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DIGITAL DIVIDE IN PAKISTAN: BARRIERS TO ICT USAGE AMONG THE INDIVIDUALS OF PAKISTAN

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ABSTRACT

The Information and Communications Technology (ICT) revolution has radically improved connectivity across the globe and pervaded into most aspects of modern human life. The fourth industrial revolution is currently taking place, and it will be digital. Pakistan has made significant progress in the last few years in IT, but currently, Pakistan is ranked 135 out of 144 in access to the internet. This low level of ICT usage depends on the multiple factors affecting the individual's decision to ICT usage. For this purpose, this study surveys the correlates of ICT use capabilities in Pakistan. ICT usage is composite of specified digital skills. The data sourced from PSLM – HIES survey (2018-2019) was used for empirical analysis. The empirical evidence is based on the Logit model. The marginal effects of the Logit model suggest that socioeconomic, demographic, regional, and supply-side factors well explain the variation in the ICT usage capabilities of the individuals. Moreover, the leading determinants of the digital divide are ICT infrastructure and access to focal technology. We found a sizeable digital divide among the individuals of Pakistan. This study is an implication of target 9c of the ninth goal of sustainable development goals related to increasing access to ICT and striving to provide universal and affordable access to the internet in least-developed countries. The study's findings help the researcher highlight the factors hindering the ICT use capabilities of individuals and bridging Pakistan's digital divide diffusion.

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INTRODUCTION

Pakistan's information and telecommunication sector is a significant contributor to the nation's economy and a major share related to computers and its services. Pakistan's IT services exports, since FY 2010, grew at 10.8% per annum from US$433 million and more than US$1.23 billion in FY2010-2019. The share of IT services raised from 44% of total ICT exports to 73% from FY2010 to FY2019, with an annual growth rate of 17.3%. Pakistan's global ICTs services share was meagre, only 0.2 in 2018, which is very low (State bank of Pakistan, 2020). Data from PSLM 2018-19 show that only 14 percent of households have access to a computer/ laptop/ tablet, while 27 percent are urban and 7 percent in a rural area, while internet access is only 14 percent overall but still hints at a substantial distance to universal access. Over the years, Pakistan's ranking of 135 has gotten worse in the ICT Development Index (IDI-2020), with other countries progressing faster and the lowest of the major South Asian economies in terms of IDI.

In the light of Sustainable Development Goals (SDGs) 9, Target 9.c roadmap (2030), equal access to digital technology to every section of society and region. Today digital economy and digital technologies revolution has superficially enhanced global accessibility, connectivity, and privacy and has pervaded a substantial impact on the welfare of societies. ICT is a means to ensure the provision of essential services and livelihood opportunities (Fernández-Portillo et al., 2020; Rabelo and Gusmeroli, 2008). We can know more interconnected, right of entry into e-information, e-shop, voice opinion, e-massages, e-government services and gain consumer with the switch internet or touch by e-device. The adoption and usage of hardware and software for communication and information sharing are said to be ICT which plays a vital role in the growth and development of a country (Zafar and Aftab, 2007; Fernández-Portillo et al., 2020). Due to its importance in the modern world, the United Nations recognizes one of the critical target goals in the sustainable and Millennium Development Goals. Almost 3 out of 169 targets of SDGs are directly related to the usage and access of information and communication technology (these targets are 5.b, 9.c, and 17.b). Today, basic economic organizations are changing from neo-classical economics to Austrian economics, whereby the fundamental principle of

production and consumption divert to innovation, new technology, new creativity of product, and frequently seeking a new area of innovation (Nelson and Plosser, 1982; Teece, 2014). The advancement in the digital economy and ICTs have a new upswing and changed entirely to a new era of economic innovation that upswing welfare.

Pakistan's government is resolute in bridging the digital gap among the citizens and empowering individuals with digital technology. For this purpose, Pakistan's government launched the programs' Digital Pakistan Vision' in December 2019 and the 'Rolling Spectrum Strategy' policy 2020-2023 based on 5-G technology (PTA-2020). These policies' objectives are expanding the knowledge-based economy by accelerating the digital ecosystem. Moreover, selected programs are undertaken by the government to deliver citizen digital services (land records, tax returns, e-governance, education, health, finance, justice, etc.).

