INTERNET USE IN THE WORKPLACE: INEQUALITY OF OPPORTUNITY AND ITS CONSEQUENCES

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Abstract

The study based on Russian data tests hypotheses about the existence of gaps in the Internet use by employees according to gender, age and educational criteria and assesses the impact of these gaps on the position of workers in the labor market. Accordingly, the inequality of opportunities to use digital technologies in the workplace was assessed at the first stage of the study, and the consequences of this inequality were assessed at its second stage.

Regression analysis with control of characteristics of employees and workplaces showed that, other things being equal, women, workers under 35 with higher education are more likely to use the Internet for work purposes. The use of the Internet for work turned out to be a positive statistically significant factor in the Mincer salary equation and in the logistic regression equations that assessed job satisfaction in general, working conditions and career opportunities. These results are important not only from the standpoint of developing programs to improve digital literacy and accessibility of digital infrastructure, but also the policy of personnel management, its involvement and retention.

Key words: labor market, digital divide, digitalization of the economy

JEL Code: J24, J31

Introduction

Currently, when studying the digital economy, researchers note digital inequality more often. Modern research shows that digital inequality is not limited to access to information and communication technologies. It also leads to offline inequality associated with inequality of access to socio-economic resources (Vassilakopoulou, P., Hustad, E., 2023). For people who cannot use digital resources due to various reasons, the risk of becoming partially or completely excluded from the life of society and significant segments of the labor market increases. That is why overcoming digital inequality is important for the sustainable development of society and the economy.

Modern research records the complexity of the digital divide problem. If earlier this problem was considered almost exclusively in a spatial context, today it is recognized that it has a hybrid character (M. Graham, 2011). From the perspective of this study, a three-level approach to digital inequality is of particular interest (Attewell, 2001).

The first level is related to the gap in Internet access. Technologically, in many countries, this gap has almost been overcome due to the spread of broadband Internet. At the same time, even in countries with a high level of technological development, this level of inequality remains relevant (A. van Deursen, J. van Dijk 2018; M. Büchi et al., 2016). The role of this gap should not be underestimated because new technological advances are constantly emerging in modern society.

The second level is the gap in digital literacy and digital competencies of users. Their absence or insufficient level of development leads to the fact that users cannot effectively use information and communication technologies (M. Büchi et al., 2016, A. E. Bucea, 2020). Unlike the previous level, this level draws attention to the fact that users can have access to the Internet but use it in different ways (A. Scheerder et al., 2017, Van Deursen and Mossberger, 2018).

Among the factors determining differences in skills, researchers most often name the level of education, gender and age of an individual, social origin, type of settlement, and geographical location (A. Scheerder et al., 2017, D. Ferreira et al., 2021, Vassilakopoulou, P., Hustad, E., 2023, A. E Bucea et al., 2020, M.J. Stern et al., 2009). At the same time, the list of factors tends to expand. For example, more and more often among the factors determining differences in digital skills, researchers name motivation and social environment (L. Wang et al., 2021, K. Pihlainen et al., 2023).

The first two levels of inequality are quite closely related. The lack of digital infrastructure also leads to a lack of skills to use it, although the presence of infrastructure does not always lead to the formation of skills.

The third level of the digital divide is associated with obtaining offline benefits and opportunities from the use of information and communication technologies in economic, social, cultural and other spheres of life (G. Blank, C. Lutz, 2018, F. Castellacci, C. Viñas-Bardolet, 2017, J. Millán et al., 2021). Examples of such benefits in the labor market can be, for example, higher wages, career growth, job satisfaction, new activities and opportunities, more effective social interactions. Given the significance of the lack of knowledge of this gap, we can agree that its role is underestimated (A. Scheerder, et al., 2017).

Based on the theory of the levels of digital inequality and on the research of the factors that form it, the authors consider the factors of inequality formation based on data representative for the Russian Federation and assess the consequences that digital inequality leads to. The peculiarity of our study is that the consequences are assessed not only by objective indicators (wages), but also by subjective indicators (job satisfaction).

Research methodology

Based on the theory of levels of digital inequality, we will estimate different levels of inequality. The study is based on data from a survey of individuals (a part of the 31st wave of the Russia Longitudinal Monitoring Survey RLMS-HSE[1]), conducted in 2022 and representing the entire population of the Russian Federation. There were 4,995 respondents representing the employed in the sample structure. In the survey , employees were asked the question "Did you use the Internet for work in the past 12 months?". This question allows to get an integrated assessment of the first two levels of digital inequality - access to infrastructure and Internet usage opportunities.

To assess the factors of inequality in Internet use in the workplace, we used a logistic regression:

$$f(z) = \frac{1}{1+e^{-z}}, z = b_o + \sum b_i x_i + u \quad (1)$$

where z - dependent variable, зhe value of which is determined by a linear combination of independent factors, x_i, e - base of natural logarithm, b_i - estimated regression parameters, and u - random error.

