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ORIGINAL SCIENTIFIC PAPER

The Effects of Digitalization and Skills on Women's Labor Market Inclusion- Serbian Gap Study

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A B S T R A C T

In this paper, women's social inclusion in the labor market as a long-lasting employment problem is researched under the new digitalization requirements. Furthermore, the importance of the factors is explored, including those connected to the digital knowledge and skills of women (WDKS) and the institutional support of digitalization (DIS), for women's inclusion in the labor market (WLMI) and employment in a digital age. Using the Likert scale instrument for 15 claims within the specified variables of the study conducted in Serbia in 2022, 224 women participated in the research and rated the influence. Findings showed that the knowledge, digital skills, and competencies of girls and women (WDKS) are strongly correlated with their social inclusion in the labor market (WLMI). The impact of the DIS, institutional measures, and policies as a set of digital infrastructure, networks, and low-level adjustments for the digitization process's development is also important as a part of national digital ecosystem development.

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These findings contribute to the literature on digitization and new knowledge development, the SDG goals on gender divide and equality, and further feminist economics scientific works.

KEYWORDS: *digitalization, education, digital skills, sustainability, institutional support, SDGs*

Introduction

This research focuses on the labor market opportunities that arise from digitalization in the new normal. COVID-19 has significantly changed the working patterns in Europe and Serbia in favor of home-based and flexible jobs on the platform. The platform or gig economy via applications includes crowdsourcing and on-demand work.

ILO has published several studies on non-standard employment, agency work, and temporary and dependent self-employment, with discussions on open issues of employment relationships and hidden employment relationships (McKinsey Global Institute, 2015; 2017; ILO, 2016; WEF, 2016a; 2016c; Bertrand, 2011; UN Women, 2005).

Many studies of platform work assume that atypical employment relationships involving casual, daily, or seasonal contracts are not covered or are covered only to a limited extent by traditional employment protections (Nambisan, Wright, & Feldman, 2019; Nambisan, Siegel, & Kenney, 2018; Balsmeier& Woerter, 2019; Ahlstrom, 2020).

Platform female workers are usually legally treated as self-employed, and many EU countries have modernized labor law and made the labor market more flexible by modifying common law (Leahy & Wilson, 2014; Radović-Marković, Kočović & Grozdanić, 2013; Radović-Marković, Grozdanić & Jevtić, 2017).

The paper also respects the SDGs concerning sustainable employment of women and gender equality (Worthington, 2014), which are connected to:

- Economic benefits of women, SDG 5
- Unemployment and wages of women, SDG 8
- Gender-sensitive policies addressing environmental sustainability challenges (SDG 12–17)

Based on the literature (Jacobides, Cennamo, & Gawer, 2018; Frenken et al., 2020; Hinings, Gegenhuber, & Greenwood, 2018; Brynjolfsson &

McAfee, 2014; Faik, Barrett, & Oborn, 2020), the authors defined the further research question (RQ) for this study as "*Are digital skills and knowledge of women (WDSK) and institutional support for digitalization development (DIS) significantly impacting the labor market inclusion of women (WLMI)?"*

In selecting digital job opportunities for women, the authors include the SDG pillars of sustainability, equality issues, and the increase of women's employment rates faster than men's by the end of the decade (Diesendorf, 2000; Dunphy, 2000**; EU** Treaty for Equality Promotion by 2030).

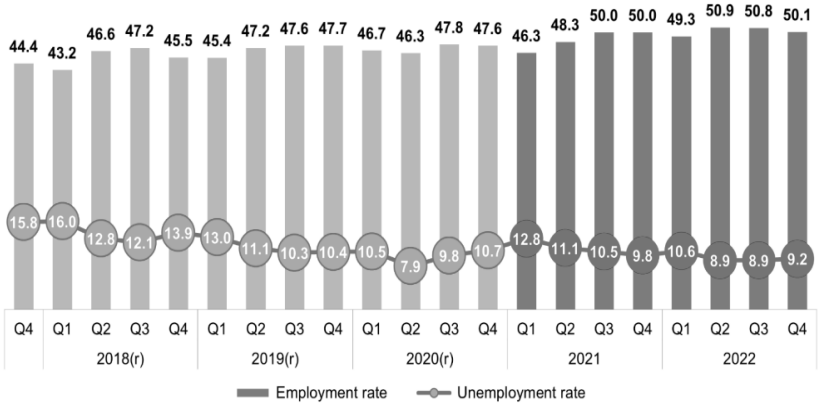
Both traditional and modern industries can be considered the demand side of the labor market for female employment in the digital era (Sorgner et al., 2017; Acemoglu & Autor, 2011; Popović & Jevtić, 2020; Mitić et al., 2020; 2020a; Grozdanić, Radović-Marković & Vučić, 2008).