The Government of Pakistan (GOP) has taken measures for the diffusion of technology in Pakistan. The glimpses at the dynamic pattern of digital diffusion in Pakistan in the form of mobile phone subscriptions, bandwidth, mobile broadband subscriptions, and internet users are presented in Figure 1. The mobile phone subscription per 100 surged from 20 to 80 over the last decade. This surge is due to the Next Generation Mobile Spectrum Auctions (NGMSA) policy launched at the start of the previous decade. The bandwidth per internet user surged after 2014 due to 'The Digital Policy,' which was related to launching the 3G/4G Policy (NGMSA) in 2013 and 2014 (Jamil 2020, Ministry of Information Technology and Telecom, 2015-2018 Policy). The dynamic pattern of internet users suggests an increase from 8 percent to 15.5 percent over the last decade. This slow growth of ICT usage caught the attention to determine the factors affecting ICT usage. Although ICT usage is an essential source of economic growth for emerging economies, little attention has been towards its effect at the individual level. To the best of our knowledge, the study (Abdullah, 2015; Jamil, 2020) is related to digitalization in Pakistan. The existing literature is not based on the nationally representative data of the PSLM-HIES survey and ignores the role of ICT usage, capabilities, and its determinants.

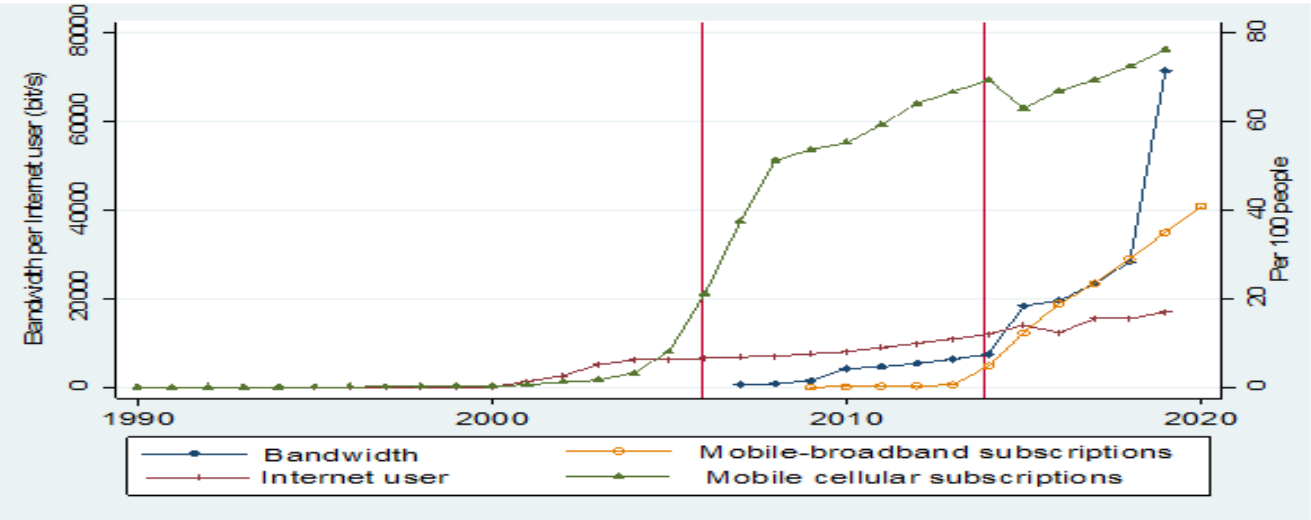

Figure 1. Dynamics of digital indicators in Pakistan (Source: World Development Indicators).

