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The Impact of AI on Women's Participation in Gig Economy in Rawalpindi and Islamabad

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Abstract

Artificial Intelligence (AI) can play a vital part in revolutionizing the gig economy by improving employee effectiveness and output, as well as boosting their engagement with digital labor markets. This study aims to explore the consequence of access to the AI tools, internet access, barriers to using AI tools and previous digital experiences on women's digital skills and engagement in the gig economy. The second purpose of this research is to explore the moderating effect of educational level between digital skills and women's involvement in gig economy. 212 gig workers from Rawalpindi and Islamabad made up the study's sample, which was conducted using the survey method. An online survey using questionnaires based on a five-point Likert scale was used to gather the results. The study's findings demonstrate that women's digital capabilities are enhanced by the availability of AI tools, the internet and their previous digital experience, which in turn increases their engagement in the gig economy. The results also indicate a strong correlation between participation by women in the gig economy and digital skills. Furthermore, the association between digital skills and women's participation in the gig economy was significantly moderated by education level. The results of these findings have implications for policy makers and organizations to facilitate females' access to technology and digital abilities in order to encourage women to participate in the gig economy.

Keywords

Gig economy, AI tools, Digital skills, Women Participation, Education level, Pakistan

1. Introduction

AI is rapidly evolving, bringing opportunities and challenges for workers globally. With the rise of gig markets such as Upwork, Fiverr, and Freelancer (Soumya & Jekka Chandrasekaran, 2024) individuals are now able to work remotely, flexibly, and globally. Opportunities for women who face structural and cultural impediments to formal work

are changing as a result of the integration of AI technology in the informal economy in underdeveloped nations like Pakistan (Do, Nguyen, & Vu, 2024). AI-powered tasks automation and artificial intelligence customer communication tool have greatly increased efficiency, enhanced the value of effort, and streamlined client interactions in the gig area. (Narijo, Shaikh, & Siddiqui, 2025) report that gig work, both online and AI assisted, is transforming and is having a positive impact on women's skills, income and lessening digital exclusion. AI is playing an essential function in narrowing the disparity between Pakistan's women and their economic empowerment and digital participation to empowerment through gig economy.

The way in which women contribute to the global labor force and manage their careers and households is changing due to the adoption of AI in freelance websites. Some challenges remain such as limited technical knowledge, cultural attitudes, and Internet access that limit the involvement of females in the AI freelance work (Kalim, Kanwar, Sha, & Huang, 2025). There is limited internet access and digital literacy in Pakistan but women are slowly getting the opportunity to be freelancers in cities such as Rawalpindi and Islamabad (R. Ahmad, Sharif, Ahmad, Gul, & Abdirasulovna, 2024).

AI tools like ChatGPT, Grammarly, and AI design platforms enable women to enhance their communication skills and tailor their services to meet customer needs, leading to better satisfaction. However concerns about unstable employment, inadequate wages and the potential replacement of human work by AI continue to exist (Jing, Qinglan, & Taoxuan, 2023). While the introduction of AI technology has been embraced by many women freelancers in Pakistan, there is a lack of understanding regarding its impact on the active participation, skill enhancement and income generation of women freelancers in the gig economy sector. Therefore, the present research examines the consequences of AI in women's typical engagement in the traditional gig economy and how this can ease or constrain their involvement with digital engagement in Rawalpindi and Islamabad.

The reviewed literature indicates that hardly any research has been conducted on the gig economy and the advantages of AI in women productivity. Previous research studies have explored the contribution of technology and online platforms in ensuring employment and communication (Andrea, Petra, Maryse, Brita, & Amelie, 2023). The number of studies on how access to AI tools, internet access, work experience, and technological barriers influences women's involvement in gig work is relatively limited, particularly in the context of digital economy in Pakistan (Do et al., 2024). There exists limited research exploring the association of feminine digital competency as well as educational attainment on their overall engagement with AI-supported freelance platforms.

Previous research has looked at the implications of online services and technology on the gig economy, but research studies that look at the effect of AI applications on the gig economy participation of women within a developing country such as Pakistan are lacking. Furthermore, little study has looked at the significance of digital skills in women's participation in the gig economy considering the context of AI implementation. This study presents and tests a model that will explain why the use of AI tools, internet access, barriers related to the adoption of AI instruments and prior experience of participants influence the participation and productivity of women in the freelance economy in Rawalpindi along with Islamabad. Moreover, the paper analyses the

relationship between the digital skills of women and education. This study provides more reflective insights on the role of technological resources and skill development in women's engagement in digital labor markets, based on the Human Capital Theory and Empowerment Theory.

For this reason, this paper has three main contributions. Through the first, it proposes and empirically tests a theory which looks into the effect of AI systems regarding the role of women within the gig market in the city of Rawalpindi as well as Islamabad. Second, Second, the research adds to the body of literature by the explaining how the adoption of AI can improve the digital skills of women, professional competence, and ability to effectively participate in knowledge based freelance employment. Finally, the study employs an empirical approach with Structural Equation Modeling (SEM) to gain insight into the role of technology based opportunities and threats on women's inclusivity and advancement throughout the gig mrket. Hence, the analysis can help extend the theoretical framework of Human Capital Theory and Empowerment Theory and can offer some insights as well as suggestions for women freelancers and platform providers.

2. Theory and hypotheses

2.1 Theoretical perspective

The advancement of AI-powered digital employment has transformed the framework of the modern gig work, especially among women who depend on remote, task-oriented jobs. Freelance activities that involve writing, designing, coordination, and information processing have become highly reliant on effective communication, organization, and precision by which AI-augmented applications have become essential for management of knowledge-based tasks (Soumya & Jekka Chandrasekaran, 2024). The freelancer women are now working in a technologically mediated context where creativity is not alone considered as a measure of the quality of work, and digital skills are normalized (Do et al., 2024). This evolving scenario gives greater importance to theoretical interpretations as the processes that influence women's participation in gig labor are not fully visible only visible through the technological tools that are placed at the forefront of digital work.

According to Human Capital Theory, the acquisition of technological, analytical, and communication skills can be considered an important determinant of productivity and earning capacity of women working in digital labor markets (Narijo et al., 2025). In the meantime, Empowerment Theory highlights the function of modern technology and education in boosting women's autonomy, decision making power and ability to overcome socio-cultural barriers in the absence of mobility and formal employment opportunities (Kalim et al., 2025).

