

Measuring Digital Inclusiveness and Its Impact on Gender Inequality for Women

Dhea Rizky Amelia¹, I'tishom Al Khoiry², Nurul Aini³, Nanang D. Praatmana⁴, Caraka Hadi⁵

^{1,4,5}Faculty of Economics and Business, Universitas Negeri Semarang

²Faculty of Economics and Business, Universitas PGRI Semarang

³Directorate of Population & Social Security, Indonesian Ministry of National Development Planning
email: dhearizkyamelia@mail.unnes.ac.id

ABSTRACT

This study investigates whether digitalization reduces or reinforces the gender gap in working hours in Indonesia. Using the 2023 National Labor Force Survey (SAKERNAS) and the Oaxaca–Blinder decomposition approach, it compares the working hour disparities between men and women in both digital and non-digital employment. The findings reveal that the gender gap in working hours is relatively smaller in the digital sector and is largely explained by observable characteristics such as education, formal employment, and training. In contrast, a significant portion of the gap in the non-digital sector remains unexplained, indicating strong influences of social norms and structural biases. These results suggest that digitalization can enhance women's labor market inclusion if supported by affirmative policies that improve access to technology and training. Meanwhile, the non-digital sector still requires broader structural reforms to achieve gender equality in working hours.

Keywords: Digitalization; Gender; Working Hours; Digital Employment; Oaxaca–Blinder

ABSTRAK

Penelitian ini menganalisis apakah digitalisasi memperkecil atau memperbesar ketimpangan jam kerja antara laki-laki dan perempuan di Indonesia. Dengan menggunakan data Survei Angkatan Kerja Nasional (SAKERNAS) 2023 dan pendekatan Oaxaca–Blinder Decomposition, studi ini membandingkan kesenjangan jam kerja pada kelompok pekerja digital dan non-digital. Hasil menunjukkan bahwa kesenjangan jam kerja di sektor digital relatif lebih kecil dan sebagian besar dapat dijelaskan oleh perbedaan karakteristik individu, seperti pendidikan, pekerjaan formal, dan pelatihan. Sementara itu, di sektor non-digital, sebagian besar kesenjangan bersifat tidak terjelaskan, mencerminkan kuatnya pengaruh norma sosial dan bias struktural. Temuan ini menunjukkan bahwa digitalisasi berpotensi mendorong inklusi perempuan dalam dunia kerja jika disertai kebijakan afirmatif yang memperkuat akses terhadap teknologi dan pelatihan. Sebaliknya, sektor non-digital tetap membutuhkan reformasi struktural yang lebih menyeluruh untuk mencapai kesetaraan gender dalam jam kerja.

Kata kunci: Digitalisasi; Gender; Jam Kerja; Oaxaca-Blinder

Introduction

In the past two decades, digital transformation has profoundly reshaped global labor markets, simultaneously generating new employment opportunities and presenting challenges to achieving gender-equitable labor outcomes. Digital technologies have not only broadened the range of occupational types but also introduced temporal and spatial flexibility through work arrangements that are not necessarily contingent on physical presence or fixed schedules. Within theoretical discourse, digitalization is frequently positioned as a catalyst for women's economic empowerment. Nevertheless, further empirical inquiry is warranted to understand the extent to which digitalization contributes to improving women's status in the labor market, particularly

with regard to working hours and their equitable distribution or whether it reinforces pre-existing gender disparities.

A growing body of literature suggests that digital work flexibility may enhance female labor force participation, especially among those bearing dual domestic responsibilities (Chung & Van der Lippe, 2020; Wood et al., 2019). In this context, digital-based work is often considered capable of accommodating women's simultaneous roles as income earners and household managers. Nonetheless, the quality and sustainability of digital jobs for women remain contested, largely due to their overrepresentation in low-paid, precarious, and short-term employment (Sorgner et al., 2017).

