Dynamics of Digital Inequality in Russia

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This article contains research about the phenomenon of digital inequality among different social groups in Russia. The short literature review, conducted in it, concerns the factors, which have an impact on the rise and spread of digital inequality. The types of digital inequality have been analyzed, and each of them has the relative digital divide indicators calculated. It has been revealed, that the digital divide in terms of the Internet and information and communications technology access between the rural and urban population has been decreased, however the divide in terms of digital skills has been increased. There is almost no digital divide in ICT among the middle-aged groups, and it is constantly decreasing. Although the digital divide among the older-aged groups is also growing down, it is still high, and the divide in digital skills remains unchanged. It is noted, that the country's territory in length objectively increases the IT infrastructure costs, hampers providing for the high-quality internet-connection for the rural people and is the reason for digital divide in terms of Internet-access.

Keywords: Internet, digital inequality, competitive edge, information,
communications technology.

The appliance of ICT became a key factor of socio-economic development, which widespread nature resulted from the advent and extensive user of the world network (Ragulina, Semenova, Zueva, Kletskova, & Belkina, 2018). Using ICT fundamentally changes many aspects of daily life. The Internet turned into a usual communication environment, allowing to overcome time and spatial restrictions on the way to information and social services access (Higher School of Economics [HSE], 2018). However new risks and threats, concerning the irregular distribution of ICT and unequal access to them, appears along with new social-economic development facilities. And this is called "digital inequality."

The term "digit inequality" or "digital divide" was originally discussed at the G8 summit in 2000, where the "Charter on the Global Information Society" was adopted. The accessibility of IT for every human around the world was declared as its basic principle (Dyatlov & Selischeva, 2014). The phenomenon of digital inequality includes both individual groups of people and whole regions. According to Internet World Stats, 44.87% of the world population does not have any access to ICT (Internet World Stats, 2018).

Economy digitalization leads to ICT penetration into working and private space. According to the Higher School of Economics, 81% of Russian population at the age of 15 to 72 have ever used a personal computer; the same quantity has ever used the Internet (HSE, 2017). However, the growth rates of digitalization are higher than the rates of developing skills of most people in applying the means of the digital environment.

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As digital technologies wide and fast spread, the phenomenon of digital inequality increases its relevance and, therefore, arouses heighten research interest. It is worth noting that there is no common and developed approach to define such terms as "digital inequality," "digital divide" at present and the factor of their basis are not examined fundamentally. Therefore, the object of this research is the analysis of digital inequality.

Literature Review

Along with material factors such as income, demographical (age, sex, type of settlement), sociocultural (education, mindset, and the others) and psychological (degree of confidence regarding ICT usage) ones also have a great impact on digital divide (Dyatlov & Selischeva, 2014).

The scientific researches emphasize the multifractality of the phenomenon under study. (Várallyai, Herdon, & Botos, 2015). The majority of works examines the correlation between digital inequality with the current types of inequality: income inequality and educational inequality. The other considerations highlighted in the research were the internet infrastructure, the cost of ICT, age, sex and intentions of ICT users and the government assistance of ICT development.

The ICT spread is closely related to the equipment and internet access cost. Despite the constant depreciation of the ICT accessibility, the high cost of using the ICT adversely affects the householder's decisions to use it and becomes the main reason for people not to have access to the Internet even in the developed countries (Ganley, Dewan, & Kraemer, 2005). The differences in education, age, economic reasons, and urbanization degree are considered as the explanations for the growing information divide (Boje, Steffen, & Dragulanescu, 2018).

The analysis of digital skills level based on gender, migrational and social differences revealed that the traditional educational competencies have a significant impact on the digital skills level (Azzolini & Schizzerotto, 2017). The more educated an individual is, the more likely he or she will intensively use ICT. Moreover, among the people with the same income, the ones with a higher educational level have advanced access to ICT.

The personal income is another factor having a substantial influence over the ICT usage and access level. Many research works emphasize that the household income or/and individual income is the overriding factor which positively affects the ICT usage.