The nature of conceptual gig work revolves around information processing, client communication, critical thinking, and content creation, all of which illustrate the information-based nature of conceptual gig work and can be increasingly supported by AI-based tools to improve the efficiency and overall effectiveness of digital freelance work (Jing et al., 2023). In cities like Rawalpindi and Islamabad where access to technology and digital literacy levels are still low, AI has supported women to be free for any systemic constraints and develop their professional capabilities (I. Ahmad et al., 2022). Thus, the theoretical approach of this paper is to assume that AI can promote skill development and empowerment, which affects their engagement, self-confidence

and performance in AI assisted-digital labor scenarios.

AI tools offer a number of functions that can aid women freelancers execute knowledge-centric tasks within the gig financial system. These tools help facilitate communication, information management and content creation (Jing et al., 2023). Freelancers can now communicate more effectively with their clients and manage the information concerning their projects more effectively by using AI-powered translators, automatic responses and writing assistance. AI writing tools, such as ChatGPT, also enable users to organize concepts, create initial content outlines, and write more efficiently and grammatically, ultimately resulting in a more efficient workflow and improved digital services provided by freelancers.

Frequently, the suitability of AI tools for women freelancers can be assessed by the project type, and the match between the digital activities and the capabilities of the specific AI system in question. Communication, information management, content generation, and other types of tasks can be well-supported by AI in most scenarios, and potentially even require extra cognitive effort from the freelancer. While traditional digital tools might take less time and learning for women freelancers to get to know and effectively integrate into their workflows, advanced AI applications may necessitate more effort and education from the users (Kalim et al., 2025). Additionally, in cases of AI-generated output, the issue of algorithmic bias is not to be ignored as biased training of the algorithm can contribute to the quality and fairness of online digital support, which in turn can have an impact on visibility and credibility of women in the online work environment (I. Ahmad et al., 2022). Thus, when implementing AI to support women's participation in gig work, it is important to consider technology within a larger context, realizing that freelance knowledge work is dynamic and its requirements across different projects.

The gig economy (flexible and contract-based digital work) is something that women freelancers must continually develop, given the demands of knowledge-based work, which involve high levels of communication, information processing and organizational skills. In the Human Capital Theory, one of the significant areas identified for the empowerment of women to tackle the intricate tasks of freelance is the growth of their technological and cognitive abilities (Soumya & Jekka Chandrasekaran, 2024). Empowerment Theory helps to further elaborate and build on this understanding, and posits that as women come to have access to enabling digital resources, they are able to make independent choices about work and to do project management work well. The AI tools are then aligned with these theoretical considerations, as they assist women in understanding their client's needs, planning project information and developing digital content more effectively and with confidence (Andrea et al., 2023). In order to assess the role and support of these conceptual task requirements (Jorge, Jose-Antonio, Ana-Isabel, & Inés, 2023) and to determine women's participation and their performance about the gig economy, the evaluation of these technologies is crucial.

Regardless of the potential that AI tools have, the Human Capital and Empowerment methodologies suggests that the applicability of AI tools to women freelancers varies with contextual and structural conditions. Women in developing countries lack access of digital literacy, unreliable internet access, and socio cultural restrictions and consequently unable to use AI tools to facilitate their work as freelancers (Sadia, 2021). The Human Capital Theory suggests that lack of training and exposure reduces

women's ability to leverage the technological resources and improve their work outcomes, while the Empowerment Theory focuses on the reduced agency and lack of courage to engage in digital systems as a result of such limitations (I. Ahmad et al., 2022). Moreover, since freelance jobs are not uniform in their complexity (production of content related to creative work, some types of analysis, etc.), AI tools may not be as effective with all types of tasks. The need for more targeted interventions, where women can build their digital knowledge in different gig work areas (Cristian, Mara, Amina, Orlando, & Anna, 2024).

The incorporation of these theoretical aspects into the conceptual framework strengthens the insight through the importance of Artificial intelligence tools in the procedure of women's getting involved in digital labor through gigs. The Human Capital Theory and Empowerment Theory are both concerned with empowering women with digital skills and experience to be able to fully benefit from AI-assisted services and refining the accessibility while simultaneously enhancing the women's sense of autonomy when working in the online environment (Cristian et al., 2024). The study helps to understand the interplay between the structural barriers, the skills of women and technological resources, and is relevant to the ongoing debate on digital equality and the evolving nature of the AI-supported job. They also provide valuable insight into developing user-centered training and support programs to boost the confidence and participation of women in freelance markets (Necula, Fotache, & Rieder, 2024). Overall, the framework introduced in this paper expands both theoretical and practical knowledge of how AI assists women in the process of digital labor and provides beneficial implications to further study and practice.

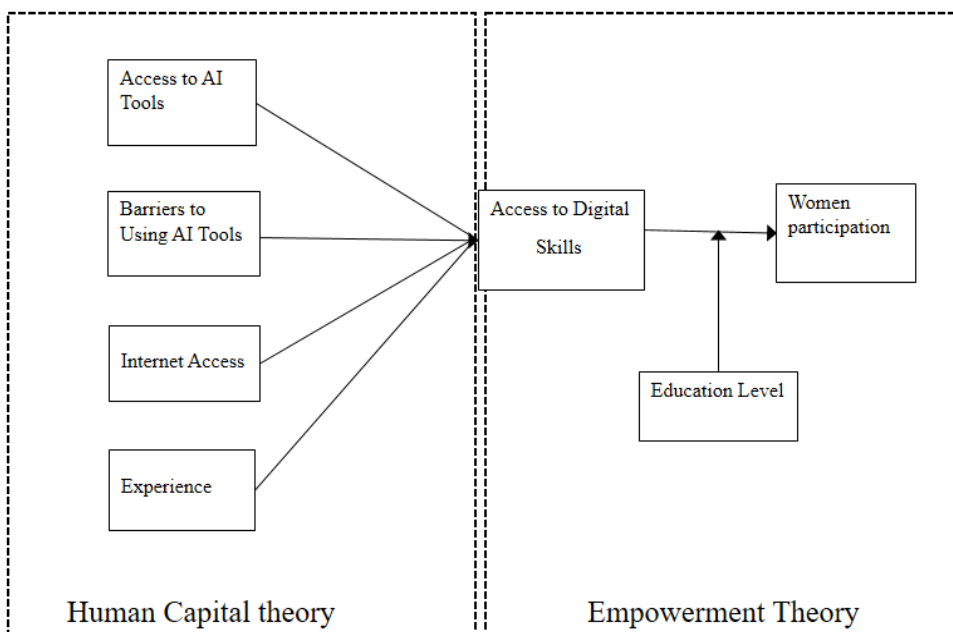


Fig 1. Research model

2.2 Access to AI tools and Digital Skills

There has been an increasing discourse around ChatGPT in various sectors due to

recent innovations in language technologies that are driven by artificial intelligence, which has significantly transformed the way humans interact with computers. ChatGPT has established recognition and appreciation for its exclusive features as it is capable of generating relevant and contextually related responses. ChatGPT is usually used for customer assistance, educational support, healthcare services and various support related activities (Jing et al., 2023). The effective implementation of AI-based tools, like the drive for learning and the use of digital resources, takes on a key part in improving the efficiency and abilities of gig employees. Through the ability to access digital resources and tools and AI-powered tools, people become more efficient and capable, helping them to complete tasks more efficiently and to acquire relevant skills for digital working platforms.