The choice of this function is due to the fact that *f(z)* an take values in the range from 0 to 1, therefore, the value of this function when substituting specific x_i can be interpreted as the probability of an event, in this case – as the probability of using the Internet in the workplace.

The value of the function in model 1 was determined by the answers "yes" or "no" to the question about using the Internet in the workplace. These responses were recoded to 1 and 0, respectively.

[1] The Russia Longitudinal Monitoring Survey - Higher School of Economics (RLMS-HSE) is conducted by the National Research University Higher School of Economics and ZAO "Demoscope", together with Carolina Population Center, University of North Carolina at Chapel Hill, and the Institute of Sociology RAS. (RLMS-HSE Survey Sites: https://rlms-hse.cpc.unc.edu and http://www.hse.ru/rlms).

Characteristics of individuals (gender, age, level of education, marital status, number of children under 18) and jobs (industry affiliation, form of ownership, position, type of settlement, region (federal district)) were used as regressors.

The third aspect, the inequality of the result in labor relations, can be assessed both by the objective characteristics of the workplace (the amount of wages received) and by subjective characteristics (satisfaction with various aspects of the workplace).

At this stage of the study, we used two groups of models to assess the impact of owning digital competencies. To do this, we used a Mincer-type wage equation, which, after logarithmization, takes a linear form:

$$wh = e^{b_0 + b_1 INT + \sum b_i x_i + e} \quad (2)$$

$$lnwh = b_0 + b_1 INT + \sum b_i x_i + e \quad (3)$$

where *wh* – average wage per hour for the last month, *INT* – a regressor reflecting the use of the Internet in the workplace, x_i – other regressors, b_i - estimated regression parameters, and *e* - random error. As in the first stage of the study, Internet use in the workplace was assessed using a binary variable (yes/no). The economic meaning of the regression coefficient b_1 in model (3) is that, all other things being equal, the use of the Internet in the workplace (*INT*=1) leads to an increase in the average hourly wage by $exp(b_i)$ times.

Also, to assess the inequality of the results, we used logistic regressions (1) characterizing job satisfaction in general, wages, working conditions and opportunities for professional growth. The ordinal scale of answers to these questions has been recoded into binary. The answers "completely satisfied" and "rather satisfied" were assigned the value 1, the answers "both yes and no", "rather dissatisfied", "completely dissatisfied" – 0.

In models, in addition to variables characterizing digital skills, the characteristics of the employee (gender, age, level of education, work experience in the organization, marital status, presence of children) and workplace (industry affiliation, form of ownership, position held, type of settlement, region (federal district)) were taken into account as regressors.

Results

The Internet is used in the workplace by 6 out of 10 Russian workers aged 15 to 65 years, 80% of whom are users whose activities do not involve the use of specialized software. It is logical that the most active Internet users are young workers under 35, working as managers and specialists in the fields of public administration, mass media, telecommunications, financial, legal services and a number of other services.

The results of the logistic regression[2] confirm that the Internet in the workplace, other things being equal, is more often used by women and young workers under 35 compared to workers of other ages, managers and specialists compared to those employed in other positions, employees with secondary professional and higher education compared to those who have graduated only from school and are employed in the private sector (in all cases $p<0.01$). At the same time, marital status and the presence of children do not have a statistically significant impact on Internet use. The current level of information technology development makes statistically insignificant differences in the use of the Internet by types of settlements. In addition, there are regional and sectoral gaps. Relatively more often the Internet is used in the workplace in the field of public administration ($p <0.01$) in transport and communications, in the service sector (in all cases $p<0.1$), less often in industry (($p<0.01$), as well as in the Siberian ($p<0.01$) and Ural ($p<0.1$) federal districts.

Thus, at this stage of the study, we can fix the presence of inequality in the use of the Internet in the workplace, based on several features, including such socio-demographic characteristics of employees as age, gender, and level of education.

Next, we constructed various modifications of the wage equation (the formula 3). In addition to the general model for all working respondents aged 15-64, we evaluated the wage equations for young workers under 35 and older workers, for men and women, as well as for workers with higher, secondary professional and lower levels of education. The choice of such modifications is due to the fact that these socio-demographic factors determine the inequality of access to the Internet in the workplace. We were interested in estimating the regression parameter for the variable "Internet use in the workplace" (INT), since the statistical significance of this variable reflects the third aspect of digital inequality - inequality of results.

For the entire sample, the regression parameter estimate for the INT variable was 0.147 ($p<0.01$). This means that, all other things being equal, employees using the Internet in the workplace receive an average salary 1.158 times higher. However, when constructing equations for different subsamples, we identified certain differences in the return on using the Internet in the workplace (Table 1).

