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DIGITAL INEQUALITY IN URBAN SPACE OF ST. PETERSBURG

The problem of digital inequality is observed in this research. Inequality is represented in online services usage by St. Petersburg residents. The existence theoretical base in the field of digital inequality is described, based on theoretical information there were proposed hypothesis. In order to test hypothesis, the regression analysis of the survey data was conducted. The results have shown that in St. Petersburg, instead of leading position in digitalization, there are problems which are the obstacles of intensive digital development. So, the most vulnerable group, that has problems with Internet access, awareness, trust, skills and benefits is older generation. According to the results, the recommendations for St. Petersburg regional authorities were developed. The importance of decision problems is ensuring equal access to digital amenities for residents through the digital adaptation policy.

Keywords: digital inequality, digitalization, regression analysis.

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ЦИФРОВОЕ НЕРАВЕНСТВО В ГОРОДСКОМ ПРОСТРАНСТВЕ САНКТ-ПЕТЕРБУРГА

Раскрывается проблема цифрового неравенства жителей Санкт-Петербурга. Проанализированы основные подходы к изучению цифрового неравенства. С целью проверки основных исследовательских гипотез был проведен опрос. Регрессионный анализ данных показал, что в Санкт-Петербурге, несмотря на лидирующие позиции в цифровизации среди российских регионов, существуют проблемы, которые препятствуют развитию новых технологий. Установлено, что наиболее уязвимой к технологиям социальной группой, испытывающей проблемы с доступом, осведомленностью, доверием, навыками и осознанием выгод, является старшее поколение. По результатам исследования разработаны практические рекомендации для региональных органов власти г. Санкт-Петербурга, суть которых заключается в том, чтобы обеспечить равный доступ к цифровым благам для жителей региона посредством проведения политики адаптации в сфере цифровизации.

Ключевые слова: цифровое неравенство, цифровизация, регрессионный анализ.

Introduction

Digital inequality is multi-dimensional discipline which is characterized by physical access to Internet and devices, level of digital skills and level of trust to technology. But it is observed that level of access, digital skills and trust are different in various age groups, among citizens with high and low income, households in urban and rural areas. Digital inequality influences all social processes in the country (Vartanova 2022: 7) and in literature it was proved that digitalization generates and increases socio-economic inequality.

As for socio-economic inequality in St. Petersburg, it is represented in gender and age composition, allocation of income, housing development between districts of St. Petersburg.

Thus, because of digitalization increases inequality, and at the same time the inequality is observed in St. Petersburg between administrative unites (18 districts). The problem of implementation the digitalization policy in the context of St. Petersburg districts under the influence of inequality factors becomes actual.

In this study it is proposed to consider such research problem as formation digital inequality in intra-urban space of megapolis St. Petersburg. The research presents the result of analysis which identifies the most vulnerable residents groups to technologies in the context of social-economic inequality.

Literature review

With the development of digitalization new way of communication has arisen which is carried out through social networks. The formation virtual networks make up for the lack of communication than previously was limited to interpersonal relationships (Kolesnik, Kornienko, Khouseva 2022: 93). The same process is observed in relationships among residents and government. Virtual communication residents with government is realized via online services. A term "digital divide" has arisen with mass distribution of computers. But the more computer penetration, the higher digital divide. As NTIA, 1998 noted "digital divide between certain groups has increased between 1994 and 1997 so that there is now an even greater disparity in penetration levels among some groups" (NTIA 1998). And this divide was observed between groups with high- and low-income levels, different racial groups, young and adult, etc.

Digital divide is defined as the gap that exists between individuals advantaged by the Internet and those individuals relatively disadvantaged

by the Internet (Rogers 2001: 105). Another definition, digital divide is division between people who have access and use of digital media and those who do not. The digital divide has arisen as a result of such reason as lack of access to Internet which can be explained by socio-economic factors, demographic characteristics of population.

Nowadays, the dimensions of digital divide are broader and focus not only on access to Internet. It is defined 3 levels:

– the 1st level — Internet access (internet, mobile internet);

– the 2nd level — digital skills, technology usage, e-participation;

– the 3rd — outcomes in the form of benefits and harms (Lutz 2019: 142).