The digital divide of rural areas is widely recognized at present. The research made by Philip, Cottril, Farrington, Williams & Ashmore (2017) is focused on revealing the nature of this engrained digital divide. The rapid flourishing of ICT and outstripping development of cities more and more engrain the differences between a city and rural area (Philip et al., 2017). The problem concerning the digital divide in rural areas and the older-aged groups exists in the countries with high economic development such as the European Union (Preston, Cawley, & Metykova, 2007), the United States of America (Pick, Sarkar & Johnson, 2015; Pick & Nishida, 2015), Japan (Nishida, Pick, & Sarkar, 2014), Australia (Park, 2016), the countries with developing economy and the ones with emerging economy (Park, Choi, & Hong, 2015) as well as in the countries with low level of economic development (Goncalves, Oliveir, & Cruz-Jesus, 2018).

The age and sex of ICT users also exert considerable influence on ICT access and usage. As a rule, Internet access and computer usage prevail among the younger generation. According to numerous studies, the age group 16-24 years leads the way in using the Internet and ICT. Additionally, a household composition, especially including children, has an impact on Internet access and ICT usage by other family members, including the older generation. The gender differences and its impact on ICT are often regarded alongside

the age ones by researchers. Nevertheless, the majority of researchers demonstrate that the gender differences of ICT users have a lesser effect unlike the age differences have.

It has been revealed, that in the cases when man's job is supposed to use a personal computer, it has a positive influence on using ICT at home (National Telecommunication and Information Administration [NTIA], 2002). That fact is confirmed by having and developing digital skills and competences. The lack of skills and necessity and interest in ICT is the main reason for most people who do not use the Internet or have no access to it.

Summarizing the results of the literature review indicates the prevailing types of digital inequality as shown in Figure 1.
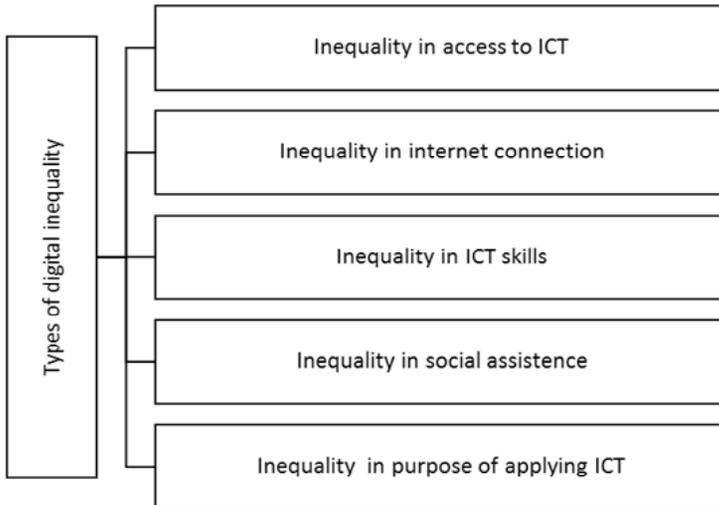

Figure 1. The main types of digital inequality

The scopes of factor analysis, presented above, are limited in comprehensive explanation for inequality in ICT usage. The researchers of inequality in ICT usage also identify other factors, as they think, related to it: the government assistance of digital technology development countrywide, occupation, language, skills, etc.

Methods

Our research is focused on the transformation of digital inequality in Russia. Digital inequality is expected to have decreased during the survey period. This hypothesis has three reasons.

Firstly, Russia embarked on a path of creating a digital economy with launching the ambitious state program concerning economy development of a new technology order in 2016 (Sukhomolon, Zubareva, & Yakushin, 2017).

Secondly, the dynamics of ICT spreading among the groups of population who use the Internet more often (the user groups at the age of 15-24 and the people with high level of education and income living in urban areas) is marked by the "ceiling effect". That means a slow growth of ICT users related to the fact that vast majority of the population already use ICT.

Thirdly, the high rise of ICT users among the people with less wealth can be caused by reducing the ICT access prices and improving digital infrastructure which leads to its availability growth.

