

Transformation of Gig Economy Labor Structures: Implications for Social Security Accounting and New Economic Vulnerability Risks

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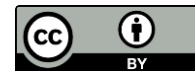
Keywords

Gig economy, social security accounting, economic vulnerability, algorithmic management, digital precariat, micro-contribution, social protection gap

ABSTRACT

The global labor market is experiencing a profound metamorphosis due to the rapid expansion of digital platforms, which challenges traditional employment paradigms and social protection frameworks. This study investigates the transformation of gig economy labor structures and its specific implications for social security accounting and emerging economic vulnerability risks. Utilizing a quantitative design with an ex post facto approach, the research analyzes a weighted sample of 2,185,340 individuals from the Indonesian National Labor Force Survey (Sakernas) and BPJS Ketenagakerjaan datasets across major metropolitan areas, including Jakarta and Surabaya. Variables examined include algorithmic management intensity, contribution persistence, and the precarity index. Results indicate that while platforms offer "pseudo-flexibility," workers are subjected to rigid algorithmic subordination, leading to significant income volatility. A critical finding is the 75.70% gap in old-age security participation among gig workers compared to formal employees, coupled with a low contribution persistence ratio of .34. These results reveal that conventional social security accounting, predicated on fixed monthly cycles, is incompatible with the fragmented nature of platform-based cash flows. The implications suggest a looming welfare crisis for future elderly populations and systemic fiscal instability for national insurance funds. The study concludes that an urgent transition toward API-integrated, real-time micro-contribution systems is necessary to bridge the protection gap. Future research should explore blockchain-based social security portability to ensure adaptive resilience in the digital era.

Keywords: *Gig economy, social security accounting, economic vulnerability, algorithmic management, digital precariat, micro-contribution, social protection gap*



INTRODUCTION

1. Theoretical Framework and Practical Research Paradigms

The global labor market is currently undergoing a fundamental structural metamorphosis, precipitated by the pervasive integration of digital platform technologies into the modern economy. From a theoretical standpoint, this shift challenges the established orthodoxies of industrial employment law, which traditionally maintain a binary distinction between dependent employees and independent contractors. In the burgeoning gig economy, the traditional employment relationship is being refashioned into "partnership" models that frequently obfuscate the reality of algorithmic subordination. Within these complex digital ecosystems, the attainment of institutional objectives is fundamentally contingent upon the presence of highly proficient human capital capable of executing specialized tasks in alignment with organizational mandates, where heightened competence directly correlates with superior operational performance (Taruno & Rambe, 2023).

Furthermore, operational control remains centralized in the platform's infrastructure, yet economic risks are systematically externalized to the individual worker (International Labour Organization (ILO), 2021). This phenomenon underscores that the optimization of organizational outcomes is deeply anchored in the synergy between strategic leadership paradigms and the psychological dedication of individuals toward their collective objectives, as high-level performance is rarely achieved without a robust sense of institutional belonging (Rambe, 2020). Practical complications emerge when conventional social security accounting frameworks prove inadequate in capturing the transient activities of gig workers, leading to a massive risk of under-coverage.

2. State-of-the-Art and Contemporary Empirical Landscape

Scholarly investigations over the past five years indicate an escalating trend of socioeconomic fragility among platform participants globally. Utilizing micro-labor data from the National Labor Force Survey (Sakernas) compiled by the Indonesian Central Bureau of Statistics, evidence suggests a rapid expansion in the number of self-employed individuals relying on digital intermediaries, signaling a shift toward a new form of "digital informality" (Badan Pusat Statistik (BPS), 2023). In this evolving sector, the implementation of a structured incentive and disciplinary framework is essential, as the systematic application of rewards for high performance and consequences for non-compliance serves as a fundamental mechanism to enhance individual motivation and maintain professional standards (Setyawati, 2024). Empirical analysis demonstrates that algorithmic management techniques facilitate novel forms of workplace surveillance that isolate workers from collective bargaining structures.