Digitalization has also contributed to labor market segmentation, placing women in structurally vulnerable positions. This phenomenon is exemplified by the increasing involvement of women in platform-based or gig economy jobs, which, while offering flexibility, tend to lack robust labor protections and income stability. In Indonesia, the female labor force participation rate remains at approximately 53%, significantly lower than the male participation rate of over 80% (BPS, 2023). Such disparities exacerbate the incidence of time-related underemployment among women, who often work fewer hours not by preference but due to structural constraints, such as caregiving burdens and discriminatory practices (Hunt & Samman, 2019; Graham et al., 2017; ILO, 2020).

Despite the income-generating potential of digital work, empirical evidence indicates that gender-based wage disparities persist even within ostensibly neutral, technology-mediated labor systems. In the Indonesian context, the urgency of this issue intensifies when considering the situation of women-headed households, who frequently face heightened economic pressures while being constrained in their labor participation due to dual roles and limited working time. This highlights the importance of investigating how household headship status affects women's vulnerability to restricted working hours within an increasingly digital employment landscape.

Against this backdrop, the present study aims to examine gender disparities in working hours by comparing male and female workers in digital and non-digital employment contexts. Specifically, it assesses whether digitalization serves to narrow or widen the gender gap in working hours. Employing a quantitative approach using the Oaxaca–Blinder decomposition technique, the study seeks to determine the extent to which observed disparities are attributable to measurable individual characteristics (explained) versus unmeasured factors (unexplained), including the potential influence of structural discrimination within digital labor markets.

Theoretical Framework and Literature Review

This study draws upon three key theoretical perspectives to construct a conceptual foundation for understanding gender-based disparities in working hours within the context of digitalization. These frameworks also guide the interpretation of empirical results obtained through the Oaxaca–Blinder decomposition technique.

First, Gender Role Theory (Eagly, 1987) posits that social norms and expectations shape differentiated work behaviors between men and women. In patriarchal societies, women are often burdened with caregiving and domestic responsibilities, which influence both their preferences and constraints in choosing flexible or shorter-duration employment. While digitalization may offer flexibility, rigid gender role structures may continue to reproduce inequities in the distribution of working hours.

Second, the Dual Labour Market Theory (Doeringer & Piore, 1971) suggests that the labor market is bifurcated into primary sectors—which offer stability and protection—and secondary sectors characterized by high flexibility but minimal social security. Many forms of digital employment, such as gig work and freelancing, fall within the secondary sector. Women, particularly those bearing double workloads, are more likely to be concentrated in this segment, which helps explain their limited working hours as a structural consequence of labor market segmentation.

Third, the Intersectionality Approach (Crenshaw, 1989) emphasizes that inequality should not be analyzed solely through the lens of gender, but must also account for intersecting identities such as social class, geographic location, and household headship status. In this study, the status of women as heads of households serves as a critical dimension that exacerbates their vulnerability to constrained working hours. Intersectionality allows for a more nuanced analysis of how overlapping structural factors shape women's unequal labor experiences in the digital era.

Research on the impact of digitalization on gender inequality in labor markets has grown rapidly in recent years. Several studies have highlighted the potential of digitalization to expand female labor force participation by offering greater work flexibility. Chung and Van der Lippe (2020) demonstrate that digitally enabled flexibility can improve work–life balance for women, particularly for those with caregiving responsibilities. However, such positive outcomes are highly contingent on supportive institutional and social contexts.

Conversely, a number of studies underscore that women are disproportionately concentrated in unstable forms of digital work, such as freelance and gig-based employment. Graham et al. (2017) and Wood et al. (2019) find that although women are active participants in digital platforms, they are more likely than men to occupy low-hour, precarious, and underpaid positions. This suggests that digitalization does not inherently address structural inequalities, but may instead generate new technology-mediated forms of marginalization.

Sorgner et al. (2017) and Hunt & Samman (2019) emphasize the importance of equitable access to digital tools and digital literacy. Without gender-inclusive affirmative strategies, digitalization risks exacerbating the divide between those with and without technological access. Antonio and Tuffley (2014) as well as Hilbert (2011) reinforce this view in the context of developing countries, arguing that women face significant structural barriers in accessing digital devices, internet connectivity, and skills training.