Pakistan's vision 2025 gives a visible way to the people of Pakistan as they struggle to attain developed nation status. The ICT usage and adoption are economically crucial for Pakistan's vision 2025 to become upper-middle-income countries (top 25 global economies) and vision 2035-2047 (top 10 global economies) high-income countries. For this purpose, assessing the factors that may assist in bridging the digital divide is required. This study attempts to estimate the effect of socioeconomic, demographic, regional, and supply-side factors on digital disparities in Pakistan by using the nationally representative household sample survey PSLM-HIES survey (2018-19).

As economic and social gaps exist, the digital divide is always persistent among individuals. The digital divide is related to a lack of access to modern information technologies (Park, 2008). The digital divide concept is usually binary classification accessibility and non-accessibility to the internet (Hargittai, 2007). The prominent studies suggested the three levels of the digital divide; the first one digital divide access to a digital device, which shows inequalities in access to ICT such as computers, laptops, workplace, or home. The second level of the digital divide is subject to the lack of an individual's ability to use ICT capabilities (Riggins and Dewan, 2005). However, the third level digital divide is related to output or outcome-based. The outcome is subject to enhancing the productivity of the individual by using ICT (Song et al., 2020).

A review of the literature on the 1990s was related to the use of computers and the internet as an outcome of the digital divide. However, with the adoption of ICT, access and use of technology are most complex and diverse. This second wave of research is from the digital divide to digital inclusion (Nemer, 2015). Digital inclusion involves activities to ensure individuals and social groups access and use ICTs equally. The concept of digital inclusion is not merely access to the internet and broadband but also accessibility to software, hardware, and e-services for ICT use (Reder, 2015). Similarly, digital inclusion contained "technical infrastructure as the essential and fundamental foundation for inclusion, digital awareness

programs, and understanding of basic IT skills and digital empowerment" as part of the digital inclusion concept (Bertot, 2016; Vosloo, 2018).

Prior studies have exposed that education and age influence the likelihood of digital skills (Hargittai, 2007). Other studies in digital capability divide research, such as Van Deursen and Van-Dijk (2010), examine that digital skills are likely to improve with IT usage. They emphasized four related skills: material access, educational access, skill access, and usage access (Van Deursen and Van Dijk, 2011). Other related access qualities are associated with users' level and digital security skills (Dodel and Mesch, 2018). Furthermore, these studies have also exposed that ICT literacy influences internet diffusion more than regional socio-demographic factors such as income, age, gender, and occupation.

Education, income, and age are crucial aspects of digital technologies that have become vital to engaging digital inclusion. Digital inclusion and digital literacy and its social outcome were different due to demographic, social, and economic outcomes (Reder, 2015). Digital inclusion and online behaviour of individuals are significant critical demographic and non-demographic internet characteristics (Borg and Smith, 2018). However, as noted earlier, education, age, income, and employment status influence the digital divide.

Pakistan is a developing nation, and it faces many challenges related to ICT infrastructure due to its larger population (Shair et al., 2021). Previous studies examine the digital divide in access, basic usage, and applications among people (Zafar and Aftab, 2007); digital divide and digitalization initiatives in Pakistan (Ahsan, 2009); the digital divide and caste system and use of ICT in the rural area (Abdullah 2015); digital divide and its impacts on social inequalities and democracy in Pakistan (Jamil, 2020); and digital divide inclusion and challenges for wide-ranging digitalization in Pakistan (Jamil, 2021). However, according to the best of our knowledge, no study is available the in the context of Pakistan related to the digital divide in ICT usage capabilities by using the nationally representative household data set. Most studies used small sample sizes or macro-level indicators. This study attempts to explain country and micro-level data analysis. Further, we examine the socio-economic, demographic, regional, and supply-side drivers of the digital divide approaches to digital inclusion at the individual level.

DATA AND METHODOLOGY

Econometric Methodology

The literature extensively suggests the Logit model in the presence of dichotomous dummy-dependant variables to figure out the likelihood of given the covariates and also graph the marginal plot (Shair and Majeed, 2020). Moreover, in the literature on ICT access and use capabilities, Asrani (2021) and Derso et al. (2014) used a logit model. The logistic regression model (Gujarati et al., 2012; Greene, 2018) is econometrically specified as follows:

$$P_i = E(y_i = 1 \,|X_i) = \Lambda(Z) = \frac{e^z}{1+e^z} \qquad (1)$$

Where *Pi* donates the probability of the ICTs used by individuals knowing specific skills. Y_i is a binary dummy dependant variable, coded 1 if individual knows the specific skill and zero otherwise. While Z=Xβ and X is a vector of variables comprises individual characteristics such as age, gender, income, education, area, provinces and access to focal technology, regional ICT density. β is a vector of parameters.