The paper is structured through the introduction, the case study gap, the materials and methods with the main findings, the conclusions, and the references used in the study.

Serbian Gap Analysis

The number of employed persons in Serbia decreased to 2,888,700 in 2022 from 2,942,000 in 2021 (SORS, 2023) (Figure 1). The labor force participation rate in Serbia remained unchanged at 55.80 percent in 2022.

Figure 1: The trend of employment/unemployment rates (in %), population 2017-2022.



Source: SORS (2020) https://publikacije.stat.gov.rs/G2023/PdfE/G20231047.pdf

The number of unemployed persons in Serbia decreased to 427.15 thousand in December 2022 from 428.96 thousand in November 2022 (Table 1).

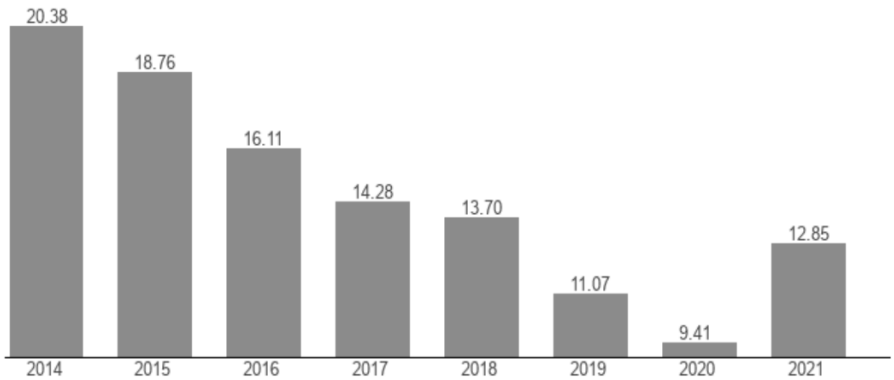
Table 1: Serbia, some indicators of labor market trend, 2022

	2022	**Changes relative to the previous year**	
	(in 000)	**(in 000)**	**%**
Population 15+*	5769.8	-68.5	-1.2
1. Active	3179.8	-54.3	-1.7
1.1 Employed	2888.7	-28.7	-1.0
1.1.1 Formally employed	2519.2	0.4	0.0
1.1.2 Informally employed	369.5	-29.1	-7.3
2. Unemployed	291.1	-25.6	-8.1
3. Outside the labor force*	2590.0	-14.2	-0.5

Source: Statistical Release on Labour Force Survey for the fourth quarter 2022 available at: http://publikacije.stat.gov.rs/G2023/Xls/G20231047.xlsx.

Female unemployment in Serbia was reported at 11% in 2021, according to the World Bank development indicators (Figure 2). Although the youth unemployment rate in Serbia decreased from 25.40 percent in the third quarter of 2022 to 24.30 percent in the fourth quarter of 2022, it is still very high.

Figure 2: The female unemployment rate for Serbia, 2014-2021.



Source: SORS, 2022. available at: G20231047.pdf (stat.gov.rs)

The reason for taking this country for the gap study lay in the fact that Serbia is among the ten economies in the world by the number of freelancers in terms of population. About 100,000 freelancers were employed, mostly equally men and women, in 2021. According to SORS (2022), most freelancers work for foreign companies, and most of them did not sign any contract, and if they did, such a document is not recognized in the Serbian legal system as the platform company is not recognized as an employer.

Furthermore, the research found the following insights:

- More men are working in the technology sector than women.
- Men are mostly better paid than women.
- Women usually offer language courses, translation, textile design, writing, fashion, and similar services over online platforms (Vučeković et al., 2021).
- The number of women joining the "gig" economy is growing, and the feedback is usually positive.
- Freelancing is the main source of revenue for many women, as the gross value of such income is double the average gross wage in Serbia.