There are several dimensions of developing digital skills related to the gig economy. Numerous studies have examined these attitudes through job autonomy, emotional experiences, and work related outcomes. Earlier studies indicate that AI based applications, including chatbots, positively influence skill development and work-related capabilities by enhancing creativity, task managing, and teamwork, as these tools support positive work knowledge and understanding outcomes (Wu & Yu, 2023). Empirical evidence also suggests that AI based chatbots enhance user's skills and performance by providing continuous support, as empirical evidence shows a beneficial connection among the use of AI-powered chatbots and student's learning related outcomes, including academic performance, motivation, and self-efficiency. It is therefore hypothesized that women's digital skills will increase due to access to AI-based tools leading to the development of the following:

H1. Access to AI tools has a positive effect on women's digital skills.

2.3 Barrier to AI tools and Digital Skills

There are several dimensions in which skills in the gig economy can be developed digitally. The attitudes have been assessed in different aspects such as autonomy at work, emotional experiences and work-related outcomes. Previous research suggests positive impacts on skill development and work-related competencies from AI based applications, such as chatbots, as they contribute to work knowledge and understanding (Chang, Chen, & Lin, 2022; Woodman & Mangoni, 2023). When AI tools, guidance, and other digital resources are not accessible to gig workers, their likelihood of developing digital skills and completing work-related tasks will be diminished. The lack of access to technological support and skill developing tools may create obstacle to the efficient work of gig workers and their successful achievement of client expectations.

Gig workers are a critical part of this new online gig economy, and the variables that impact their performance are key to consider. Uncertainty about how to use the tools, lack of support, and access to digital resources can lead to resistance, which will impact job satisfaction, engagement, and motivation, and therefore the gig workers' performances (Kim, Sawyer, & Dunn, 2025). The prior studies believe that resourcefulness and supporting working environment are positively correlated with workers' performance. With barriers to AI tool usage, this relationship can have a negative effect on their effectiveness in their job. A shortage of availability of AI based materials could also contribute to more uncertainty and make it hard to be able to handle job demands efficiently by gig workers. This implies that gig workers might not

have enough time to adjust to it, build necessary digital skills, and adapt to operating effectively (Ali Saleh et al., 2026). These constraints could also put the coping ability and proactive strategy of gig workers at risk, thereby diminishing their performance (Woodman & Mangoni, 2023). Therefore, we put forward the following hypothesis:

H2. Barrier to using AI tools has a negative effect on women's digital skills.

2.4 Internet Access and Digital Skills

There has been rising discussion around internet connectivity across different sectors due to a high level of digitalization, as better connectivity has significantly transformed individuals learning and utilizing digital capabilities in online platforms (Sadia, 2021). Reliable internet is a concern to enable meaningful interaction with digital platforms and learning of technological skills in technological driven working environments. Internet connection enables people to participate in e-learning, service and work in various professions. An important part of the analysis of the freelance economy is understanding the consequences of the internet on gig workers' access to and use of digital skills that are important for online work. Good internet connectivity allows for continuous interaction with online apps and platforms, essential to developing capabilities in gig based work (Malik, Visvizi, & Skrzek-Lubasińska, 2021). Digital infrastructure and access to online resources is available regularly, enabling people to invest more time and energy into the learning process and in skill development and linking digital skills into work outcomes.

There are multiple and complex links between digital skills and Internet access. Other research shows that higher internet connectivity correlates with the skills of individuals to learn new technologies, to create digital practices, and to work effectively in a dynamic setting. Similarly, studies indicate that the regular presence of internet connectivity may contribute to the emergence of digital skills which are vital in taking part in the gig market. Therefore, it remains that availability of internet connectivity plays an important role in improving the digital skills, enabling active involvement in gig based work (Cristian et al., 2024).

The following theory is put out in light of the discussion above.

H3: Internet access has a positive effect on digital skills.

2.5 Experience and Digital Skills

The value of experience in the digital skills of people in technologically rich work environments has been a growing topic. Digital and online work-related experiences give an individual the opportunity to develop new knowledge of online platforms, processes and ways of working through problems, continuing in their skills development (Necula et al., 2024). Work experience, therefore, becomes one of the factors affecting the gradual acquisition, application and development of digital skills over time (Cristian et al., 2024). This is particularly crucial to investigate the effect of prior work experience on gig worker capacities to access, apply and develop digital skills to work online in the gig environment. The acquired knowledge with digital tasks helps individuals to better handle work on the platforms using the technology and respond to changes in the demand of work (Soumya & Jekka Chandrasekaran, 2024). By engaging in digital activities and working environments online, people can more effectively learn using experience, develop technical skills and translate the experience to improve digital skills on a higher level to enhance work results.

A growing body of research on the contribution of work experience to skill development,

effectiveness of learning and performance in the digital labor market. Previous research suggests that representatives of the more experienced group are more prepared to embrace new technology, cope with digitally based tasks, and perform adequately in online working conditions (Wang, Gao, & Zhang, 2025). Similarly, empirical evidence indicates that practice helps to develop digital competencies that are critical in the long term and long-lasting involvement in the gig sector (Malik et al., 2021). This perspective views experience as an investment that grows skills and productivity over time, which enables them to improve performance and outcomes over time in the digital and gig based working context.

Thus, the following hypothesis can be set up.

H4. Experience has a positive effect on digital skills.