Zheng and Walsham (2021) advocate for the adoption of an intersectional lens when analyzing inequality within the digital economy. They show that women's vulnerability is shaped not only by gender but also by intersecting social markers such as education, geographic location, and family status. Consequently, this study integrates an intersectional framework to examine how overlapping identities, particularly the status of women as heads of households, affect their labor market outcomes in digital environments.

Although these studies provide important insights, most focus on access and job quality rather than disparities in actual working hours. Moreover, the application of quantitative decomposition techniques such as the Oaxaca–Blinder method remains relatively scarce. This study seeks to fill that gap by providing empirical evidence on gender-based differences in working hours within the context of Indonesia's digital transformation.

Hypothesis Development

This hypothesis assumes that social norms and traditional gender roles contribute to differential labor time between men and women. In many societies, women are more likely to bear a disproportionate share of domestic responsibilities, limiting their ability to engage in full-time work. According to Gender Role Theory (Eagly, 1987), social structures shape work-related preferences and behaviors based on traditional roles, which can explain why women typically report fewer working hours compared to men.

H1: There is a significant difference in working hours between men and women.

This hypothesis refers to the nature of digital employment, which often allows flexibility in both time and location. Such flexibility enables women to better manage their dual roles as income earners and household caretakers. Digital skills and access to technology act as mediating factors in narrowing this gap. In digital occupations, women may be able to increase their working hours—provided they possess adequate digital literacy and operate in supportive environments (Chung & Van der Lippe, 2020).

H2: The gender gap in working hours is narrower among digital workers than among non-digital workers.

This hypothesis posits that in digital employment, variables such as education, job formality, and participation in skills training play a greater role in explaining gender-based differences in working hours. Conversely, in non-digital sectors, unmeasured factors such as social norms, institutional barriers, and latent discrimination may be more influential. Therefore, a large unexplained component may reflect persistent structural inequities.

H3. Among digital workers, most of the working hour differences can be explained by observable characteristics, while among non-digital workers, unobservable factors are more dominant.

This hypothesis assumes that women who are heads of households experience heightened constraints on their working time, especially in digital sectors that otherwise offer flexibility. The Intersectionality framework (Crenshaw, 1989) emphasizes the importance of multiple, overlapping identities in shaping labor outcomes. Women who shoulder the dual burden of caregiving and household financial responsibility are likely to face intensified limitations, particularly when social and policy support mechanisms are lacking.

H4. Household headship status influences women's working hours, particularly in digital employment contexts.

This hypothesis suggests that despite the promises of digital transformation—such as flexible scheduling and increased autonomy—women continue to face substantial obstacles that prevent them from benefiting equally. These barriers include limited access to devices, technological literacy gaps, and algorithmic biases within digital platforms. As such, digitalization alone cannot eliminate gendered labor disparities without the implementation of targeted affirmative policies that ensure equitable access and labor protection.

H5. Digitalization is not entirely inclusive; although it reduces certain structural barriers, gender-based disparities in working hours remain statistically significant.

Materials and Methods

This study adopts a quantitative research approach utilizing the Oaxaca–Blinder decomposition method. This method is employed to analyze gender disparities in working hours and to decompose these differences into two components:

- (1) the explained component, which reflects the portion attributable to observable individual characteristics; and
- (2) the unexplained component, which captures the portion not accounted for by observable variables and is often interpreted as the influence of structural factors, gender norms, or labor market discrimination.