Table 1. Definition of the variables used in the analysis.

Variables	Description
Dependant variable	
Email	=1 if individual knows the skill of Sending emails with attached files, 0 otherwise
Word processing	=1 if individual knows skill of basic arithmetic formulas in a spread sheet or word processing in MS Office, 0 otherwise
Web browsing	=1 if individual knows that skill of finding, downloading, installing and configuring software, 0 otherwise
ICT	=1 if knows the skills of email, word and web, 0 otherwise
Independent variables	
Age	Age of the individual divide in six categories: 10-20; 21-30; 31-40; 41-50; 51-60; above 60
Female (=1)	=1 if individual is female, 0 otherwise
No Education (=1)	=1 if individual is illiterate, 0 otherwise
Primary (=1)	=1 if individual is enrolled/completed below 5 classes, 0 otherwise
Middle (=1)	=1 if individual is enrolled/completed 6 to 8 classes, 0 otherwise
Secondary (=1)	=1 if individual is enrolled/completed 9 to 12 classes, 0 otherwise
Higher (=1)	=1 if individual is enrolled/completed 13 or above classes, 0 otherwise
Urban (=1)	=1 if individual is from urban area, 0 otherwise
KPK (=1)	=1 if individual is from Khyber Pakhtunkhwa province, 0 otherwise
Punjab (=1)	=1 if individual is from Punjab province, 0 otherwise
Sindh (=1)	=1 if individual is from Sindh province , 0 otherwise
Balochistan (=1)	=1 if individual is from Balochistan province , 0 otherwise
Log(HH income)	Log natural of household income
Regional ICT access Density	It is proxied for ICT infrastructure. It is ratio the of household reported using internet (fixed-broadband or mobile-broadband device) in the house to total household in the primary sampling unit (PSU) or enumeration block. Previously, it was used by Asrani (2021) to account for the ICT infrastructure such as network and telecom towers.
Computer (=1)	=1 if individual has access to computer, 0 otherwise
Internet (=1)	=1 if individual has internet access, 0 otherwise

The empirical analysis data is sourced from the Pakistan Bureau of Statistics (PBS) official website. We used Pakistan Social and Living Standard–Household Integrated Economic (PSLM – HIES 2018-19) survey, which covered 24,809 households from Punjab, KPK, Sindh, Balochistan, and Federal Capital Territory. In the analysis, almost 115,632 individuals are 10 or above years of age which is part of our empirical analysis. The sample includes 41,971 urban individuals and 73,661 rural and semi-rural individual areas. The definition of the variables used in the analysis is given in Table 1.

RESULTS AND DISCUSSION

Descriptive Analysis

The PSLM 2018-2019 survey with regional (Urban/Rural) breakdown reveals that only 34 percent of households and 8.24 percent of individuals have their own computer/ laptop/ tablet or any other such device(s), while 24 percent households and 17 percent individual have own internet connection. The greater digital capabilities disparities among the individual of Pakistan as depicted in the regional breakdown in Table 2. At the provincial level, internet use in different Punjab overall has the highest proportion of ICT skills while Balochistan lower skills, as seen in Table 2.

Scholarly, the young population show greater and easy adoption of new technology than the older one (Asrani, 2021; Zhou et al., 2011). The younger the age slab of 21-30 years, the most useful ICT devices and capabilities of specific skills such as e-mail, word processing and web browsing. However, lower ICT-skills use capabilities by the individual as the age groups higher in 2018-19 see Figure 2.