Also, Jun Van Dijk defines 4 phases of digital divide: 1) motivational access is based on "no need or significant usage opportunities", "no time or liking" and "rejection of the medium"; 2) material access is divided into two types a) physical access (hardware, operational software, and services of computers, networks) and b) conditional access (entry to particular applications, programs, or contents of computers and networks); 3) skill access are presented by set of digital skills which allow to operate computer and network (operational skills), search information online (information skills); achieve certain goal in network or goal-oriented behaviour (strategic skills); 4) usage access describes the actual usage of technology, because to have access to computer and use it are different behavioural characteristics. Based on actual usage there is possibility to determine usage time. Then this time can be spent for different purposes: search information, communication, work, education, shopping, and this one is called usage diversity. Nevertheless, the time and diversity can be increased with adoption of broadband (broadband usage). And the last dimension of access usage is creativity usage, when users create some certain content by themselves (van Dijk 2005).

But with the appearance of ICT another term also has arisen — digital inequality. There is no certain definition of digital inequality. But DiMaggio offered to expand the focus of research from the "digital divide" between "haves" and "have-nots" (or between users and non-users) to the full range of digital inequality in equipment, autonomy, skills, support, and scope of use among people who are already online (DiMaggio et al. 2001: 360).

It exists across a variety of demographic, ethnic, and geographic dimensions. In other words, digital inequality tends to mirror existing social inequalities in terms of socio-economic status, education, gender, age, geographic location, employment status, and race (Lutz 2019: 146).

Methods and research design

Digital inequality is defined as the disparities in knowledge and ability of using digital and information technology among individuals with different demographics, socioeconomic backgrounds, and digital and information technology experience and competencies (Cai 2016).

In the context of digital divide **Internet access** is the crucial factor to be the part of digital economy. It defines those who have access to Internet have possibility to use ICT technologies. In order to use Internet effectively it is necessary to get **digital skills**. In study (Ferro, Helbig, Gil-Garcia 2011: 7) it was mentioned that IT literacy is positively associated with Internet access and Internet use. Moreover, it is important to provide for users who have access and digital skills an information secure. Thus, the more **level of trust** to technologies the less digital divide. Also, providing information secure positively affects the experience of users, because the previous successful experience influences on subsequent use of ICT.

Since this study addresses the issue of digital inequality, it is necessary to consider the socio-economic characteristics of the population. One of the main factors is **age**, because elderly people show greater reluctance to adopt new technologies than young people (Varallyai, Herdon, Botos 2015). Also**, income** is significant in case of possibility to buy devices and to get an Interne access or up-to-date Internet services (Ferro, Helbig, Gil-Garcia 2011; Varallyai, Herdon, Botos 2015). In case of internet usage, no less important is the level of **education**, that allows the individuals to understand the possibilities of the Internet and to use it meaningfully (Ferro, Helbig, Gil-Garcia 2011: 7).

But what are the consequences of digital divide and / or inequality? Pollitzer (2019) supposes, that digital divide will not allow to achieve 17 Sustainable Development Goals, duing to the low level of digital skills, literacy, and ICT demand, it may lead to lack of innovative resources, as a result the lack of innovations will not provide the overcoming of poverty, quality education, climate changes and so on.

The digital inequality will worsen the current situation in terms of socio-economic inequality. Another consequence of digital divide / inequality can be illustrated in the labour market. In 2010 80% of companies accepted application for job only online (Horrigan 2011: 22). Thus, those who do not have Internet access at home or do not have digital skills they may not get a job, as a result it will be observed increasing of unemployment rate.

Digital divide is not profitable for government, because it is cheaper to serve citizens via online services than financially support physical locations,

and for citizens it is better to use e-service, thus people save time and costs receiving online services, than in-person.

Additionally, in Russia digitalization of urban life and development of unified digital structure for federal and municipal authorities becomes actual. Large financial and technical resources are allocated for the development and implementation in urban space (Eremicheva 2020: 911).

Research results

Based on this theory the hypotheses were set:

– H1: the older population, the lower level in involvement in online services.
– H2: the older population, the lower level of digital skills.
– H3: the lower level of digital skills, the lower level of trust.

To test hypotheses online and offline survey was conducted. The survey is devoted to identifying digital inequality of St. Petersburg citizens. It includes set of questions which are presented 4 factors of digital inequality: access of Internet and devices; awareness about online services; level of digital skills; trust the online services and communication with authorities via online services; deliberate benefits on online services usage.

