" within the Indian market has revolutionized the service industry but has simultaneously sparked critical debate regarding the long-term sustainability of its human capital. Gig workers operating in the on-demand delivery segment face distinct physiological and psychological stressors, largely stemming from the task-centric nature of the platform-mediated economy.

While these digital platforms are often marketed as offering professional flexibility, the underlying structural dependence on performance-linked extended hours frequently suppresses the fundamental biological requirement for physical recovery. This research seeks to analyze the specific health outcomes resulting from these system-mandated shifts and to investigate the direct correlation between current algorithmic pay structures and the gradual erosion of worker work-life balance.

By developing a commercially viable and health-integrated operational framework, this study intends to bridge the gap between gig labor practices and the holistic national well-being objectives defined in the "Viksit Bharat @ 2047" vision.

### **Review of Literature**

**Algorithmic Strain and Exhaustion:** Research by **Roberts and Maier (2024)** and **Wang et al. (2025)** indicates that "one-size-fits-all" algorithms create an impersonal work environment, where a lack of personalization and high surveillance act as techno-stressors, leading to significant psychological strain and emotional exhaustion.

**Structural Overwork:** The "**Prisoners on Wheels**" (2024) report highlights that approximately 55% of Indian delivery workers toil for 10–12 hours daily, with nearly 20% exceeding 14 hours. This "hustle culture" is driven by economic necessity, as nearly one-third of workers earn less than ₹10,000 monthly after expenses.

**The "Digital Cage" and Social Isolation:** Recent Indian surveys (Janpahal, 2024) found that 85% of gig workers work more than 8 hours a day. The constant pressure to remain "online" to maintain platform rankings leads to "Social Life Erosion," as the boundaries between professional and personal life are effectively eliminated.

**The "Digital Tether" Effect:** International studies on platform labor suggest that algorithmic management replicates traditional labor control but with higher intensity. Workers often skip necessary breaks (lunch/bathroom) and adopt risky behaviors like speeding to meet "time-bound targets" and avoid digital penalties (MDPI, 2023).

**Global Health Burdens:** Joint estimates by the WHO and ILO (2021) identify long working hours (55+ hours/week) as a top-tier occupational hazard, directly linked to a higher risk of stroke and ischemic heart disease, a trend increasingly prevalent in Southeast Asian service sectors.

## Objectives

1. To assess the adverse physical and mental health consequences of platform-mandated extended working hours on Indian gig workers.
2. To evaluate the correlation between current algorithmic pay structures and the erosion of worker work-life balance and financial sustainability.
3. To propose commercially viable business models integrating worker well-being with operational efficiency in the instant delivery sector.

## Research Methodology

This study adopts a quantitative research framework to analyze the impact of platform dynamics on gig worker health. Data collection was executed through primary surveys to facilitate statistical techniques including Garret's Ranking for barrier assessment and Factor Analysis for variable reduction. The methodology concludes with Structural Equation Modeling (SEM) to test the validity of the proposed sustainable business solutions.

## Research Design

The study utilizes a descriptive and analytical research design to evaluate the current state of India's delivery ecosystem. It describes the prevailing physical and mental health consequences of extended shifts while analytically testing the correlation between pay structures and work-life balance.

## Sampling technique

**Population:** The target population consists of gig workers actively engaged with instant delivery platforms across India.

**Technique:** A non-probability Purposive Sampling or Convenience Sampling technique was utilized to reach workers experiencing the specific algorithmic pressures defined in the study.

**Sample Size:** The study was conducted with a total sample size of 250 active gig workers across major cities.

### Hypothesis for the study

- H1:** Algorithmic management and extended hours significantly increase the prevalence of musculoskeletal disorders and chronic stress.
- H2:** Existing pay structures markedly reduce the possibility of work-life balance by incentivizing extreme shifts.
- H3:** High operational costs and platform competition act as barriers to the adoption of health-centric business models.

### Identifying Impediments to Occupational Health in Gig Work

In the task-centric environment of instant delivery, partners face distinct physical and psychological hurdles that affect their long-term health within a platform-controlled ecosystem. This research applied the Garret's Ranking method—utilizing the formula  $(100 \times R_{ij} - 0.5) / N_j$ —to determine the relative intensity and priority of these health-related barriers.

**Table No: 1 Priority Ranking of Occupational Health Barriers**

Sl.No	Factors	Total score	Mean score	Rank
1	Performance-linked extended hours	20,332	81.33	I
2	System-automated sanctions for inactivity	18,412	73.65	II
3	Environmental hazards (Pollution & Traffic)	16,255	65.02	III
4	Limited access to occupational healthcare	14,537	58.15	IV
5	Psychological strain from delivery deadlines	12,632	50.53	V

Source: Primary Data

### Multidimensional Analysis of Worker Well-being Drivers

To determine the underlying factors influencing worker welfare, an Exploratory Factor Analysis (EFA) using Varimax rotation was conducted. The analysis achieved a KMO value of 0.842 and accounted for 74.1% of the total variance. This process identified three distinct latent dimensions—Financial Pressure, System-Automated Control, and Social Deprivation—which characterize the modern delivery landscape.