The individual's education is important in determining the likelihood of knowing specific skills (Campos-Castillo, 2015). The descriptive statistics also confirm the findings that individuals with higher education have more proportionate use of ICTs skills than individuals with lower education. Across the three skill categories, the person with higher education is proportionately more in the usage of word, web and email. The education of the individuals looks to be a strong positive relationship for ICT adoption and its use capabilities.

Table 2. General description analysis of variables.

Variables definition	Mean			SD	Min	Max
	Urban	Rural	Total			
ICT (=1)	0.0204427	0.0041406	0.0100578	.0997832	0	1
E-mail (=1)	0.0511067	0.0068286	0.0229002	.1495861	0	1
Word (=1)	0.0180839	0.0040591	.0090719	.0948138	0	1
Web (=1)	0.0275667	0.0040591	.0125917	.1115044	0	1
Age1 (10-20)	0.3386148	0.3723273	.3600906	.4800285	0	1
Age2 (21-30)	0.2335184	0.209446	.2181835	.4130145	0	1
Age3 (31-40)	0.1595387	0.1476765	.1519822	.3590051	0	1
Age4 (41-50)	0.1139596	0.105361	.1084821	.3109896	0	1
Age5 (51-60)	0.0902051	0.0897761	.0899319	.2860853	0	1
Age6 (Above60)	0.0641634	0.075413	.0713297	.2573759	0	1
Female (=1)	0.4969622	0.5096591	0.505055	.4999767	0	1
No.education (=1)	0.2872936	0.4944815	.4192784	.4934431	0	1
Primary (=1)	0.1714517	0.1871411	.1814463	.3853892	0	1
Middle (=1)	0.1603965	0.1303268	0.141241	.3482717	0	1
Secondary (=1)	0.2652546	0.1522787	0.193285	.3948767	0	1
Higher (=1)	0.1156036	0.0.035772	0.064749	.2460826	0	1
Log(Household Income)	10.5669	10.18017	10.32054	.6588479	6.5023	14.2209
Internet (=1)	0.2365443	0.0779381	.134928	.3416482	0	1
ICT access density	0.4544642	0.188895	0.2852888	.250353	0	1
Number of Observation	41971	73661	115632	115632	115632	115632

Note: (SD) Standard deviation Source: own calculation by using PSLM survey (2018-19).

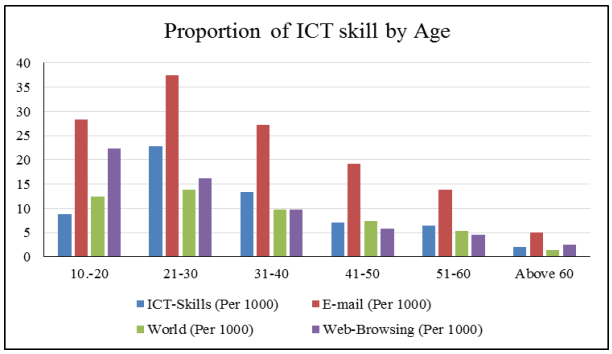

Figure 2. Proportion of ICT skills by individual by same age groups. Source: Author's own calculation base on PSLM surveys (2018-2019).

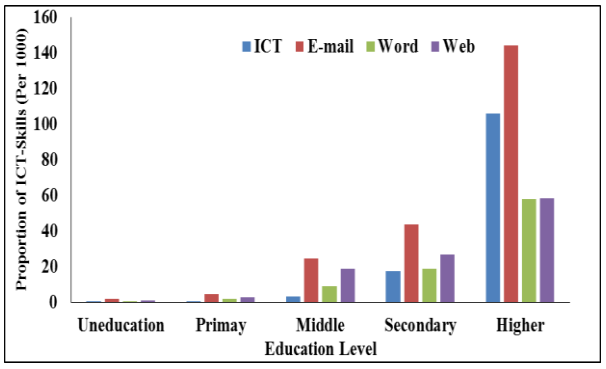

Figure 3. Proportion of ICT skills by education. Source: Author's own calculation base on PSLM surveys (2018-2019).