In the time of the digital transformation of work in Serbia, legal structures were not changed and adapted to new circumstances of employment and new work patterns. Stronger labor and social protection regulatory rules have to be developed, and policymakers in Serbia would have to work to shape the transformation of regulations.

Concerning the ICT sector in Serbia, its impact on economic and social influence on new business models is expanding, and it can be said that the industry opportunities are growing each year with more support from the national ecosystem (Špiler et al., 2023). Illustrative could be the positions of Serbia among 144 other countries in:

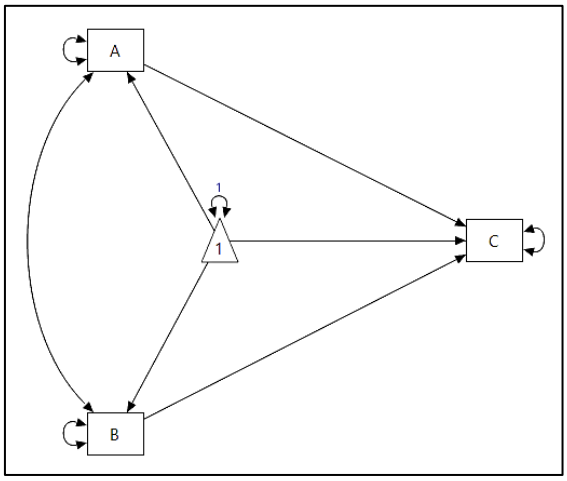
- 125th in firm-level technology absorption, 134th in the extent of staff training, 131st in capacity for innovation in ICT, 97th in B-C use of the Internet, 86th in business-to-business ICT usage, 101st in FDI and technology transfer, and 107th in access to basic services by ICTs, ICT use, and government efficiency;
- 72nd in technology readiness; Internet access in schools, 89th; Internet bandwidth, 88th; fixed internet, 46th; mobile broadband subscriptions per 100 people, 55th position.

- But in terms of labor market efficiency, Serbia is in the lower positions: the country's capacity to retain and attract talent is low, ranking 79th in women in the labor force in ratio to men, 68th in pay and productivity, with 46% of knowledge-intensive jobs in the workforce, and 80th out of 144 in hiring and firing practices.
- 65% of individuals using the Internet have digital skills (more men); 68% use virtual social networks; in the E-Participation Index, 78th position (WEF, 2022).

Methods and Materials

This research is part of a wider investigation by authors across Serbia about the success triggers of female employment opportunities and barriers in the age of new technologies. To answer the research question, an empirical analysis was conducted in Serbia in 2022, which included 224 unemployed female participants (T. 2). One main and two auxiliary hypotheses are defined in the *hypothetical research model* given in Figure 3.

Figure 3: Hypothetical research model



Research variables are:

1. Independent variable: digital competencies and skills of women (WDSC) ,

2. Independent variables: institutional support of digitalization development (*DDIS*), and one
3. dependent variable: labor market inclusion of women (*WLMI)*

The main hypothesis of the research defined based on the literature review is that H0 = digital knowledge and skills of women (WDKC), and institutional support for digitalization development (DIS) significantly impacts the labor market inclusion of women (WLMI), or

H_0 *= C is not impacted by A and B.*

H_a *= C is impacted by A and B.*

Two auxiliary hypotheses are also defined as follows:

H_1 *= A does not impact C.*

H_{a1} *= A impacts C.*

H_2 *= B does not impact C.*

H_{a2} *=B impacts C.*

A mixed-methods research design was adopted, with the online quantitative data collected through 15 claims to identify the participants' attitudes and correlation and regression analysis realized in SAS JMP 17.

The sample includes women and girls from all over the country. In terms of demographic characteristics, 33.93% of participants are between the ages of 18 and 24, and 29.91% are between the ages of 25 and 40, which makes up the majority of the sample (young people, 63.84% of the total number). Most have secondary and high education levels: 168 girls and women (65.00%). Employment status shows that 89 participants are temporally employed, 78 are not employed, and 43 lost their jobs because of being laid off (technological decline, job reduction, company closing), which makes 54.02% of women unemployed for both reasons. 6.25% of participants were employed on full-time contracts in various industries (Table 2).