2.6 Digital skills and Women's participation in the Gig Economy

The gig economy has played a major role in increasing reliance on freelance and temporary jobs (Malik et al., 2021). Digital skills are essential for empowering women to embrace flexibility and contribute to the gig economy's expansion (Do et al., 2024). Gig workers highly value the independence and control over the working process as many of them value the freedom of choice and ability to select tasks and clients, enabling them to adjust the work opportunity according to personal preferences and interests. The work alignment of gig labors is influenced by preferences for flexibility, satisfaction with task diversity and autonomy, concerns about income stability and perceived control over decisions related to work (Hunt, Samman, Tapfuma, Mwaura, & Omenya, 2019). Here, digital abilities and positive work attitudes can make women feel more autonomous, confident, and have control over work decisions, enabling them to actively participate in employment through gig based platforms. In such situations, women can convert their skills, values, and external support to a meaningful role in the environments of mediational work in the digital and platform.

In addition, studies show that the usefulness of digital platforms, users' willingness to use digital tools, and their confidence in using digital tools can strongly impact women's engagement in digital platforms (Cristian et al., 2024). Additionally, women's readiness to participate in gig and internet labor is influenced by their work-related preferences; perceptions and judgments from the digital environment have an impact on the transformation of these skills, platform features and external pressures into participation-related decisions (Andrea et al., 2023; Kim et al., 2025).

Thus, the hypothesis is the following:

H5. Digital skills have a positive effect on women's participation in the gig economy.

2.7 Education level as a moderator between Digital Skills and Women's Participation in the Gig Economy

The contemporary workplace is highly dynamic, therefore employees need certain skills and competencies to be successful in their jobs in digital and gig based working environments (Chang et al., 2022). These involve flexibility, and responsiveness to emerging ideas and digital work processes. The educational level as a source of empowerment and perceived competence, is an important moderating variable that determines the correlation between digital skills and the involvement of women in the gig economy. Additionally, the earlier study shows that digital skills' effectiveness in boosting women's engagement in gig economy will vary with education, as education might play a role in how effective digital skills were in women's gig economy

involvement (Andrea et al., 2023).

The moderating effect of education has also been emphasized and needs to be explored with other constructs especially in relation to digitization and evolving workplaces, for a better understanding of how women can be better supported to participate and perform in the gig economy (Cristian et al., 2024). Furthermore, education itself is an investment which enhances skills, productivity and the sense of support and competence, allowing women to translate their digital competencies into meaningfully engaging in organizations that are technology driven.

Thus, the following hypothesis can be set up.

H6. Education level moderates the association between digital skills and women's participation in the gig economy.

3. Method

3.1 Data collection method

For this study, all the data were collected from women gig workers from different freelance services on digital labor platforms of Rawalpindi and Islamabad, Pakistan. The gig economy's rapid expansion, the rise of women workers, and Pakistan's continued usage of digital technology and artificial intelligence all influence the research's current state (Cristian et al., 2024; Malik et al., 2021). In particular, this research went into considerable detail with the women freelancers operating on digital platforms that are predominantly linked to knowledge-based gig work. An online survey on a five-point Likert scale, from 1 (strongly disagree) to 5 (strongly agree), was used to gather the results. The questionnaire was created and sent in English. The data were gathered in a one-shot way and the relationships suggested in the research model were studied. A survey design was adopted to gather the necessary information due to a number of reasons. Surveys can be used to gather empirical data from a large and diverse population that can be used to analyze research on the gig economy and digital workplace (Malik et al., 2021). When dealing with complex relationships of various variables in this study, this is especially helpful. The surveys can also be performed with low cost as compared to other data collection methods (Mahmud, Hossain, Saju, Ullah, & Hasan, 2024). The relationships proposed in the study were observed by taking the data at one point of time.

The appropriate sample size was obtained using a regression based power analysis in R. The first set of approached participants were 220 on the different digital labor platforms. Participants were notified at the beginning of the survey, the participants were informed that their responses will only be made for research purposes and that all of the information they provide will be kept confidential. Of total 212 valid responses received 212 responses were used in the final analysis. Once the questionnaire was completed, all responses were thoroughly checked and verified for invalid incomplete responses and removed. Data screening resulted in 212 valid responses, which were used in further analyses.

3.2 Measurement instruments

In the current research, the constructs were assessed through scales developed and validated by others in various research settings. Access to AI tools was assessed based on the indicators for the use and learning of AI technologies by the women gig workers in doing their gig work. Barrier to AI tools was assessed using items that captured the challenges and career related barriers that faced by women in accessing opportunities

and effective use of digital technologies in gig based activities. The measurement of internet access included measures that reflected access to and success with internet connectivity for gig based work activities.

The number of items that define the previous interaction of the respondents determine the measurement of the experience. The digital skills were evaluated with the support of the items which indicate the skills of women to use digital technologies and online platforms effectively to undertake gig jobs. The women's involvement in the gig economy was measured by various indicators reflecting their involvement and active participation in the gig economy based work. Moderating variables such as education level were included in the study to assess the impact of education level on the association among digital skills along with the participation of women in gig economy.

4. Data analysis and Outcomes

The partial least square structural equation modeling (PLS-SEM) approach of structural equation modeling (SEM) was used to analyze the data using R software. This study is suitable for SEM because the explanatory model that is proposed in this study is built on a good theoretical basis. Additionally, SEM enables the researcher to quantify and analyze the model's structure, which allows the researcher to analyze whether the hypothesized relationships among the constructs are supported by the sample data.

4.1 Common method bias

The wording of the questionnaire items was improved by conducting a pilot test. The respondents were informed that their answers would not be revealed and the items that were related to each research construct were scattered throughout the questionnaire. To reduce common method bias (CMB), several procedural measures were implemented. More precisely, the questionnaire's several sections contained the items that measured the research constructs, and it was explained to the respondents that their answers would remain confidential. Additionally, statistical tests were conducted to examine the potential for common approach bias, including confirmatory and exploratory factor analysis based on a single factor model. These findings suggest that our data did not contain any common method bias.

4.2 Model evaluation

The suggested measurement model has an appropriate degree of validity and reliability, according to the measurement model analysis. The Partial Least Squares Structural Equation Modeling (PLS-SEM) technique is utilized to evaluate the overall model, taking into account factors such as indicator reliability, internal consistency, and convergent validity. The results show that the model proposed in this study has a good measurement property and can be further analyzed in the structural model. The barrier to AI tools construct was not included in the recommended thresholds of reliability and factor loading; therefore, it was not included in the measurement model analysis, also it was not included in the structural model testing.