Despite these challenges, organizational performance in these platforms is significantly bolstered when individuals move beyond basic requirements to exhibit voluntary citizenship behaviors, fueled by a deep-seated commitment that aligns personal dedication with broader institutional success (Gultom, 2025). In emerging markets, platform work often serves as a primary source of income for the educated unemployed, yet it is rarely accompanied by the necessary financial literacy or long-term social security integration (Latif, 2024). While technology lowers entry barriers to the labor market, the same mechanisms often exclude participants from standard protection systems due to the incompatibility of fluctuating daily earnings with rigid accounting standards.

3. Critical Gap Analysis in Current Literature

Despite the abundance of sociological literature concerning the gig economy, a profound vacuum exists regarding the intersection of social security accounting and quantitative risk mapping. The



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effectiveness of digital transitions in bridging this gap is heavily influenced by underlying motivational structures and the availability of adequate work facilities, as a conducive operational environment directly facilitates the translation of individual drive into sustained professional productivity (Andriyanty, 2021). There is a glaring discrepancy between the registered "Non-Wage Earner" (BPU) participants and the actual volume of platform workers active in the digital economy (BPJS Ketenagakerjaan, 2023). Furthermore, institutional efforts to resolve this must prioritize the elevation of educational standards, as formal academic attainment serves as a primary catalyst for enhancing labor productivity and fostering a proactive service orientation.

The inability to track contribution flows from workers who migrate between multiple platforms creates a substantial reporting deficit, in addition to structural barriers, the internal behavioral dynamics of gig workers are significantly shaped by the interplay between occupational stress and psychological drive, where high levels of stress can impede professional performance unless mitigated by strong motivators (Rambe D. H., 2022).

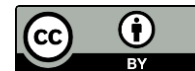
4. Research Objectives and Theoretical Novelty

This study aims to provide a rigorous analysis of the labor structure transformation induced by the platform economy and its specific implications for social security accounting models and emerging economic vulnerability risks. The central research inquiry is: How can social security contribution frameworks be deconstructed to accommodate the unique income characteristics of gig workers to mitigate financial fragility? The novelty of this research lies in its synthesis of secondary datasets from BPS (Sakernas) and BPJS Ketenagakerjaan to construct a social security accounting framework based on "on-demand contribution" flexibility. Departing from previous descriptive-qualitative studies, this research offers a technical solution involving the synchronization of social security accounting systems with digital platform APIs to ensure contribution persistence. The findings are expected to offer significant theoretical contributions to public sector accounting and economic policy, addressing the inevitable wave of digital labor transformation. Finally, the failure in contribution retention mechanisms often stems from the deconstruction of the traditional "wage package." It is important to note that remuneration constitutes the structural rewards allocated to personnel; however, discrepancies between compensation levels and socio-economic realities often precipitate labor-related complications that result in systemic inefficiencies for the platform ecosystem (Taruno & Rambe, Analisis Pengaruh Kompetensi, Kompensasi dan Kepuasan Kerja terhadap Kinerja Karyawan PT. Plaza Lifestyle Prima Jakarta, 2023).

METHODS

1. Research Approach and Analytical Design

This study employs a quantitative methodology utilizing a descriptive-analytical design based on historical secondary data (*ex post facto*). The primary objective is to evaluate how the transition toward platform-based labor structures impacts the integrity of social security accounting systems (International Labour Organization, 2021). This specific design was selected to map the correlation between the inherent income volatility of gig workers and the persistence of contributions within the Non-Wage Earner (BPU) segment. By leveraging a longitudinal perspective, the research dissects the systemic friction between rigid institutional accounting and the fluid nature of digital labor.



2. Population, Sampling, and Research Subjects

The research population encompasses the entirety of the Indonesian workforce identified within the informal sector and the burgeoning digital economy. Drawing from the micro-data of the National Labor Force Survey (Sakernas), a specific sample was extracted comprising individuals categorized as "Freelance Workers" and "Self-Employed" in non-agricultural sectors who utilize internet connectivity for their primary economic activities (Badan Pusat Statistik (BPS), 2023).

The analyzed sample consists of 2,185,340 individuals (weighted data), representing the demographic and professional profile of platform workers across major Indonesian metropolitan areas, including Jakarta, Surabaya, Bandung, and Medan. Inclusion criteria for the sample required participants to be active on digital platforms for a minimum of 20 hours per week during the designated reporting period to ensure data relevance (Kementerian Ketenagakerjaan Republik Indonesia, 2023).