Table 2: Sample characteristics

Respondents age range		N	Column %
(18-24)		76	33.93%
(25-40)		67	29.91%
(41-50)		55	24.55%
(51-65)		26	11.61%
	All	224	100.00%
Education level		**N**	**Column %**
Primary		33	14.73%
Secondary school		123	54.91%
High education		45	20.09%
Without education		23	10.27%
	All	224	100.00%
Social status/Employment		**N**	**Column %**
Not employed		78	34.82%
Temporally employed		89	39.73%
Laid off - technological decline, job reduction, company closing		43	19.20%
Full employed		14	6.25%
	All	224	100.00%

Research Findings

The defined impact of 3 variables is analyzed through 15 further claims:

Claims	A. Independent variable, Digital knowledge and skills of women (abbr. WDKS)
a_{11}	Helping women with new job opportunities, helping companies in digital positions provision to women, and helping SDGs goals fulfillment.
a_{12}	Digital skills' literacy (skills gaps and shortages) of women working online on a platform, freelancing
a_{13}	Investing in the professional learning and capabilities in basic knowledge and new technologies of women
a_{14}	Entrepreneurship Training, Mentoring, and Support for self-employment
a_{15}	Education and mentoring for entrepreneurs
Claims	**B. Independent variable, Institutional support for digitalization development (abbr. WDIS)**
b_{11}	Gender-sensitive legislation for social inclusion of women

b_{12}	Government bodies coordination policy for the promotion of WDIS
b_{13}	Inclusive supply chains & linkages, public procurement targeting women entrepreneurs.
b_{14}	Women and girls' better approach to technology infrastructure, the internet, and networks.
b_{15}	Legislation and administration adjustments to digital platforms development and women's digital work opportunities
Claims	**C. Dependent variable, Labor market inclusion of women (abbr. WLMI)**
c_{11}	Employment/reemployment (public enterprises and institutions)
c_{12}	Employment/reemployment in SMEs, businesses, ICT firms
c_{13}	Self-employment, technology entrepreneurship, Online Outsourcing
c_{14}	Working online over the platform, freelancing
c_{15}	Informal work, micro work

The standard deviation and mean scores for the respondents' attitudes toward the stated claims within the variables are given in Tables 3 and 4.

Table 3: Factors and values for the (A, B & C)

A	**Mean**	**Std Dev**
a_{11}	4.21875	0.8789548676
a_{12}	4.5267857143	0.7452067631
a_{13}	3.9866071429	1.1063611859
a_{14}	4.3616071429	0.7801052632
a_{15}	4.3214285714	0.8386866277
B	**Mean**	**Std Dev**
b_{11}	4.2678571429	0.8882102007
b_{12}	4.28125	0.8398196742
b_{13}	4.4017857143	0.8413082001
b_{14}	4.3258928571	0.9113382006
b_{15}	4.7142857143	0.6271663289
C	**Mean**	**Std Dev**
c_{11}	4.4955357143	0.6828965469
c_{12}	4.2321428571	0.9515825182
c_{13}	4.4642857143	0.9320267845
c_{14}	4.1071428571	1.1431774055
c_{15}	4.5401785714	0.7624553

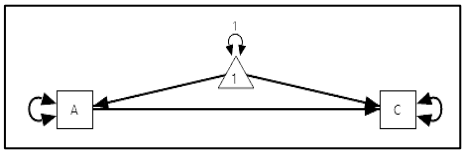
Table 4: Factors and values for the (A, B & C)

	Mean	Std Dev
A	4.2830357	0.7217801
B	4.3982143	0.6198484
C	4.3678571	0.6046478

Variable (AC) Correlation analysis

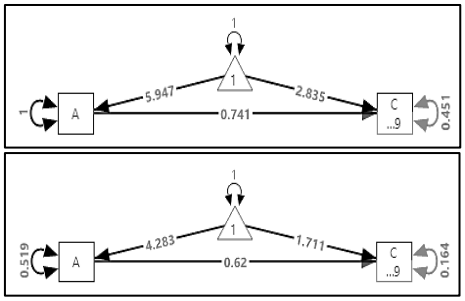
The hypothetical model of A & C is given in the further Figure.