In order to test the hypotheses, a regression analysis of the survey results was carried out. In regression analysis it was used the following variables (table 1, 2).

Table 1

Data description

Variable	
Access	Access to Internet.
IntUsage	Frequency of Internet usage
SatisfGU	Satisfaction by portal “Gosuslugi”
TechSkills	Level of digital skills
TechTrust	Trust in technologies
Involve	Preference for online services over traditional methods
Gender	Gender
Age	Age
Educ	Level of education
IncomeLvl	Level of income

309 people participated in the survey (N = 309), the minimum age of the respondent is 14 years, the maximum is 84. 18% of men took part in the survey (in the table, the binary variable is zero if the respondent is a woman, and one if the respondent is a man).

Table 2

Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Access	309	4.369	.974	1	5
IntUsage	309	4.553	.861	1	5
SatisfGU	309	3.443	.977	1	5
TechSkills	309	3.984	1.213	1	5
TechTrust	309	3.751	1.187	1	5
Involve	309	3.602	1.195	1	5
Gender	309	.175	.380	0	1
Age	309	45.932	15.875	14	84
Educ	309	3.634	.644	1	5
IncomeLvl	309	3.068	.882	1	5

The Polychoric Correlation analysis was used to calculate the correlation between ordinal categorical variables. And has shown the following results (table 3).

Table 3

Correlation matrix

	Access	IntUsage	SatisGU	TechSkills	TechTrust	Involve	Educ
Access	1						
IntUsage	.600	1					
SatisGU	.272	.312	1				
TechSkills	.488	.707	.399	1			
TechTrust	.435	.402	.256	.520	1		
Involve	.392	.498	.386	.601	.449	1	
Educ	.192	.191	.196	.238	.100	.230	1
IncomeLv	.455	.380	.181	.351	.279	.207	.290

High level of correlation was observed between such variables as:

Internet access and frequency of Internet usage (Access &IntUsage), that is obvious. If person has constant Internet access the more possibilities to use it more often.

The digital skills and frequency of Internet usage (IntUsage&TechSkills).

Involvement and Skills.

Further, linear regression models were constructed. These models checked the hypothesis, which were proposed in research.

Regression model 1. Identification of factors affecting digital skills.

$$y(TechSkills) = \alpha + \beta\, Access + \beta\, Involve + \beta\, SatisfGU + \beta\, Gender + \beta\, Age + \beta\, Educ + \beta\, IncomeLvl + \varepsilon.$$

Table 4

Linear regression model 1

TechSkills	Coef.	St.Err.	*t*-value	*p*-value	[95% Conf	Interval]	Sig
Access	.105	.057	1.83	.068	–.008	.219	*
Involve	.276	.049	5.67	0	.180	.371	***
SatisfGU	.143	.055	2.62	.009	.036	.251	***
Gender	.398	.134	2.97	.003	.134	.661	***
Age	–.032	.004	–8.98	0	–.039	–.025	***
Educ	.173	.081	2.13	.034	.013	.333	**
IncomeLvl	.037	.065	0.57	.572	–.092	.165	
Constant	2.701	.439	6.14	0	1.836	3.565	***
Mean dependent var		3.984	SD dependent var			1.213	
R-squared		0.498	Number of obs			309	
F-test		42.734	Prob > F			0.000	
Akaike crit. (AIC)		797.832	Bayesian crit. (BIC)			827.699	

*** $p < .01$, ** $p < .05$, * $p < .1$

The regression model is statistically significant and has average level of explanation. The following variables are statistically significant: Involve, SatisfGU, Gender, Age, Educ. Thus, there are such results.

Involvement positively effect on level of digital skills. So, online public services and usage of its help citizens increase their skills.

Satisfaction by portal "Gosuslugi" increases digital skills. It can be explained by the fact that positive experience of usage of portal helps development of digital skills on order to use these online services.

Men have more digital skills compare with women.

The older respondents have the lower level of digital skills.

Respondents with the higher education have higher level of digital skills.