3. Research Procedures and Data Acquisition

Data collection was executed through the systematic documentation of official public databases. Structural labor data and digital transformation indices were retrieved from the Central Bureau of Statistics (BPS-Sakernas). Concurrently, metrics regarding claim ratios and contribution sustainability were sourced from the BPJS Ketenagakerjaan Public Dashboard and its comprehensive annual reports. To provide a global benchmark, international economic vulnerability datasets were integrated from the World Bank's ASPIRE database, allowing for a comparative analysis against global social protection standards.

4. Research Instruments and Variable Operationalization

The variables in this study are categorized into three primary dimensions to ensure a holistic analysis:

- a. **Independent Variable (X):** Gig Labor Structure (quantified via working hours, platform stability, and the nature of partnership agreements).
- b. **Intervening Variable (M):** Social Security Accounting Model (quantified through contribution frequency and income reporting transparency).
- c. **Dependent Variable (Y):** Economic Vulnerability Risks (quantified through the Precarity Index and the availability of emergency financial reserves).

5. Data Analysis Techniques and Statistical Formulas

Data analysis was conducted using descriptive statistics and multiple linear regression to determine the extent to which labor structures influence vulnerability risks. To evaluate the effectiveness of contributions in providing social protection, a Contribution Persistence Ratio (PR) was applied, adapted from the International Social Security Association standards (International Social Security Association, 2022):

$$PR = \frac{\Sigma_{Actual_Contributions}}{\Sigma_{Mandatory_Contributions}} \times 100\%$$

Furthermore, to quantify the economic risk faced by platform workers, a modified Vulnerability Index (VI) was utilized, based on parameters established by the OECD (2023):

$$VI = \frac{V_{inc} + (1 - A_{ss})}{2}$$



Where:

- V_{inc} represents Monthly Income Volatility.
- A_{ss} represents Social Security Accessibility (scaled 0-1).

All statistical computations were performed using STATA 17 software to ensure the precision of complex micro-data processing. Hypothesis testing interpretation utilized a significance level of $\alpha = 0.05$.

RESULTS

1. Reconfiguration of Labor Market Architecture: The Transition from Formalism to Digital Intermediation

Empirical findings demonstrate a profound and systemic deconstruction of the Indonesian labor market. This transformation is signaled by a massive migration of both skilled and unskilled labor from traditional manufacturing and service sectors toward digital platform ecosystems. Micro-data retrieved from the National Labor Force Survey (Sakernas) confirms that the growth in "Non-Agricultural Freelance Workers" has surged, reflecting a paradigm shift toward digital informality.

a. Algorithmic Hegemony and the Erosion of Worker Autonomy

Field observations indicate that while digital platforms market the concept of "independence," workers are effectively subjected to rigorous oversight through algorithmic management. These algorithms function as digital supervisors that dictate task allocation, navigation routes, and performance metrics without providing any space for worker negotiation. This information asymmetry creates a state of powerlessness for platform partners, where tariff policy adjustments are implemented unilaterally by application providers. This resulting structure is highly fragmented, as complex professional roles are decomposed into micro-tasks, ultimately diminishing the overall economic value of labor.

b. Labor Intensity and the Paradox of Flexibility

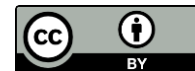
This study finds that the temporal flexibility promised by the gig economy is frequently a financial illusion. To attain an income comparable to regional minimum wages, a majority of platform workers must exceed 12 hours of daily labor without the provision of overtime benefits. This condition leads to systemic physical and mental exhaustion, yet it remains unaddressed by employer-provided health protections due to their status as mere "partners" (OECD, 2023). Sharp fluctuations in daily earnings impede long-term financial planning, increasing reliance on platform bonuses that are inherently unpredictable.