Table 1 results show that the measurement model that was employed to measure the key variables in the study has a reasonable reliability in terms of composite reliability estimates. As far as the factor loadings are concerned, most of the indicators have loadings above the acceptable value of 0.50, with a range of 0.52 and 0.74 for Access to AI tools, 0.57 and 0.71 for Internet, 0.61 and 0.73 for Experience, 0.55 and 0.73 for Digital Skills, 0.52 and 0.86 for Education, and between 0.67 and 0.74 for Women participation. While some of the Cronbach's alpha scores are slightly sub-optimal at

0.70, the literature of PLS-SEM has suggested that a more appropriate assessment of internal consistency is composite reliability (DG rho). The composite reliability scores are between 0.67 and 0.80, which is higher than the recommended minimum score of 0.60 in exploratory research thus showing acceptable internal consistency. AVE values are slightly below the recommended threshold of 0.50, but they are near the threshold and they still are acceptable due to the satisfactory composite reliability. Overall, these findings justify the adequacy of the measurement model to be used in further structural analysis.

Table 1

Factor loadings, reliabilities, and validities of the study variables.

Construct	Loadings	Cronbach's Alpha	Composite Reliability	AVE
Access to AI tools	0.52–0.74	0.46	0.71	0.38
Internet	0.57–0.71	0.28	0.67	0.41
Experience	0.61–0.73	0.40	0.72	0.45
Digital Skills	0.55–0.73	0.70	0.80	0.35
Education	0.52–0.86	0.60	0.77	0.46
Participation	0.67–0.74	0.51	0.75	0.50

Note: AVE = Average Variance Extracted

4.3 Correlation analysis

The study hypotheses were tested using the R software, as well as correlation analysis. Descriptive data and correlations among the constructs that were analyzed are shown in Table 2. The mean and standard deviation values indicate how spread out and central the sample data is. The direction and strength of the associations between the study's variables are shown in a correlation table. It is interesting to note that the age is negatively correlated with major constructs of the study. Specifically, Age is negatively correlated with access to AI tools ($r = -0.27$, $p < 0.001$), internet access ($r = -0.37$, $p < 0.001$), digital skills ($r = -0.45$, $p < 0.001$), and women's participation ($r = -0.38$, $p < 0.001$), which means that, younger respondents are more likely to feel high digital engagement and involvement in the gig economy. In opposition, higher education shows a positive relationship with access to AI tools ($r = 0.17$, $p < 0.05$), digital skills ($r = 0.18$, $p < 0.01$), and women's participation ($r = 0.20$, $p < 0.01$) and suggests that more education is connected with greater digital skills and participation. Moreover, digital skills are positively correlated with access to AI tools and internet access ($r = 0.55$, $p < 0.001$ and $r = 0.55$, $p < 0.001$, respectively), which shows the important digital infrastructure is to enhancing skill development. Women's participation has a significant correlation with digital skills ($r = 0.62$, $p < 0.001$), it suggests that engagement in gig-based work is strongly correlated with digital proficiency. Furthermore, Educational level is correlated positively with digital skills ($r = 0.65$, $p < 0.001$) and women's participation ($r = 0.56$, $p < 0.001$), which gives a preliminary indication to study Educational level as a moderator between digital skills and participation. The correlation tests' overall findings indicate that the research variables are statistically significant to each other, thus, the proposed research framework is supported and further analysis of the structural models can be done.

Table 2

Correlation matrix and descriptive statistics.

	Mean	SD	1	2	3	4	5	6	7	8
Age	31.48	3.99	–							
Higher Education	2.99	0.74	–0.09	–						
AI Access	3.91	0.61	–0.27** *	0.17*	(0.62)					
Internet Access	3.83	0.63	–0.37** *	0.09	0.49** *	(0.64)				
Experience	3.93	0.52	–0.30***	0.15*	0.27** *	0.42** *	(0.67)			
Digital Skills	3.87	0.60	–0.45** *	0.18**	0.55** *	0.55** *	0.48** *	(0.58)		
Educational Level	3.92	0.72	–0.49***	0.25** *	0.47** *	0.53** *	0.45** *	0.65** *	(0.68)	
Women's Participation	3.94	0.65	–0.38** *	0.20**	0.52** *	0.52** *	0.47** *	0.62** *	0.56** *	(0.71)

Note:

N = 212.

Square root of AVE is indicated by values in parenthesis.

*p < 0.05, **p < 0.01, ***p < 0.001.

4.4 Hypothesis testing

The results shown in Table 3 provide some clues to the hypothesis testing and relationships explored in this study. The direct effect analysis shows that the use of AI tools is indeed important for the digital skills of women working as gig workers, with a significant positive influence on their digital skills ($\beta = 0.341$, $p < 0.001$), which supports H1. The hypothesis concerning the barriers to AI tools usage (H2) was not evaluated, the construct was dropped during the measurement framework because of the insufficient reliability as well as validity.

Interestingly, the internet access exhibits a significant positive direct effect on digital skills ($\beta = 0.274$, $p < 0.01$), which confirms H3 and suggests that reliable access to the internet plays an important role in acquiring skills in the digital working environments. Likewise, experience positively affects digital skills ($\beta = 0.273$, $p < 0.001$), which validates H4, suggesting that women's prior exposure and participation in digital activities helps to improve their technological skills.

Additionally, women's participation in the gig economy is significantly improved by digital skills ($\beta = 0.511$, $p < 0.001$). The ability to develop skills is crucial for ensuring active participation in freelance activities based on the use of AI.

Furthermore, moderating role of level of education was assessed in the connection between digital skills and female participation in this study using multi-group analysis

(MGA). Additionally, the sample was split into two groups according to the median education level (low and high education level); the two groups differ significantly from one another. The findings of the two groups are reflected in Table 4 and Fig 2, which demonstrate that there is a significant difference between the two groups. Specifically, women's engagement in the low-education category is strongly and favorably impacted by digital abilities ($\beta = 0.782$, $SE = 0.078$), but there is a weak and statistically non-significant relationship in the high-education group ($\beta = -0.052$, $SE = 0.124$). Furthermore, the difference between the two groups were statistically significant as confirmed by the slope difference test ($Z = 5.694$, $p < 0.001$). Therefore, these findings thus validate H6 and indicate that education level moderates the association between digital skills and the women's participation in the gig economy.