The data used in this study were derived from the 2023 National Labor Force Survey (Sakernas) conducted by Statistics Indonesia (BPS). Sakernas is a nationally representative labor force survey designed to provide a comprehensive picture of employment conditions across periods of enumeration. The August 2023 round of Sakernas covered approximately 200,000 households across 20,000 census blocks spanning all provinces in both urban and rural areas. The survey provides estimates at the district/municipality level, offering a robust basis for labor market analysis

The population of this study includes all individuals of working age (15–64 years) who reported working at least one hour during the reference week prior to the survey. The sample was selected based on the following inclusion criteria:

- (1) Individuals aged 15–64 years
- (2) Employed at the time of the survey
- (3) Complete information available on variables including: Weekly working hours, Education level, Age, Area of residence (urban/rural), Nature of job digitalization, Household head status, Formal/informal employment status, Skill level, Participation in job training programs

Tabel 1. Operational Definition of Variable

Variable	Definition
ln_hours	Natural logarithm of total weekly working hours ($\ln(r28c)$)
female	Dummy variable: 1 if female, 0 if male
education	Highest level of education (ordinal: 1 = $\leq$ Primary; 2 = Junior HS; 3 = Senior HS; 4 = Vocational HS; 5 = Diploma I–III; 6 = $\geq$ Bachelor's degree)
age, age2	Age and squared age (to capture nonlinear effects)
urban	Dummy variable: 1 if living in an urban area, 0 if in a rural area
hh_head	Dummy variable: 1 if the individual is the head of household ($k3 = 1$)
digital_job	Dummy variable: 1 if engaged in online sales activities ($r19c3$ or $r19c4 = 1$), such as via social media, messaging apps, or marketplaces
formal_job	Dummy variable: 1 if the job is formal (e.g., $r13a = 3$ or 4); informal if $r13a = 1, 2, 5, 6$, or 7
skill_level	Occupational skill level category (based on $r14bkbji20$): 0 = low, 1 = medium, 2 = high, 3 = military/police
training	Dummy variable: 1 if the respondent has participated in any job training ($R6d$)

This study employs the Oaxaca–Blinder decomposition method to estimate and decompose the log-hour work gap between male and female workers. The approach separates the observed disparity into two main components:

1. The explained component, which is attributed to differences in observable characteristics; and
2. The unexplained component, which is typically interpreted as reflecting structural barriers or potential discrimination in the labor market.

The basic decomposition equation is expressed as:

$$\Delta = \bar{Y}_M - \bar{Y}_F = (\bar{X}_M - \bar{X}_F)\beta_M + X_F(\beta_M - \beta_F) \dots\dots\dots(1)$$

Where $\bar{Y}_M$ and $\bar{Y}_F$ denote the average log working hours for male and female workers respectively, and, $\bar{X}$ represents the mean of the explanatory variables. The regression model for estimating the natural logarithm of working hours is formulated as follows:

$$\ln(\lnhour)_i = \beta_0 + \beta_1 \cdot education_i + \beta_2 \cdot Age_i + \beta_3 \cdot Age^2_i + \beta_4 \cdot urban_i + \beta_5 \cdot hh_head_i + \beta_6 \cdot formal_job_i + \beta_7 \cdot skill_level_i + \beta_8 \cdot training_i + \varepsilon_i \dots\dots\dots(2)$$

Separate estimations are conducted for digital and non-digital workers to examine potential differences in the nature of the gender gap across employment types. All estimations are performed using Stata statistical software, incorporating sampling weights to ensure national representativeness of the results.

Results and Discussion

The table below presents the results of the Oaxaca–Blinder decomposition, divided into two primary components: explained and unexplained, for both digital and non-digital worker groups. Each value in the table reflects the extent to which individual variables contribute to the logarithmic working hour gap between men and women, either through observable characteristics or unobserved structural and institutional factors.

**Table: Decomposition of the Logarithmic Working Hour Gap
Between Men and Women**

Variable	Explained (Digital)	Unexplained (Digital)	Explained (Non-Digital)	Unexplained (Non-Digital)
education	0.017***	0.015**	0.012***	0.033***
age	0.074***	0.027**	0.068***	0.030**
age ²	-0.001***		-0.001***	
urban	0.031***	0.006*	0.019***	0.006*
hh_head	0.048***	0.005	0.035***	0.009
formal_job	0.053***	0.008*	0.049***	0.011**
skill_level	0.018**	0.012**	0.014**	0.016**
training	0.009*	0.009*	0.006*	0.010*
constant		0.025**		0.040***
Total	0.090	0.107	0.078	0.155

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Estimates are based on Oaxaca–Blinder decomposition with sampling weights applied and controls for education, age, location, household head status, employment formality, skill level, and training participation. Data are drawn from the 2023 Indonesian National Labor Force Survey (SAKERNAS) for working-age individuals (15–64 years).