Four types of digital inequality studied in this research are inequality in access to ICT, inequality in the frequency of using ICT, inequality in skills, and inequality in goals of ICT usage for rural residents. We have calculated the relative digital divide indicator of each type for rural residents:

$$DD_i^c = 1 - \frac{P_i^R}{P_i^U} \qquad (1)$$

where DD_i^c – the relative digital divide of the i-th indicator of ICT usage for rural residents compared to urban ones; P_i^R – a quantitative households estimation in rural areas of the i-th indicator of ICT usage, percent of total number of households; P_i^U – a quantitative households estimation in urban areas of the i-th indicator of ICT usage, percent of total number of urban households.

We have calculated the relative digital divide indicator of each type for ICT users of different age groups:

$$DD_i^{AG} = 1 - \frac{P_i^{AG_i}}{P_i^{15-24}} \qquad (2)$$

where DD_i^{AG} – the relative digital divide of the i-th indicator of ICT usage for each age group compared to the age group of 15-24 years; $P_i^{AG_i}$ – a quantitative user's estimation for each age group of the i-th indicator of ICT usage, percent of total users number of an age group; P_i^{15-24} – a quantitative user's estimation for the 15-24 age group of the i-th indicator of ICT usage, percent of total users number of this age group.

We used the databases of the Federal State Statistics Service and the Higher School of Economics for providing the dynamics of digital inequality analysis in this research work.

Results

According to the Federal State Statistics Service in 2018, in spite of the rapid development of technology and a variety of Internet access along with meeting different needs (including government and social services, education and entertainment), every sixth (16.3%) Russian citizen at the age of 15-74 has never used the Internet (Várallyai et al., 2015). There are a little more 13% such citizens among the urban residents and 25.7% - among the rural ones.

The leading explanation for the refusal from the Internet that the majority (70.1%) called is about the lack of necessity and interest to it. In the meantime, the number of those who had to give up using ICT due to limited digital skills is rapidly growing up. In 2015 this reason was called by every fifth (21.8%) and in 2017 – every third (29.0%). Such factors as high costs of the Internet connection (11.5% in 2017), the absence of the technical capabilities of the Internet connection (4.1%) became irrelevant as the reason for not using ICT.

Nevertheless, the digital divide among rural and urban inhabitants still exists, despite decreasing in some indicators. For instance, the significant digital divide took place in the Internet access (from 0.2537 in 2014 to 0.1635 in 2017), but the divide in the ICT access among rural residents caused by the growing digital divide in the availability of PC in 2017 happened to increase (from 0.2715 in 2015 to 0.7994 in 2017). However, the divide in the availability of mobile devices decreased markedly (from 0.4192 in 2014 to 0.0537 in 2017), as shown in Table 1.

Table 1. The dynamics of the digital divide between an urban and rural area

Indicator	2014	2015	2016	2017
ICT access				
Internet access	0.2537	0.2231	0.1898	0.1635
Presence of devices with Internet access				
PC	0.3025	0.2715	0.2497	0.7994
Mobile devices	0.4192	0.0424	0.0726	0.0537
Frequency of using the Internet	0.2672	0.2238	0.2159	0.1731
Work skills				
Basic skills	0.2370	0.2325	0.2327	0.2357
Work with text editor	0.2145	0.1751	0.2235	0.2163
File transfer between a computer and a peripheral device (digital camera, player, mobile phone)	0.3083	0.2736	0.2034	0.2257
Work with spreadsheets	0.3854	0.3447	0.3574	0.3693
Using the programs for editing image, video and audio files	0.0789	0.1167	0.1149	0.1063
Creating electronic presentations using special software	0.1979	0.2523	0.2645	0.2609
Advanced skills				
New device connection and installation	0.4324	0.4000	0.3692	0.3709
Changing the parameters and settings of configuration software.	0.5417	0.4000	0.5349	0.4815
Installation of a new OS or OS reinstallation	0.4884	0.3810	0.4000	0.3617
Writing a software code with different program languages independently	0.4706	0.5333	0.625	0.5789
Purposes of ICT use				
Entertainment	0.0766	0.0649	0.0512	0.1128
Shopping	0.4638	0.3842	0.3449	0.2071
Communication	0.3346	0.2650	0.2548	0.2654
Improving educational or/and cultural level	0.4329	0.4146	0.3727	0.2052
Health	0.3319	0.2789	0.207	0.1634
Financial operations	0.5362	0.4409	0.3811	0.2866
Study and searching for information about it	0.3106	0.2581	0.3175	0.3614
Job search and professional interaction	0.4077	0.2419	0.2295	0.1128
Participation in public and political life	0.4694	0.6032	0.5000	0.5143

　　　　　　 - the digital divide growth between rural and urban areas.