Figure 4: Hypothetical model (A & C)



The coefficient of determination value is 0.548503. It showcases that the (C) variable can be described by 54.85% of the (A) variable. Also, 0.74061 is the coefficient of correlation between two variables, which means a strong relationship between them (Figure 5).

Figure 5: (A & C) hypothetical model contribution sizes/Standard (up) and non-standard (down)



[F (1, 222) = 269.6979, p <0.0001] statistical significance assessment is given in (Table 5).

Table 5: (A & C) variables ANOVA

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	44.718688	44.7187	269.6979
Error	222	36.809884	0.1658	**Prob > F**
C. Total	223	81.528571		<0.0001

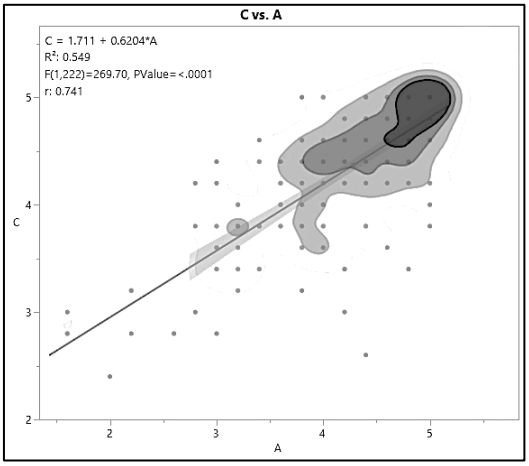
According to the findings, the first hypothesis H1 = a does not impact C cannot be confirmed (the alternative one is accepted, Ha1: that A impacts C). 4.2830357 is the mean score for the A variable.

The multiple regression equation reads (Formula 1):

$$C = 1.7105676 + 0.620422 \cdot A \qquad (1)$$

(A & C) diagram is presented in further Figure (6).

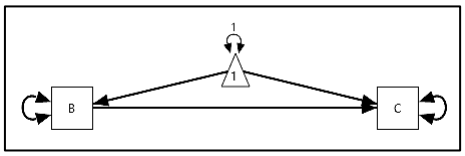
Figure 6: Diagram for A & C variables



(BC) variable correlations

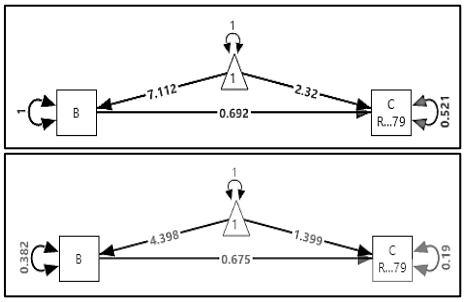
The hypothetical research model (BC), composed by one independent (B) variable, and (C) dependent one (Figure 7).

Figure 7: Theoretical system model (B & C)



The coefficient of determination is 0.478716, and the variable (C) is 47.87% described by the (B) variable. 0.691893 is found as a value of the coefficient of correlation between the variables, showing a weaker relationship (Figure 8).

Figure 8: (B & C) system model contribution sizes- Standard (up) and non-standard (down)



[F (1, 222) = 203.8714, p <0.0001] is statistical importance, presented in Table 6.

Table 6: (B & C) variables ANOVA

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	39.029019	39.0290	203.8714
Error	222	42.499553	0.1914	**Prob > F**
C. Total	223	81.528571		<0.0001

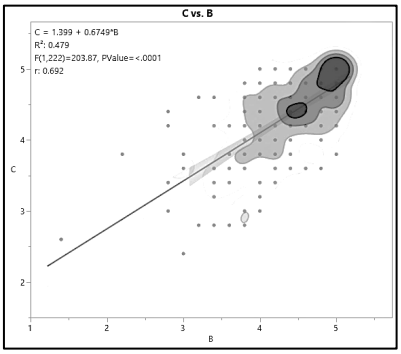
According to the findings, ***H_E=B does not impact C, so that can be accepted as alternative hypothesis H_{a2}: that B impacts C***.

The mean score for the (B) is 4.39282143.

A multiple regression equation, based on the given data, can be defined, and it reads (2):

$$C = 1.3993898 + 0.6749256 \cdot B \quad (2)$$

Figure 9: The regression equation diagram (B & C) is presented.