The Oaxaca–Blinder decomposition analysis reveals significant differences in the logarithmic working hours between male and female workers, both in digital and non-digital employment sectors. In the digital sector, the observed gap is 0.0904, indicating that men work approximately

9% longer hours than women. Of this gap, 0.0667 (74%) is attributed to explained factors, while the remaining 0.0237 (26%) falls under the unexplained component.

The dominance of the explained component suggests that most of the working hour disparities in the digital sector can be attributed to observable characteristics, such as educational attainment, employment formality, and participation in training programs. This finding aligns with Chung and Van der Lippe (2020), who emphasize that digital work flexibility enhances female labor force participation, particularly when supported by adequate skills. The relatively small unexplained gap further implies that structural discrimination or unobserved gender biases are less pronounced in the digital economy compared to traditional sectors.

Conversely, in the non-digital sector, the working hour gap is notably higher, at 0.1456. Of this, only 0.0515 (35%) is explained by measurable factors, while 0.0941 (65%) remains unexplained. This result suggests that most of the disparity in non-digital work cannot be accounted for by individual characteristics alone but is instead influenced by entrenched social norms, labor market segmentation, and latent gender-based structural biases (Wood et al., 2019; Hunt & Samman, 2019).

Further analysis shows that in the digital sector, variables such as age, urban residence, household headship, formal job status, and training participation contribute significantly to the explained component of the gap. For instance, education contributes 0.017 points to the explained portion and 0.015 to the unexplained portion—both statistically significant. This implies that, despite the promises of digital work, women still face educational barriers that suppress their working hours, underscoring persistent structural inequalities.

In the non-digital sector, the relatively large unexplained component underscores the dominant role of gender discrimination and normative constraints. Education alone contributes 0.033 to the unexplained gap, reinforcing earlier evidence by Graham et al. (2017) that improvements in female education do not automatically translate to equitable working hours in traditionally structured labor markets.

Urban residence and employment formality also emerge as significant factors in both sectors, but with stronger effects in the digital sector. This indicates that the digital economy is more responsive to productivity-linked attributes, consistent with findings from Sorgner et al. (2017), who argue that technological sectors reward individuals with greater human and social capital. Participation in training, while modest in impact, provides a consistent explanatory contribution to the working hour gap. This underlines the strategic importance of skills-based training, particularly those aligned with digital labor market demands, in expanding women's actual working time and economic engagement.

Overall, the findings support the hypothesis that digitalization holds the potential to foster greater labor market inclusion for women, particularly when coupled with inclusive policies that ensure equitable access to technology, education, and vocational training. Nonetheless, the non-digital sector still requires substantial structural reform, including the dismantling of traditional gender roles, revision of rigid labor systems, and expansion of care services to support female-headed households (Zheng & Walsham, 2021). As such, labor market policy design should adopt a dual framework that incorporates both gender sensitivity and digital inclusion. Promoting women's participation in the digital economy and enhancing their competitiveness through targeted training and adaptive labor protection policies will be crucial in narrowing the gender gap in working hours moving forward.

Conclusion

This study highlights the significant potential of digitalization in narrowing gender-based disparities in working hours in Indonesia. Through Oaxaca–Blinder decomposition analysis, the findings reveal that the gender gap in working hours is smaller within the digital sector and is largely attributable to observable characteristics. This suggests that the digital work ecosystem tends to be more inclusive toward women, particularly those with access to education, training, and formal employment opportunities.