Prior studies explained that individual with higher incomes has more probability of adopting ICT devices (Asrani, 2021; Chakraborty and Bosman, 2005). The descriptive statistics, in this regard, suggest that the proportion of individuals knowing the specific skills is higher in the upper decile than in the lower decile (see Figure 4). It implies that income disparities are also a major source of the digital divide.

The digital divide also exists at the provincial and regional (Rural/Urban) levels. Punjab has the highest percentage of internet users (15 per 1000) categories by rural (4.6 per 1000) and urban (10.4 per 1000), followed by KPK (6 per 1000) and Balochistan (1.7 per 1000). However, in the case of Sindh, urban (8 per 1000) and rural (0.8 per 1000) internet use at the individual level has more disparities compared to Punjab and KPK see Figure 4. While ICT access and use capabilities gap in urban and rural area were considerable at about 27 per 1000, with allies in urban areas having better ICT use capabilities and basic skills abilities. Individual ICT access in Punjab is high in urban and low in similar rural trends also observed in other provinces see Figure 5.

The male population is more likely to access and use ICTs device(s) than females (Asrani, 2021). The data also indicate variation in gender sees Figure 6. Proportionate use of ICT technology at individual level females 32 per 1000 and males 78 per 1000. It implies that females are less in proportion in ICT skill use which indicates that gender disparity is also a potential source of the digital divide across individuals.

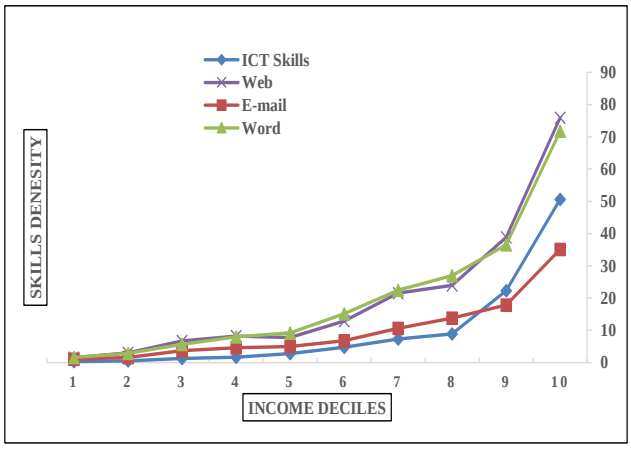

Figure 4. Proportion of ICT skills by Household Income. Source: Author's own calculation based on PSLM surveys (2018-2019).

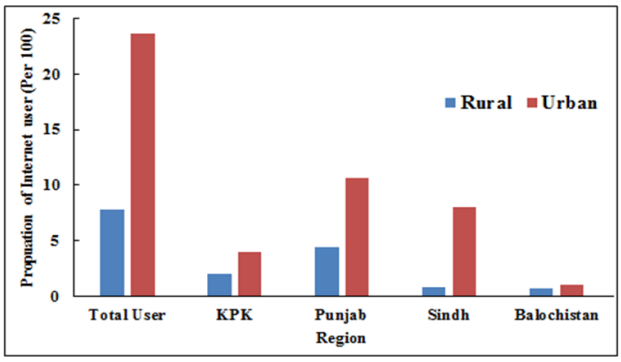

Figure 5. Proportion of ICT skills by provinces. Source: Author's own calculation based on PSLM surveys (2018-2019).

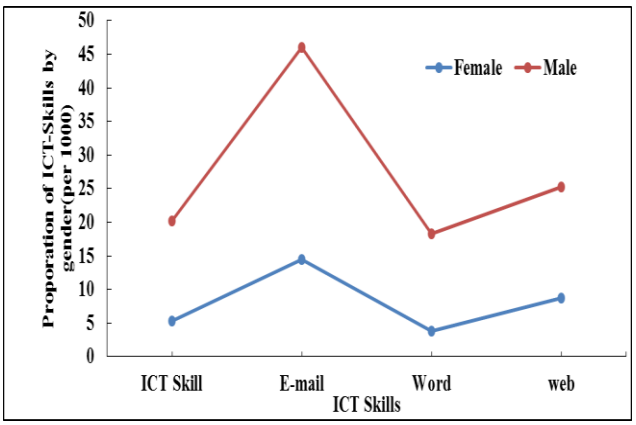

Figure 6. Proportion of ICT-Skills by gender (per 1000). Source: own calculation base on PSLM survey (2018-2019).