Table 3**Results for hypotheses testing.**

Direct effects	Digital Skills	Women Participation
Access to AI tools	0.341***	
Internet Access	0.274**	
Experience	0.273***	
Digital Skills		0.511***

Table 4**Multi group analysis by education level.**

Group	Beta	SE	Z-value	P-value
Low Education	0.782	0.078		
High Education	-0.052	0.124		
			5.694*	<0.001

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

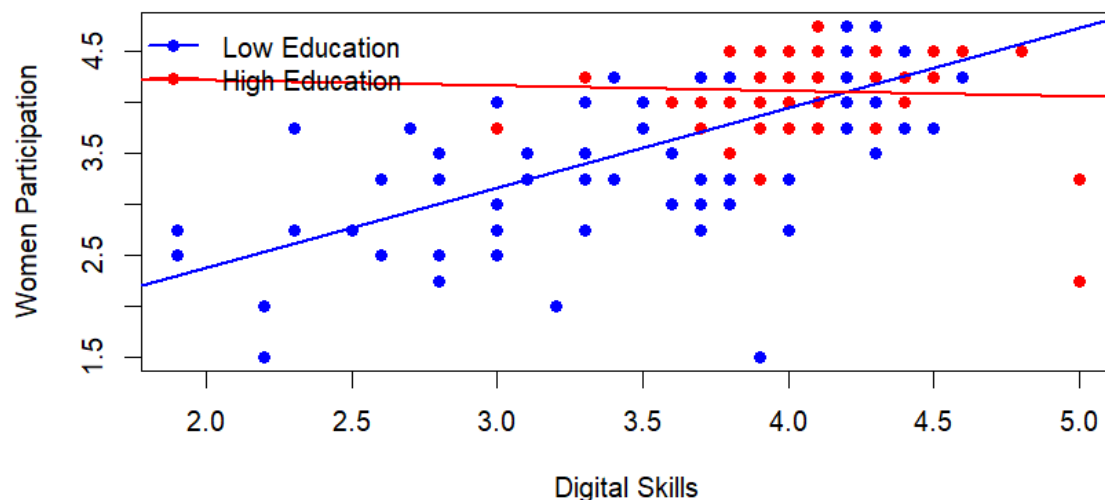
Multi-Group Analysis: Education Level (Low vs High)

Fig. 2. Moderating role of education level in the relationship between digital skills and women's gig economy participation.

5. Discussion

This article looks at the impact of the accessibility of Artificial Intelligence (AI) and its digital features on women's engagement in the gig economy. More specifically, the research examined the effects of access to AI tools, internet access and prior experience in the development of digital skills among women in the digital working environment. Furthermore, this paper explored the influence of digital skills on the involvement of women in gig economy and also on the education moderating the impact of digital skills on the participation of women in gig economy. The outcomes of the present study give useful information on the implications of the digital technologies and personal skills for women's participation in digital labor markets.

The findings demonstrate that using AI techniques improve women's digital skills. This means that as more women gain access to artificial intelligence technologies, the more likely they are to develop technological skills required to successfully complete online tasks. The use of AI based tools can facilitate learning, enhance productivity, and support individuals to become more familiar with the digital environment, which ultimately empowers their digital capabilities. The access to internet was determined as having a significant positive impact on women's digital skills. High quality Internet connectivity is essential to offer individuals with the wide range of educational resources, online platforms and technology all critical components of digital competencies. By giving women access to the Internet, they can educate themselves, communicate effectively, and participate in various online activities to build technology skills (Sadia, 2021). Women's digital skills are also influenced by prior experiences with digital online activities. Digital literacy is more likely to be gained by women with prior experience of the digital world, who are also more likely to feel confident in using digital tools. This experience enables them to adapt better to the fast-changing technologies and to work digitally more effectively (Huang, Burtch, Hong, & Pavlou, 2020). Secondly results demonstrate that women's participation in the gig economy is positively impacted by digital abilities. Competent female with digital skills will be able to perform their gig-based work and work online more efficiently. Digital skills are crucial for users to interact with clients and complete online tasks using digital tools, which ultimately increases the level of engagement with digital workplaces (Narijo et al., 2025).

Thirdly, the moderating analysis revealed that education level has a substantial part in the association between the digital skills and participation of women in the gig economy. The findings indicate that the positive effect of digital skills on participation is greater among women with lower education levels, and weaker among women with higher education levels and is statistically not significant. This means that digital skills could be more essential to help lower educated women participate in the labor market. Gig economy platforms enable them to engage in income generating activities without overly depending on formal educational attainments (Memon, Nobre, & Ahmad, 2025). To sum up, the results of this study highlight the significance of having access to AI tools, internet access, and prior digital experiences for digital skills and promoting female's participation in the gig economy. These findings highlight the importance of digital skills as a crucial mechanism in which women may gain economic opportunities and participate in digital labor market.

Fourth, the research also further supports the Human Capital Theory and Empowerment

Theory in the explanation of the women participation in the gig economy. Findings reveal that access to AI tools, internet and prior experience with digital tools contributes to acquisition of digital skills by women which further enhances their participation in gig based work. The results suggest that technological resources and digital competencies can be more effectively used to enter into digital labor markets for women, who tend to be more productive. Moreover, the education level also plays a facilitating role in the translation of digital skills into the involvement of women in gig economy (Cristian et al., 2024; Narijo et al., 2025).

5.1 Theoretical implications

This research adds to the existing literature by providing valuable theoretical perceptions to the function of artificial intelligence and digital capabilities in influencing participation in the gig economy. The results broaden the application of Human Capital Theory that posits that people improve their productivity and economic performance by gaining knowledge and skills (Becker, 1964). This study shows that technological resources such as AI tools, Internet connectivity and digital experience are some of the most fundamental enablers of the acquisition of women digital skills within the freelance working industry and therefore improve their ability to access digital labor markets in terms of gig economy.

First, this study contributes existing literature about gig economy by focusing on the importance of access to AI tools as a component of the women gig workers' digital capability-building. Previous researchers have highlighted the growing trend of digital technologies in formation of involvement in online work marketplace (Huang et al., 2020; Shaw, Fiers, & Hargittai, 2023). The result supports this idea, as they reveal that women freelancers can advantage after the use of AI-driven tools for learning they need to master in order to perform digital processes and successfully interact in a gig environment.