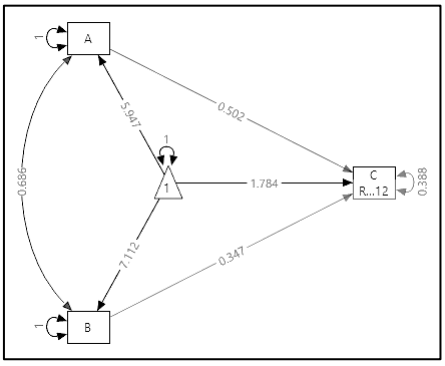


(A, B & C) Variable Multiple Correlations

The hypothetical research model (ABC) is shown in Figure 3. 0.612228 presents the determination indicator, meaning that with 61.22% (C), it can be closer defined by two variables, AB.

By analyzing the variables ABC together, a strong correlation is found. Among A and C, the correlation is the highest, 0.7406. The largest variance size is 0.519, and it is the size of the A variable. The smallest variance of 0.382 is found for the dependent variable (C).

Figure 10: (A, B & C) system model standard contribution sizes



[F (2, 221) = 174, 4616, p <0.0001] is the assessment of statistical significance, presented in the further Table.

Table 7: (A, B & C) ANOVA

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	2	49.914109	24.9571	174.4616
Error	221	31.614462	0.1431	**Prob > F**
C. Total	223	81.528571		<0.0001

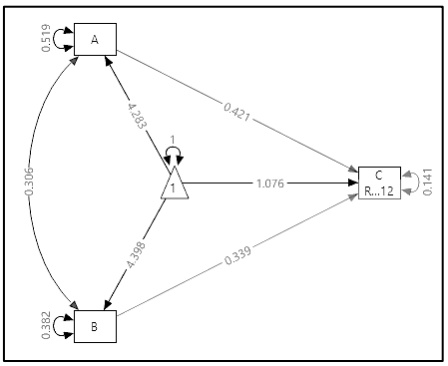
Source: Authors

According to the findings, the main hypothesis cannot be confirmed (***H0: A and B do not impact C), and the alternative one, Ha: A and B impact C, can be accepted.***

Figure 11 presents the non-standard contribution values set system model.

A positive correlation between variables (A) and (B) was found. The 0.502397 is the variable (A) with the highest impact on (C). Variable (B) has a lower impact of 0.347089. The 0.686 is found as the mean value of the impact of the deviations of two variables (A) and (B) from their respective means.

Figure 11: (A, B & C) System model

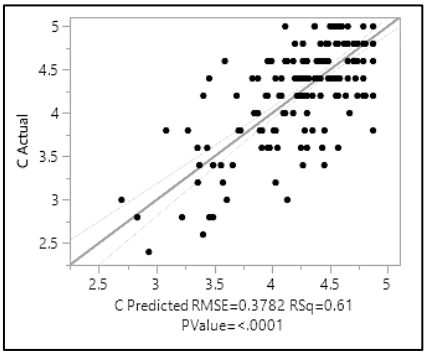


A multiple regression equation is formulated, and it reads (3):

$$C = 1.0761355 + 0.4208663 \cdot A + 0.3385774 \cdot B \qquad (3)$$

The (A, B & C) multiple regression equation diagrams are given in (Figure 12).

Figure 12: (A, B & C) variables multiple regression equation diagrams



Conclusion

The inclusion of women in the Serbian labor market depends on educational factors, digital capabilities, skills, and government support with labor laws and other regulations. The main hypothesis is supported by the correlation analysis provided in the paper.

To support educational efforts in Serbia, investing in training and reskilling opportunities for women, mid-career, or those returning to the workplace is needed and recommended (Radović-Marković et al., 2022). It would mean that the country subsidized transition costs for selected occupations and sectors, increased transparency on labor demand trends, and launched informational campaigns targeting women (Grozdanić, Radović-Marković & Jevtić, 2013).

To address labor mobility constraints, women need support in balancing family care and work obligations, and finally, they need help reducing stereotypes about gendered occupations. Positive movements are found with institutional support for nurturing changes in digital transformation, as they provide an open platform for the sustainability of women's employment in the global workforce.

The research also showcased the levels of the digital divide and social inclusion issues (SDGs) in the "gig" economy. Furthermore, the paper's results contribute to the current literature regarding women's human and labor rights, education, flexible work patterns, and the digital transformation of work.

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