Regression Analysis

The present study is an attempt to estimate the likelihood ICT use capabilities of the individual (above the age of 10 years) in Pakistan based on demographic, regional, income and other covariates. The dependent variable is a dichotomous dummy variable coded 1 if the individual knows the specific skill ICT and zero otherwise. We run four binary regression models: Model 1 shows the result on the likelihood of all specified ICT skill capabilities, model 2 shows the results on the likelihood of email, model 3 shows the results on the likelihood of word processing, and model 4 shows the results on the likelihood of web browsing. We presented the graph of the estimates of the logit model across the categories.

Demographic factors play a significant role in ICT usage capabilities of individuals. The age is divided into six groups, explained in Table 1. Individuals aged 10-30 years are more likely to know all three basic skills. The marginal effect also shows the use of ICTs skills and three basic skills of individuals high in the age group (10-30) and low in the high age group (see Figure 7a). The marginal effect indicates that the use of ICT skills and specific skills are less likely in female than male. This is due to a lack of freedom of choice and lower women's empowerment. The predictive marginal plot (see Figure 7b) understand the ICT skill level across gender. Higher education has a significant effect on the likelihood of ICT usage capabilities, as depicted in Figure 7c that an individual with higher education has a higher likelihood of ICT usage capabilities than an individual with a lower level of education. It implies that a higher level of education is associated with higher self-efficacy, which is a direct link to ICT usage capabilities.

The individual from an urban area is more likelihood of ICT usage capabilities than the individual from a rural area across the specific skill, and a composite of all three skills is shown in Figure 7d. It is due to the fact that urban area is more developed with better internet infrastructure, higher purchasing power, and quality network coverage which in turn promotes the use of the internet of things (IoT) and its applications to benefit online services. The estimates of the other regional variable suggest the presence of a digital divide across the province. The individual from Punjab (an advanced province) is a relatively higher likelihood of ICT usage capabilities than the individual from other provinces (see Figure 7e). The individual of Balochistan (a less developed

province) has a lower likelihood of ICT usage capabilities due to a lower literacy rate and less availability of e-equipment and penetration when compared to the rest of Pakistan.

The higher level of household income is associated with a higher likelihood of ICT usage capabilities (see Figure 7f for the marginal plot). Generally, the higher income indicates the higher purchasing power of the individual, which is directly related to the affordability of new digital technology. Access to digital technology equips the individual to link the digital world and ICTs accessories. The role of internet infrastructure is crucial in ICT usage development. The co-efficient of ICT density and internet access is positively associated with ICT usage capabilities as shown in Table 3. The higher level of ICT density is associated with a higher likelihood of ICT usage capabilities (see Figure 7g). It implies that better internet coverage within a given region indicates a relatively higher bandwidth, which increases the demand for ICT skills. Moreover, the individual having access to a computer and the internet at home is more likelihood to ICT use capabilities. It suggests that access to focal technology is an important source of ICT skill usage and contributes to digital inclusion.

Table 3. Estimates of the individual's ICT use capabilities.