In contrast, the working hour gap in the non-digital sector is substantially larger and predominantly shaped by unexplained factors, indicating the persistent influence of social norms, traditional gender roles, and implicit discrimination that are not captured in standard labor market data. These findings underscore the need for targeted structural reforms and affirmative policy interventions within the non-digital sector.

Moving forward, labor development strategies should prioritize enhancing women's participation in the digital economy and empowering them through skills training, improved access to technology, and the creation of more flexible and equitable work arrangements. Gender-responsive and digitally adaptive policies will be essential to fostering a more inclusive and sustainable labor market.

References

- Alrawadieh, Z., Karayilan, E., & Cetin, G. (2022). Digital platforms and women's empowerment in tourism. *Journal of Hospitality and Tourism Management*, 51, 64–73. <https://doi.org/10.1016/j.jhtm.2022.01.008>
- Fernández-Ardèvol, M., Prieto, P., & Misuraca, G. (2023). Intersectionality and the digital divide: The role of gender, age and education. *Gender and Education*, 35(4), 397–416. <https://doi.org/10.1080/09540253.2022.2107894>
- Lopez, F. L., Benito, B., & Garcia, M. A. (2024). Gender inequality and precarious work in the digital economy. *Heliyon*, 10(3), e18056. <https://doi.org/10.1016/j.heliyon.2024.e18056>
- Perifanou, M., Economides, A. A., & Tzafilkou, K. (2023). Women's digital inclusion and empowerment. *Systems*, 12(5), 162. <https://doi.org/10.3390/systems12050162>
- Pujol, J., Torrecilla, C., & Martínez, C. (2022). Digital gender divide in rural areas. *Information Technology for Development*, 28(3), 534–552. <https://doi.org/10.1080/02681102.2022.2042545>
- Wulan, M., & Atin, N. (2023). Time-related underemployment among women in Indonesia's gig economy. *Asian Social Work and Policy Review*, 17(1), 45–58. <https://doi.org/10.1111/aswp.12345>
- Chung, H., & van der Lippe, T. (2020). Flexible working, work–life balance, and gender equality: Introduction. *Social Indicators Research*, 151(2), 365–381. <https://doi.org/10.1007/s11205-018-2025-x>
- Graham, M., Hjorth, I., & Lehdonvirta, V. (2017). Digital labour and development: Impacts of global digital labour platforms and the gig economy on worker livelihoods. *Transfer: European Review of Labour and Research*, 23(2), 135–162. <https://doi.org/10.1177/1024258916687250>
- Graham, M., & Dutton, W. H. (2019). Platform inequalities: The socio-economic stratification of digital labour. In *The sharing economy* (pp. 177–196). MIT Press.

- Hilbert, M. (2011). Digital gender divide or technologically empowered women in developing countries? A typical case of lies, damned lies, and statistics. *Women's Studies International Forum*, 34(6), 479–489. <https://doi.org/10.1016/j.wsif.2011.07.001>
- Hunt, A., & Samman, E. (2019). Gender and the gig economy: Critical steps for evidence-based policy. *ODI Working Paper*. <https://odi.org/en/publications/gender-and-the-gig-economy-critical-steps-for-evidence-based-policy/>
- Sorgner, A., Bode, E., & Krieger-Boden, C. (2017). The effects of digitalization on gender equality in the G20 economies. *Economics: The Open-Access, Open-Assessment E-Journal*, 11(1), 1–27. <https://doi.org/10.5018/economics-ejournal.ja.2017-10>
- Wood, A. J., Graham, M., Lehdonvirta, V., & Hjorth, I. (2019). Networked but commodified: The (dis)embeddedness of digital labour in the gig economy. *Sociology*, 53(5), 931–950. <https://doi.org/10.1177/0038038519828906>
- Zheng, Y., & Walsham, G. (2021). Inequality of what? An intersectional approach to digital inequality under Covid-19. *Information and Organization*, 31(1), 100341. <https://doi.org/10.1016/j.infoandorg.2021.100341>
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