[2] Nagelkerke R Square – 0.377, correctly predicted values for the cut value is 0.5 – 76.1%

Tab. 1: Estimates of the regression parameter for the binary variable "Internet use in the workplace" in the wage equations for various subsamples

Group of employees (subsample)	Level of education		
	Higher	Secondary professional	General secondary
All employees	0.242***	0.158***	0.122***
Men	0.169**	0.185***	0.079*
Women	0.291***	0.145***	0.173***
Employees from 15 to 34 years old	0.078	0.203***	0.185***
Employees over 35 years old	0.303***	0.141***	0.112***

*** - p<0.01, ** - p<0.01, * - p<0.1

Source: authors' calculations

Comparing the obtained estimates, we can draw several conclusions.

Firstly, the return on owning Internet technologies is generally positively correlated with the level of education. Exceptions for employees aged 15-34 with higher education are explained by the small size of the corresponding subsample and require additional research.

Secondly, the return on owning Internet technologies is on average higher for women compared to men. Probably, this fact may be related to the structure of women's jobs. In general, the obtained result is consistent with the well-known explanations about the higher return on education for women compared to men.

Thirdly, estimates of the impact of using Internet technologies by age groups, especially for younger workers, are quite high.

Further, the study analyzed employee satisfaction with various aspects of work. By analogy with the analysis of wages, we estimate the influence of the variable INT on various aspects of job satisfaction depending on the gender, age and educational characteristics of employees in the logistic regression model (the formulas 1). Due to the fact that the interpretation of estimates in the logistic model is not as obvious as in the linear one, for ease of perception, we indicated the direction of the relationship (plus – positive relationship, minus-negative) and the statistical significance of obtained estimates (Table 2).

Tab. 2: Estimates of the regression parameter for the binary variable "Internet use in the workplace" in the work satisfaction equations for various subsamples

Group of employees (subsample)	Satisfaction			
	with job in general	with salary	with working conditions	with prospects for professional growth
All employees	+***	+***	+***	
Employees with higher education	+***	+**	+***	+**
Employees with secondary professional education	+***	+**		
Employees with no professional education	+***	+***	+***	
Men	+***	+*	+***	
Women	+***	+***	+***	
Employees from 15 to 34 years old	+***	+***	+***	+**
Employees from 35 to 64 years old	+***	+**	+***	

*** - p<0.01, ** - p<0.01, * - p<0.1

Source: authors' calculations

Thus, all other things being equal, the use of the Internet in the workplace is associated with an increase in job satisfaction. At the same time, it is important to note that in conditions of low labor supply in a number of segments of the labor market, the fact that the use of Internet technologies by young and highly educated workers is positively associated with satisfaction with professional growth prospects is of particular importance.

Conclusion

The obtained results are of interest in several aspects.

Firstly, they indicate that, despite the rapid development of Internet technologies, a number of issues related to digital inequality still remain relevant. These are, on the one hand, issues of access to modern communication channels and software, and, on the other hand, the development of digital competencies of employees, especially those of older age groups. The persistence of existing gaps in the near future may lead to a significant reduction in employment opportunities for certain groups of the workforce. The inequality of Internet access revealed on Russian data and related to people's gender, age and education is consistent with the known data for other countries (for example, A. E Bucea et al., 2020). At the same time, our study did

not reveal any differences in Internet use by type of settlement, although, perhaps, taking into account the quality of communication and the intensity of Internet use could slightly adjust the obtained results.

Secondly, we see that the use of Internet technologies by employees is rewarded by the labor market. This is manifested not only in higher wages, but also in non-paid characteristics associated with job satisfaction. The conclusions we have obtained also do not contradict the conclusions obtained in other countries (Millán, J. et al, 2021, F. Castellacci, C. Viñas-Bardolet, 2017). ЭThis aspect of digital inequality is of particular interest for understanding the processes in the Russian labor market.

This is due to a shortage of labor supply in a number of segments of the labor market. Equipping workplaces, the emergence of new tasks and methods of work associated with the use of modern technologies can provide a company with an advantage in the labor market and increase its attractiveness, especially for young and highly educated workers.

At the same time, a number of issues related to the impact of the Internet technologies use on the position of the employee remains relevant. In particular, it is interesting to assess the impact on the level of possession of digital competencies, and not on the very fact of using the Internet in the workplace. It is possible that information about the fact, but not about the level of proficiency in Internet technologies led to an overestimation of INT. In the future, the return on the level of employees' digital competencies development can be assessed either by having relevant microdata, or by grouping employees into professional groups correlated with certain groups of digital skills development, which requires the use of larger samples. Finally, it is of interest to study the impact of the use of digital competencies on personnel rotation in the organization.

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