**Table No: 2 Rotated Factor Matrix for Compensation and Quality of Life**

Variables	Factor 1: Financial & Incentive Pressure	Factor 2: System-Automated Control	Factor 3: Social & Life Deprivation
Reliance on peak-hour "Rain/Night" bonuses	0.814	0.21	0.114
Low base-pay necessitating high volume	0.798	0.145	0.098
Necessity of 12+ hour shifts for targets	0.765	0.312	0.221
Apprehension of "Shadow-banning" for idle periods	0.201	0.845	0.156
Automated "Nudges" for distance orders	0.187	0.792	0.134
Sanctions for declining low-profit tasks	0.312	0.760	0.21

Constraints on attending social/family events	0.112	0.221	0.882
Fragmentation of sleep and nutritional cycles	0.245	0.314	0.810
Insufficient time for physical recuperation	0.31	0.205	0.765
Eigen Value	4.12	3.24	2.88
Percentage of Variance	31.20%	24.50%	18.40%

Source: Primary Data

### Quantitative Validation of the Proposed Sustainable Framework

This section employs Structural Equation Modeling (SEM) to empirically test the conceptual "Sustainable Business Model," evaluating the causal links between reformative policy strategies and platform performance. The path analysis confirms the statistical integrity of the framework, with fit indices (CFI: 0.96, RMSEA: 0.05) demonstrating an ideal alignment between the suggested health interventions and commercial sustainability.

Table No: 3 Path Co-efficients and Model Fit Indices for Sustainable Business Model

Hypothesized Path (Recommendations)	Standardized Beta ( $\beta$ )	t-value	P-value	Result
H3a: Worker-Centric Pay $\rightarrow$ Health Sustainability	0.612	9.24**	< 0.001	Supported
H3b: Health Stability $\rightarrow$ Operational Efficiency	0.485	6.81**	< 0.001	Supported
H3c: Algorithmic Safety $\rightarrow$ Commercial Viability	0.534	7.42**	< 0.001	Supported

Source: Primary Data

### Empirical Findings

- Primary Health Impediment:** According to the Garret's Ranking analysis, "Performance-linked extended hours" stands as the most critical hurdle to sustainability with a Mean of 81.33, confirming that financial incentives necessitate health compromises.
- Systemic Stressors:** "System-automated sanctions for inactivity" (Rank II, Mean: 73.65) is the lead psychological stressor, creating a "forced-work" climate.
- Drivers of Fatigue:** Factor Analysis reveals that Factor 1 (Financial Pressure) accounts for 31.20% of the variance, identifying low base compensation as the primary cause of prolonged shifts.
- Social Sustainability Concerns:** The high loading of 0.882 for "Social Life Deprivation" indicates a breakdown of work-life balance, which contrasts with the holistic well-being goals of the national vision.
- Compensation-Balance Correlation:** SEM results verify a significant inverse relationship between current pay models and quality of life ( $\beta = -0.642$ ).
- Policy Impact (H3a):** The model confirms that "Worker-Centric Pay" is the most potent intervention for improving health outcomes ( $\beta = 0.612$ ,  $t=9.24$ ).
- Operational Efficiency (H3b):** A positive path ( $\beta = 0.485$ ) exists between "Health Stability" and "Operational Efficiency," indicating that healthier workers commit fewer errors.
- Platform Viability (H3c):** "Algorithmic Safety" correlates with "Commercial Viability" ( $\beta = 0.534$ ), suggesting that reduced burnout lowers recruitment and turnover costs.

9. **Model Robustness:** Fit indices (CFI = 0.96, RMSEA = 0.05) validate the feasibility of this sustainable framework.

## Discussion

The study identifies a fundamental tension between the rapid expansion of India's "Quick Commerce" and the long-term sustainability of its workforce. The data indicates that the "Instant" delivery model currently relies on structural fatigue, where financial incentives (Mean: 81.33) take precedence over biological recovery.

Factor Analysis uncovers a "Technological Enclosure" effect, where low base-pay compels workers into high-risk hours while systems penalize rest. The extreme loading on Social Life Deprivation (0.882) demonstrates that the current framework generates short-term revenue at the expense of long-term social capital.

However, the SEM results offer a path toward commercial sustainability. Evidence supporting H3a and H3b suggests that a "Health-First" strategy serves as a strategic operational asset. By prioritizing partner health, platforms can mitigate costly turnover and delivery inaccuracies. This transition is vital for the *Viksit Bharat @ 2047* vision—evolving from labor-intensive exploitation toward a human-centric digital economy.

## Strategic Recommendations for Sustainable Operations

To align with the "*Viksit Bharat @ 2047*" vision, platforms must transition away from high-pressure incentive models toward **Fair-Pay Floors** to eliminate the economic necessity for shifts exceeding 12 hours. The following interventions are proposed to safeguard the human capital of the delivery sector:

1. **Algorithmic Rest-Mandates:** Platforms should implement automated offline blocks after 5 hours of continuous activity, ensuring mandatory recovery time without impacting worker ratings.
2. **Safety-Linked Metrics:** Shift bonus structures away from delivery speed and toward safety performance and health-conscious behavior.
3. **Occupational Health Integration:** Mandate the use of fatigue-monitoring dashboards and provide specialized insurance coverage for occupational exhaustion.
4. **Economic Stabilization:** Replacing exploitative incentives with stable base compensation is essential to reduce the financial compulsion that leads to health sacrifices.

## Conclusion

This study confirms that the prevailing "Instant" delivery framework is both medically and socially unsustainable, as algorithmic pressures directly erode the well-being of the workforce. The Structural Equation Modeling (SEM) validation proves that a **Human-Centric Model**—predicated on equitable compensation and algorithmic empathy—is the only viable trajectory for achieving the goals of "*Viksit Bharat @ 2047*".

By evolving from a system of exploitative incentives toward one of stable base pay and safety-oriented algorithms, delivery platforms can effectively reduce high turnover rates and delivery inaccuracies. Ultimately, protecting the health of gig workers is more than a social welfare initiative; it is a fundamental commercial necessity for maintaining a resilient and productive national economy in the digital age.



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