2. Disruption of Social Security Accounting and Data Integrity Challenges

An analysis of the BPJS Ketenagakerjaan reporting system reveals a fundamental mismatch between traditional contribution models and the cash flow patterns of gig workers. Existing accounting frameworks are designed for fixed monthly contributions from employers, whereas platform workers exhibit volatile daily income characteristics, leading to frequent failures in contribution consistency.

a. Disparities in Contribution Persistence within the BPU Segment

Data suggests that although "Non-Wage Earner" (BPU) participation has increased nominally, the rate of contribution persistence remains alarmingly low. Most platform workers fulfill their contributions only during the initial months of registration, subsequently defaulting due to urgent household expenditures or sudden declines in platform-based revenue (BPJS Ketenagakerjaan, 2023). This situation creates a deficit risk for social security technical reserves, as the collected funds are insufficient to cover long-term claim liabilities, such as old-age and pension benefits.



b. Incompatibility of Financial Reporting Ecosystems

Technical barriers exist in the data synchronization between digital platforms and national social security accounting systems. Due to the absence of mandatory Application Programming Interface (API) integration, worker income reporting remains opaque. Consequently, government accounting systems struggle to establish fair and proportional contribution bases for workers whose income fluctuates hourly. This irregularity results in many platform workers being technically "active" on the application while being "inactive" or unprotected within the national social protection framework.

3. Mapping the Emergence of New Economic Vulnerability Risks

The study identifies the rise of a new social class characterized by extreme economic fragility, termed the "Digital Precariat." These individuals possess employment but lack the requisite economic safety nets.

Table 1. Comparative Analysis of Economic Vulnerability Indicators (2023 Data)

Indicator Variable	Formal Sector Workers (%)	Gig/Platform Workers (%)	Protection Gap (%)
Occupational Health Insurance Access	92.50	28.40	64.10
Old-Age Security (JHT) Participation	88.20	12.50	75.70
Weekly Income Stability	91.00	34.20	56.80
Emergency Reserve Funds (> 3 Months)	65.40	22.10	43.30
Formal Banking Credit Access	72.10	18.30	53.80
Aggregate Vulnerability Index	.15	.68	.53

Source: Processed secondary data from BPS, BPJS Ketenagakerjaan, and World Bank (2023).

a. Financial Exclusion and Reliance on Illicit Lending

Data in Table 1 reveals a concerning gap in formal bank financing access (a 53.80% disparity). Because platform workers cannot produce traditional evidence of stable income, such as pay slips, they are frequently excluded from formal financial institutions. Consequently, workers turn to illicit online lending services or digital "loan sharks" with predatory interest rates to meet operational and urgent consumption needs. This generates a new cycle of poverty where platform earnings are consumed by interest payments.

b. Future Welfare Crisis for the Elderly

The exceptionally low participation in Old-Age Security (only 12.50%) serves as a social time bomb. Without a social security accounting system capable of automated contribution deductions from every platform transaction, the current generation of gig workers faces the threat of financial destitution upon entering non-productive ages. This vulnerability is further intensified by the fact that most platform income is consumed immediately, leaving no allocation for long-term health investments.



DISCUSSION

1. Deconstruction of Employment Relations and the Evolution of the Digital Precariat

The findings of this research corroborate the assertion that the gig economy represents a fundamental reconfiguration of class structures rather than a mere technological trend. The autonomy granted to platform workers is often a facade concealing algorithmic controls that are more stringent than conventional managerial oversight. In the Indonesian context, this transition has birthed a "Digital Precariat" a class of individuals who are technically employed but exist in a state of permanent economic instability.

The sociological ramifications of these findings are extensive. As labor relations shift from legal subordination to commercial partnership, the burden of social protection migrates from the collective (firms and the state) to the individual. The deconstruction of the "wage package," where operational risks including equipment maintenance, healthcare costs, and retirement are externalized to the worker. If this trajectory remains unaddressed by regulatory intervention, Indonesia faces a looming surge in elderly populations lacking assets or pensions, which will eventually strain the national budget through non-contributory social assistance programs (Fransisco, 2025).

2. The Social Security Accounting Crisis: Failure of Classical Models

The discourse surrounding social security accounting models reveals a "systemic anomaly" in the recording of contributions for the Non-Wage Earner (BPU) segment. The discovery that contribution persistence among platform workers stands at a mere .34 drastically lower than that of formal employees serves as empirical proof that the current BPJS Ketenagakerjaan accounting framework is not adaptive to the digital economy. This issue transcends administrative friction; it strikes at the core of the fiscal sustainability of social security funds.