Secondly, this research contributes to the existing body of knowledge regarding digital access. According to the study, digital infrastructure is an important part of facilitating access to the digital economy, highlighting the importance of internet access and previous digital engagement to build digital capacity. They are consistent with the previous studies that indicated that better access to digital resources is one of the significant factors that contributes to reducing the digital divide and expands the capacity of people to be able to utilize technology-based workplaces (Cristian et al., 2024; Sadia, 2021)

Third, the study also contributes to the field of Empowerment Theory in which an increase in knowledge, skills, technological resources, and ways to enhance autonomy and decision-making capacity is recognized (Rappaport, 1981). The findings indicate that digital skills can contribute to overcoming structural barriers and to ensuring women's active engagement in the workforce market of gig based jobs and thereby to their economic empowerment and digital empowerment.

Lastly, the moderating effect of education in the interaction between taking part in the gig economy and digital competencies provides further theoretical insights. The conclusions propose that digital skills are especially vital for less educated women, in helping them to gain access to digital job offers and to participate engage in internet job market. This also adds overall literature on gender equality and women empowerment in emerging digital economies (Narijo et al., 2025; Shahbazi et al., 2024).

5.2 Practical implications

This research offers various practical implications to managers, digital platforms, training institutions, and policymakers who are engaged in development of gig economy. First, results indicate the relevance of artificial intelligence (AI) tools which enhance digital skills of women who are involved in freelance work. In this context Gig platforms and organizations should encourage the adoption and successful use of tools and resources such as ChatGPT, writing assistants and other AI-based tools to support knowledge-based tasks in the gig economy. With proper training, training guides, and technical tips, women freelancers can learn how to make the best of AI tools in their workflows. These initiatives might be used to enhance their productivity, the quality of services they offer, and enable them to compete better in online freelance marketplaces. Second, the results underline the need for quality internet access for digital engagement of women in the gig economy. Stable, affordable Internet access enables women to communicate with their clients, utilize online tools, and effectively engage in freelance work. The government and digital infrastructure providers should try to increase the availability and cost-effectiveness of the Internet, particularly for women who are interested in remote and freelance activity. Enhancing digital infrastructure has the potential of minimizing technological barriers and increasing opportunities of women to engage in digital labor markets.

Third, experience in the digital and online workplaces also supports the empowerment of the digital skills of women. Women with online experience develop greater skill and confidence in their ability to conduct gig-based work. Education providers and training institutions and development agencies should then provide training in freelancing, Digital literacy training and practice programs for women to learn the knowledge needed in digital workplaces. These initiatives will help women become used to the technological requirement of the gig economy.

Finally, findings indicate that digital skills enhance the chances of women to engage in the gig economy. Specifically, it turns out that digital competencies are particularly relevant to women having lower levels of formal education to facilitate their participation in online employment. This means that policy makers and development actors should think of creating digital training courses that are inclusive and engage in skills development, rather than relying on formal education. With the availability of training opportunities and favorable digital conditions, more women, in particular those that have limited educational backgrounds, will be able to benefit from gig economy's employment and revenue potential.

5.3 Research Limitations and future prospective

The research has its own contributions, however there are some limitations which should be identified. Firstly, the study results might have limited external validity since the sample size of women gig-workers was limited to Rawalpindi and Islamabad. Even though these cities are substantial digital labor markets in Pakistan, the results might not be fully applicable to women gig workers in other cities, regions, and cultures. Future studies could expand on the present study by incorporating a larger geographical and industry sample of gig workers in order to improve the results external validity.

Second, the study's foundation was the self-reported survey and data gathered using an online questionnaire. This approach to gathering data could cause response bias in the study as a participant might be providing socially desirable answers when reporting

their digital skills, or the use of AI tools or work that involves gigs. Future studies with mixed research methods (for example analyzing survey data and data obtained through interviews, observations and records on platforms to gain more insight into the experiences of gig economy workers) can help overcome restriction.

Third, the research itself employed cross-sectional study design which took place at a particular time. Therefore, the connection between the use of AI tools, Internet access, experience and digital skills and women's involvement in the gig economy cannot be fully confirmed. The research can be applied in the future by using longitudinal research design in the study to evaluate the dynamics of the digital capabilities of women and participation in gig work, as they gain more exposure to AI technologies and digital platforms.

Fourth, the present study concentrated primarily on specific technological aspects such as access to artificial intelligence applications, Internet access and prior digital experiences to develop women's digital competencies. But other factors such as organizational support, digital training availability, platform policies, motivation and social support are also conditions that may shape the role of women in the gig economy. Additional variables could be added to future research to further develop the notion of the women's place in the digital work market.

Finally, in this paper, moderating effect of educational attainment on the connection between digital skills and women's involvement in the gig economy was explored. Education was found to be a relevant factor in this relationship, however, there may be other moderating variables that influence the participation of women in digital labor, such as age, digital literacy, socioeconomic status and cultural practices. Further studies might utilize these other moderating factors to learn more about the circumstances that enable women to engage in the gig economy

6. Conclusion

The effects of artificial intelligence-related elements on women's participation in the gig economy in Rawalpindi and Islamabad has been discussed in this paper. Specifically, the study examined the effect of access to AI technologies, internet access and previous digital experience on the development of women's digital skills and their involvement in gig jobs. The paper has also explored the moderating influence of educational attainment on strengthening the relationship between digital skills and women's engagement in the gig economy has also been examined in this research.

The study's conclusion reveal that use of AI tools, internet connectivity, and previous digital experience are important factors in supporting women in gig economy to develop digital skills. Conversely, the effect of barriers to AI tools use on digital capabilities of women was not found to significantly affect them. The results also show that higher digital skills have a great impact in enhancing the participation of women in gig-based jobs. In addition, the results show that the linkage between women participation in gig economy and digital capabilities is moderated by women's level of education, suggesting that women's digital competencies may be particularly important for women with lower education levels.

Overall, the findings highlight how more important it is to consider the growing relevance of AI technologies and digital capabilities for new economic opportunities among women in digital labor markets. Greater access to AI tools, a more robust digital infrastructure and a greater capacity to build digital skills by women will create more

active roles in the gig economy and offer a greater number of flexible jobs through digital platforms.