Regression model 2. Identification of factors affecting trust in usage of technologies and online services.

$$y(TechTrust) = \alpha + \beta\, Access + \beta\, Involve + \beta\, SatisfGU + \beta\, Gender + \beta\, Age + \beta\, Educ + \beta\, IncomeLvl + \varepsilon.$$

Table 5

Linear regression model 2

TechTrust	Coef.	St.Err.	*t*-value	*p*-value	[95% Conf	Interval]	Sig
Access	.205	.068	3.01	.003	.071	.340	***
Involve	.293	.058	5.06	0	.179	.406	***
SatisfGU	.111	.065	1.71	.088	–.017	.239	*
Gender	.120	.159	0.76	.450	–.193	.434	
Age	–.008	.004	–1.91	.057	–.017	0	*
Educ	–.071	.097	–0.73	.464	–.261	.119	
IncomeLvl	.113	.078	1.46	.145	–.039	.266	
Constant	1.679	.522	3.21	.001	.651	2.707	***
Mean dependent var		3.751	SD dependent var			1.187	
R-squared		0.260	Number of obs			309	
F-test		15.138	Prob > F			0.000	
Akaike crit. (AIC)		904.537	Bayesian crit. (BIC)			934.403	

*** $p < .01$, ** $p < .05$, * $p < .1$

The regression model is statistically significant and has low level of explanation. The following variables are statistically significant — Access, Involve. Thus, there are such results:

Internet access positively effects on trust in technologies.

Involvement positively effects on trust.

Thus, it is possible to make conclusion, that portal "Gosuslugi" has a good quality, and that people who do not trust, they are not aware or didn't use online services.

Regression model 3. Identification of factors affecting involvement in public online services.

$$y(Involve) = \alpha + \beta\, Access + \beta\, IntUsage + \beta\, SatisfGU + \beta\, TechSkills + \beta\, TechTrust + \beta\, Gender + \beta\, Age + \beta\, Educ + \beta\, IncomeLvl + \varepsilon.$$

Table 6

Linear regression model 3

Involve	Coef.	St.Err.	*t*-value	*p*-value	[95% Conf	Interval]	Sig
Access	.114	.066	1.73	.084	–.015	.243	***
IntUsage	.091	.081	1.13	.260	–.068	.251	
SatisfGU	.181	.060	3.00	.003	.062	.299	*
TechSkills	.257	.067	3.84	0	.125	.389	*
TechTrust	.200	.054	3.74	0	.095	.306	*
Gender	–.139	.150	–0.93	.354	–.433	.155	
Age	–.009	.004	–2.01	.045	–.018	0	**
Educ	.186	.090	2.06	.040	.009	.362	**
IncomeLvl	–.100	.072	–1.39	.164	–.242	.041	
Constant	.363	.574	0.63	.527	–.766	1.492	
Mean dependent var		3.602	SD dependent var			1.195	
R-squared		0.377	Number of obs			309	
F-test		20.088	Prob > F			0.000	
Akaike crit. (AIC)		860.013	Bayesian crit. (BIC)			897.346	

*** $p<.01$, ** $p<.05$, * $p<.1$

The regression model is statistically significant and has average level of explanation. The following variables are statistically significant — SatisfGU, TechSkills, TechTrust, Age, Educ.

Conclusion

Now we generalized the research results:
– positive experience of usage of online public services positively effects on involvement;
– respondents with more developed digital skills are more involved in usage of online services;
– respondents who trust online services are more involved;
– the older respondent the lower level of involvement;
– respondents with higher education are more involved. into the digitalisation.

Thus, the most vulnerable group to technologies is older 55 years old. In order to overcome digital inequality in St. Petersburg it is necessary to increase involvement, increase satisfaction (quality) of online services, increase access to services, and help adult people and less educated population to adapt these technologies.

Moreover, in conditions when the Russian information technology market depends on foreign production, and supplies are limited, which led to failures on the websites of state authorities and the inability to make online transactions by the population, and as a result, the growth of distrust, it is necessary to leave alternative (traditional forms) interactions. In addition, there are people among the older generation who do not want to use the Internet and technologies, moreover, experienced users may be exposed to fraud regarding electronic devices and personal data, as a result, they will temporarily be unable to use electronic devices. As a result, a person is cut off from city life. However, digitalization should create comfort for a person both in everyday life and in unforeseen situations, and not create additional barriers.

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