Source: the data was computed and composed by the authors based on Sabelnikova et al. (2018)

The divide between rural and urban residents in Internet usage has noticeably decreased (from 0.2672 in 2014 to 0.1731 in 2017). Concurrently, a little divide increase between these groups in basic digital skills took place to be (from 0.2325 in 2015 to 0.2357 in 2017) largely owing to such skills as "File transfer between a computer and a peripheral device" (from 0.2034 in 2016 to 0.2257 in 2017), "Creating electronic presentations using special software" (from 0.1979 in 2014 to 0.2609 in 2017) and "Work with spreadsheets" (from 0.3447 in 2015 to 0.3693 in 2017). In the meantime, the digital divide in advanced skills among rural residents decreased in 2017.

The digital divide in purposes of ICT use between rural and urban residents is also formidable, but it also tends to decrease, except for some types of using in 2017. The lowest digital divide in purposes of ICT use among rural and urban residents is observed in entertainment (0.1128) in 2017. And the highest one is in participation in public and political life (0.5143), study and searching for information about it (0.3614) and financial operations (0.2866).

The increasing opportunities for Internet access (including progressive usage of mobile devices and networks for these purposes) alongside permanent Internet-resources

are improving results in a substantial change of the life among the majority of the adult population. Most habitual activities undergo digital conversion and are transferred to online.

However, there are noticeable differences among age groups. For instance, there is no significant digital divide among the age groups of 25-34 and 35-44 compared with the one of 15-24 (0.0234), and it instantly decreases (0.0155 and 0.0485 respectively). Nevertheless, the digital divide in ICT access exists for the 55-64 age group (0.3237), and the 65-74 age group (0.5701) remains at the very high rate though decreasing, as shown in Table 2.

Table 2. The dynamics of the digital divide in ICT access and usage among age groups of 15-74 years

Indicator	2014	2015	2016	2017
ICT access				
Presence of devices with Internet access (PC)				
15–24	0.0219	0.0199	0.0201	0.0234
25–34	0.0366	0.0269	0.0256	0.0155
35–44	0.0962	0.0902	0.0667	0.0485
45–54	0.2605	0.2228	0.1908	0.1340
55–64	0.4958	0.4425	0.3949	0.3237
65–74	0.7510	0.6736	0.6400	0.5701
The frequency of using the Internet				
15–24				
25–34	0.0614	0.0472	0.0381	0.0220
35–44	0.1732	0.1576	0.1175	0.0962
45–54	0.3783	0.3344	0.2931	0.2249
55–64	0.6371	0.5959	0.5492	0.4812
65–74	0.8673	0.8339	0.8042	0.7636

Source: the data was computed and composed by the authors based on Sabelnikova et al. (2018).

The essential digital divide among age groups is observed in ICT skills including basic skills, as shown in table 3. Furthermore, the lowest division in digital skills is noticed in the age group of 35-44 years (0.1419) compared with one of 15-24 years (0.2071), but not in the younger age group of 25-34 years (0.2151), as it was expected. It can be ascribed to the greater motivation of the people at the age of 35-44 to improve his or her digital competences due to the necessity of ICT using while working.