References

- Ahmad, I., Sohail, S., Nizamuddin, S., Jameel, A., Aziz, S. H., Waheed, Z., . . . Heeks, R. (2022). Fairwork Pakistan Ratings 2022: Labour standards in the gig economy.
- Ahmad, R., Sharif, F., Ahmad, S., Gul, A., & Abdirasulovna, Z. A. (2024). Does the digital economy improve female employment? A cross-country panel data analysis. *Heliyon*, 10(13), e33535. doi:[10.1016/j.heliyon.2024.e33535](https://doi.org/10.1016/j.heliyon.2024.e33535)
- Ali Saleh, A., Syed Ali, F., Mohammad Bin, A., Abdullah Hamoud Ali, S., Abu Elnasr, E. S., & Judit, O. (2026). Ripple effect of gig work: How hands-on experience and networks shape future female entrepreneurs. *Sustainable Technology and Entrepreneurship*, 5(1), 100118. doi:<https://doi.org/10.1016/j.stae.2025.100118>
- Andrea, M. H., Petra, M. Z., Maryse, M. H. C., Brita, S., & Amelie, L. (2023). "We don't need no (higher) education" - How the gig economy challenges the education-income paradigm. *Technological Forecasting and Social Change*, 186, 122136. doi:<https://doi.org/10.1016/j.techfore.2022.122136>
- Chang, T.-W., Chen, Y.-S., & Lin, C.-Y. (2022). The Myth of Organizational Change Process: A Study of Uniting Organizational Identity, Promoting Organizational Performance, and Member Behavior. *SAGE Open*, 12, 215824402210798. doi:10.1177/21582440221079891
- Cristian, B., Mara, G., Amina, M., Orlando, T., & Anna, V. (2024). Digital divide, gender gap, and entrepreneurial orientation: How to foster technology adoption among Pakistani higher education students? *Socio-Economic Planning Sciences*, 93, 101904. doi:<https://doi.org/10.1016/j.seps.2024.101904>
- Do, D. T., Nguyen, T. Q., & Vu, D. H. (2024). The impact of digital economy on women's employment: evidence from selected European and Asian countries. *Journal of International Economics and Management*, 24(3), 77-96. doi:<https://doi.org/10.38203/jiem.024.3.0095>
- Huang, N., Burtch, G., Hong, Y., & Pavlou, P. A. (2020). Unemployment and Worker Participation in the Gig Economy: Evidence from an Online Labor Market. *Information Systems Research*, 31(2), 431-448. doi:<https://doi.org/10.1287/isre.2019.0896>
- Hunt, A., Samman, E., Tapfuma, S., Mwaura, G., & Omenya, R. (2019). *Women in the gig economy: Paid work, care and flexibility in Kenya and South Africa*. Retrieved from
- Jing, L., Qinglan, X., & Taoxuan, W. (2023). Does the digital economy generate a gender dividend for female employment? Evidence from China. *Telecommunications Policy*, 47(6), 102545. doi:<https://doi.org/10.1016/j.telpol.2023.102545>
- Jorge, A.-J., Jose-Antonio, C.-A., Ana-Isabel, J.-Z., & Inés, G.-G. (2023). Improving the social performance of women-led microenterprises: The role of social media marketing actions. *Technological Forecasting and Social Change*, 191, 122484. doi:<https://doi.org/10.1016/j.techfore.2023.122484>
- Kalim, U., Kanwar, A., Sha, J., & Huang, R. (2025). Barriers to AI adoption for women in higher education: a systematic review of the Asian context. *Smart Learning Environments*, 12(1), 38. doi:<https://doi.org/10.1186/s40561-025-00390-5>

- Kim, P., Sawyer, S., & Dunn, M. J. P. o. t. A. o. H.-C. I. (2025). Gender and careers in platform-mediated work: A longitudinal study of online freelancers. *9*(7), 1-31. doi:<https://doi.org/10.1145/3757606>
- Mahmud, M., Hossain, M., Saju, A., Ullah, M., & Hasan, R. (2024). Information Technology for The Next Future World: Adoption of It for Social and Economic Growth: Part II. *International Journal of Innovative Research in Technology Basic and Applied Sciences*, *10*, 744.
- Malik, R., Visvizi, A., & Skrzek-Lubasińska, M. (2021). The Gig Economy: Current Issues, the Debate, and the New Avenues of Research. *13*(9), 5023. doi:<https://doi.org/0.3390/su13095023>
- Memon, S. B., Nobre, H., & Ahmad, N. J. J. o. D. E. (2025). Gig Work and Women's Empowerment in Rural Pakistan. doi:<https://doi.org/10.1016/j.jdec.2025.09.002>
- Narijo, D., Shaikh, D., & Siddiqui, D. (2025). Women, work, and technology: The role of generative AI in shaping the social mobility of female entrepreneurs in Pakistan. *Social Sciences Spectrum*, *4*, 498-511. doi:<https://doi.org/10.71085/sss.04.02.287>
- Necula, S.-C., Fotache, D., & Rieder, E. (2024). Assessing the Impact of Artificial Intelligence Tools on Employee Productivity: Insights from a Comprehensive Survey Analysis. *Electronics*, *13*, 3758. doi:<https://doi.org/10.3390/electronics13183758>
- Sadia, J. (2021). From digital divide to digital inclusion: Challenges for wide-ranging digitalization in Pakistan. *Telecommunications Policy*, *45*(8), 102206. doi:<https://doi.org/10.1016/j.telpol.2021.102206>
- Shahbazi, H., Hakimi, M., Ulusi, H., Rahimi, B., Quraishi, T. J. E. J. o. E. I., & Education, T. i. (2024). Exploring the Impact of Artificial Intelligence on Women's Empowerment: A Comprehensive Survey. *1*(2), 108-120. doi:<https://doi.org/10.59110/edutrend.333>
- Shaw, A., Fiers, F., & Hargittai, E. (2023). Participation inequality in the gig economy. *Information, Communication & Society*, *26*(11), 2250-2267. doi:10.1080/1369118X.2022.2085611
- Soumya, V., & Jekka Chandrasekaran, S. (2024). Analysing the evolution and patterns of the gig economy: a bibliometric examination of growth and trends. *Cogent Business & Management*, *11*(1), 2424480. doi:<https://doi.org/10.1080/23311975.2024.2424480>
- Wang, J., Gao, Q., & Zhang, R. (2025). Gig economy and its impact on individual employment: an empirical analysis. *Humanities and Social Sciences Communications*, *12*(1), 1703. doi:10.1057/s41599-025-05970-x
- Woodman, R. J., & Mangoni, A. A. (2023). A comprehensive review of machine learning algorithms and their application in geriatric medicine: present and future. *Aging Clinical and Experimental Research*, *35*(11), 2363-2397. doi:10.1007/s40520-023-02552-2
- Wu, R., & Yu, Z. (2023). Do AI chatbots improve students learning outcomes? Evidence from a meta-analysis. *British Journal of Educational Technology*, *55*. doi:<https://doi.org/10.1111/bjet.13334>