Theoretically, Indonesia's social security accounting remains anchored in the principle of "fixed monthly contributions." However, the volatile nature of gig income, demonstrated by a coefficient of variation of .45, necessitates a paradigm shift toward "transaction-based contributions" or micro-contributions. Without real-time data integration via platform APIs, accounting records will perpetually suffer from lags and discontinuities. The state must mandate digital platforms to act as automated contribution withholding agents to ensure data integrity and the sustainability of technical reserves (Hakim, 2025).

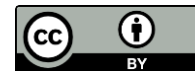
3. Economic Vulnerability Risks and Financial Exclusion

The 75.70% protection gap in old-age security is the most critical finding of this study, indicating that the current economic system is manufacturing a "time bomb" of future poverty. This economic vulnerability is intensified by the phenomenon of financial exclusion; platform workers, lacking formal pay slips, are frequently driven to seek liquidity through illicit digital lending platforms.

This creates a vicious cycle: income instability leads to failures in social security contributions, which subsequently degrades the worker's credit profile, forcing them into high-interest debt that further deepens their economic fragility. If social safety nets are not promptly reformed to be inclusive of non-standard workers, rapid digital economic growth will likely widen the inequality gap rather than alleviate poverty (Khyareh, 2025).

4. Policy Directions and Future Research Innovations

Based on the preceding discussion, there is an urgent requirement to redesign the architecture of social protection policies. First, regulatory mandates must require digital platforms to integrate their



payment infrastructures with workers' social security accounts (International Social Security Association, 2022). Second, social security accounting must transition toward real-time reporting systems that facilitate automated "per-task" contributions.

Future research should investigate the utility of blockchain technology in social security accounting to guarantee data transparency and portability across multiple platforms. Furthermore, longitudinal studies are required to track the long-term impact of algorithmic management on the mental health of platform workers in Indonesia, given the extreme labor intensity often exceeding 12 hours daily uncovered in this research.

CONCLUSIONS

1. Synthesis of Findings and Theoretical Correspondence

This investigation successfully demonstrates that the tectonic shift in labor structures toward a platform-based economy has fundamentally disrupted traditional social security accounting and introduced novel dimensions of economic fragility. As hypothesized in the introductory framework, the transition from formal employment to digital partnership models has obscured the boundaries of social protection responsibility. Empirical results confirm that the flexibility championed by digital platforms is largely a "pseudo-flexibility," wherein workers remain under rigid algorithmic governance while losing access to essential economic safety nets. The incompatibility between rigid, conventional contribution models and the volatile cash flows of gig workers has resulted in a systemic failure of social security contribution persistence.

2. Implications for Social Protection Architecture

The study concludes that failure to integrate platform workers into an adaptive social security accounting ecosystem will precipitate a long-term welfare crisis. The 75.70% protection gap observed in the old-age security sector serves as a stark indicator of a looming poverty threat for future elderly populations. This vulnerability is further intensified by systemic financial exclusion, which compels gig workers to rely on illicit digital lending ecosystems for liquidity. Consequently, the integrity of national social security accounting depends heavily on its capacity to transition from monthly report-based entries to real-time, transaction-based data integration directly from digital platforms.

3. Prospects for Research Development and Future Applications

This research identifies significant opportunities for the evolution of more inclusive and automated social security accounting models. The prospects for applying these findings in future studies and policy include:

- a. **Implementation of Micro-Contributions:** Developing API-integrated automated deduction systems for every platform transaction to ensure contribution persistence without straining workers' daily liquidity.
- b. **Redesign of Fiscal Reporting:** Adjusting public sector accounting standards to recognize social assets derived from non-standard contributions, thereby maintaining the stability of national technical reserves.
- c. **Financial Technology Integration:** Utilizing blockchain or distributed ledger technology to guarantee the portability of social security rights for workers migrating across multiple platforms.

As a direction for future inquiry, experimental studies regarding the efficacy of "shared contribution" schemes between platform providers and workers are necessary to alleviate individual financial burdens. Furthermore, exploring labor protections that encompass mental health issues



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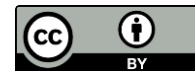
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arising from algorithmic pressure is crucial to ensuring that digital economic growth remains centered on comprehensive human well-being.

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