Table 3. The dynamics of the digital divide in digital skills of age groups compared with the age group of 15-74

Indicator	Age groups, years					
	15–24	25–34	35–44	45–54	55–64	65–74
Basic skills	0.2071	0.2151	0.1419	0.1996	0.4370	0.6134
Work with text editor	0.2270	0.2357	0.0766	0.1304	0.3909	0.6007
File transfer between a computer and a peripheral device (digital camera, player, mobile phone)	0.1347	0.1399	0.1746	0.2667	0.4664	0.6444
Work with spreadsheets	0.3133	0.3253	0.0912	0.1720	0.5152	0.7589
Using the programs for editing image, video and audio files	0.2642	0.2744	0.2212	0.3045	0.4615	0.6044
Work with e-mails	-0.0359	-0.0373	0.1416	0.1970	0.4877	0.6766
Calls over the Internet	0.0972	0.1009	0.1653	0.1711	0.3304	0.4890
Creating electronic presentations using special software	0.6104	0.6339	0.1574	0.2747	0.5909	0.6667
Advanced skills	0.1295	0.1345	0.2973	0.3654	0.5379	0.7049
New device connection and installation	0.1419	0.1474	0.2778	0.3333	0.5256	0.7027
Changing the parameters and settings of configuration software.	0.1150	0.1194	0.3220	0.3500	0.5769	0.7273
Installation of a new OS or OS reinstallation	0.0664	0.0690	0.3148	0.4324	0.5238	0.7000
Writing a software code with different program languages independently	0.2140	0.2222	0.3333	0.5000	0.5714	0.6667

▮▮▮ - the lowest digital divide compared with the age group of 15-24

Source: The data was computed and composed by the authors based on Sabelnikova et al. (2018).

Discussion

The problems of the digital divide were noticed in the earlier studies. The essential reasons for it were a high financial limitation, substandard, expansive and low-rank telecommunications infrastructure, heavy prices of the Internet provider's services, vast country's territory (Dyatlov & Selischeva, 2014). And this stipulates the spatial distribution of work places, enterprises, and organizations of different types (Akberdina, Tretyakova, & Vlasov, 2017), (Kiselitsa, Shilova, Liman, & Naumenko, 2018).

Over the last five years, most of the reasons turned out to be irrelevant and were not confirmed in our research expect for the vast country's territory. However, it is the country's territory in length that drives up the costs intrinsically, hampers providing for the high-quality internet-connection. And it is the reason for the digital divide in terms of Internet access between rural and urban residents.

The lower income of rural residents or GDP per capita is the main factor, which significantly prevents getting access to the Internet via PC or other devices. It is also common for other countries (Várallyai et al., 2015).

The rising digital divide between rural and urban residents in basic ICT skills can be explained by involving the social groups of population in digital environment, who are not in need of such skills as "Creating electronic presentations using special software" and "Work with spreadsheets" in their ordinary life along with the absence of motivation in getting listed skills. They do not have any financial means to buy a PC and peripheral devices for getting the "File transfer between a computer and a peripheral device (digital camera, player, mobile phone)" skills.

The results we obtained in this research concerning digital inequality corresponds to the ones that were obtained by other researchers in the whole. The studies on the digital inequality analysis among age groups in different countries provide the information that digital skills of the oldest age groups are the most limited as far as they are not involved in a new interactive environment which declares a current technological breakthrough. Besides, new ICTs resulted in the divide grows between the instruments, used by the younger generation, and the ones, used by the older generation (Gordon & Hornbrook, 2018). The older people often face more challenges to use ICT than the younger ones do (Várallyai et al., 2015).

In the research, we emphasize the digital divide growth in digital skills as the unceasing ICT development leads to the fact that people have to get much more higher level of digital literacy to get an opportunity to live and work in a computerized community (Friemel, 2014).

Conclusion

The distinction in Internet and ICT using which is mainly called "digital divide," implies that people from different socio-economic strata and with demographical specifics can be at a disadvantage in Internet access and ICT using compared with the other groups (Gordon & Hornbrook, 2018).

The digital inequality analysis revealed that there is a digital divide between rural and urban residents and among age groups in Russia. The decrease of the digital divide in Internet access and ICT does not facilitate it's reducing in digital skills, especially among the older generation that hampers them to be involved in a new digital in a new interaction environment.

The lower income of rural residents or GDP per capita is the main factor, which significantly prevents getting access to the Internet via PC or other devices. It is also noted, that Russia's territory in length objectively increases the IT infrastructure costs, hampers providing for the high-quality internet-connection for the rural people and is the reason of digital divide in terms of Internet-access.

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