Variables	Model 1 ICT	Model 2 Email	Model 3 Word	Model 4 Web
Age (21-30)	-0.0001529**	-0.0009708***	-0.0003049***	-0.0013103***
	0.00006	0.00012	0.00007	0.0001
Age (30-40)	-0.000778***	-0.0008852***	-0.0003311***	-0.0013958***
	0.00007	0.00013	0.00008	0.00011
Age (40-50)	-0.0004667***	-0.0009092***	-0.0003657***	-0.0014576***
	0.00008	0.00015	0.00009	0.00012
Age (50-60)	-0.0004822***	-0.0011376***	-0.0004984***	-0.0014088***
	0.00008	0.00017	0.0001	0.00012
Age (Above 60)	-0.0006401***	-0.001517***	-0.0006938***	-0.0013174***
	0.0001	0.00019	0.00011	0.00015
Female(=1)	-0.0006366***	-0.000847***	-0.0007195***	-0.000711**
	0.00009	0.00013	0.00011	0.00011
Primary(=1)	0.00000591	-0.0004657	0.0010763**	-0.0004152
	0.0003	0.0003	0.00045	0.00027
Middle(=1)	0.0009885**	0.0021127***	0.0039894***	0.0023357***
	0.00042	0.00047	0.00092	0.00051
Secondary(=1)	0.0030671***	0.0021006***	0.0046965***	0.0019759***
	0.00066	0.00045	0.00092	0.00046
Higher(=1)	0.0208181***	0.00664***	0.0111425***	0.0042754***
	0.00424	0.00108	0.00254	0.00092
Urban(=1)	0.0002386***	0.0022676***	-0.0001354*	0.0017397***
	0.00008	0.00021	0.00008	0.0002
KPK(=1)	0.0007799***	0.0001585	0.0004024*	0.0000123
	0.00025	0.00026	0.00021	0.00021
Punjab(=1)	0.0009504***	-0.0000545	-0.0002336	-0.0002472
	0.00021	0.00023	0.00016	0.0002
Sindh(=1)	0.0005986***	-0.0009343***	0.0014719***	-0.0010729***
	0.00022	0.00021	0.00034	0.00017
Log(HH income)	0.0006113***	0.0002182**	0.0004757***	-0.0003853***
	0.00008	0.0001	0.00007	0.00009
ICT Density	0.00022*	0.0022762***	0.001229***	0.0013741***
	0.00012	0.00028	0.0002	0.00025
Computer(=1)	0.0022999***	0.012308***	0.0102424***	0.0075385***
	0.00038	0.00109	0.00157	0.00087
Internet(=1)	0.0016111***	0.0248598***	0.0005327***	0.0130794***
	0.00031	0.00174	0.00014	0.0013
Observations	115,632	115,632	115,632	115,632
Pseudo R^2	0.4138	0.4662	0.4134	0.3909

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

CONCLUSIONS

The study related to the 9th sustainable development goals, target 9. c roadmap (2030), equal access to technology to every section of society and region. The current study focused on determinants of ICT skills adoption, which quantify on the basis of an individual's know-how related to basic skills like email, word processing, and web browsing. For this purpose, we consider the data from the nationally representative survey PSLM-HIES (2018-19). The study confirmed the significant disparities in all basic digital skills. It has shown that education, income, demographics and region are determents of ICT availability. At the same time, age and gender are firmly classifiers for variation in individual-level ICT adoption and three basic skills. The ICT density and internet are positively associated with ICT skills and all three basic specific skills.

Socioeconomic factors like higher income and education are associated with a higher likelihood of ICT usage capabilities. The demographic factors are related to the age and gender of the individual, which depicts that the individual age slab of 10-30 years has more likelihood of ICT usage capabilities than

others. Women are less likelihood to know the specific skill. The regional factors suggest that individuals in the urban area have a higher likelihood of ICT usage capabilities. Moreover, individuals from the advanced province (Punjab) are also higher in the likelihood of ICT usage capabilities. Finally, supply-side variables indicate that individuals with access to a computer or even access to the internet are a higher likelihood of ICT usage capabilities. Furthermore, better ICT infrastructure increase the likelihood of ICT usage capabilities. It is important to provide equal access to basic education across the board for digital inclusion. Gender differences also arise in ICT usage capabilities; steps need to undertake to bridge this digital divide by uplifting the female with digital literacy. It is also required to raise the purchasing power of the individuals to afford the focal technology because access to focal technology can accelerate digital inclusion. Moreover, subsidized provision of focal technology can also help in the diffusion of digital inclusion. As noted earlier, a higher level of self-efficacy is among the youth, to equip the youth with digital skills, ICT training programs are required. Better infrastructure may result in higher ICT skill adoption. For this purpose, relevant stakeholders must generate investment in internet access infrastructure.

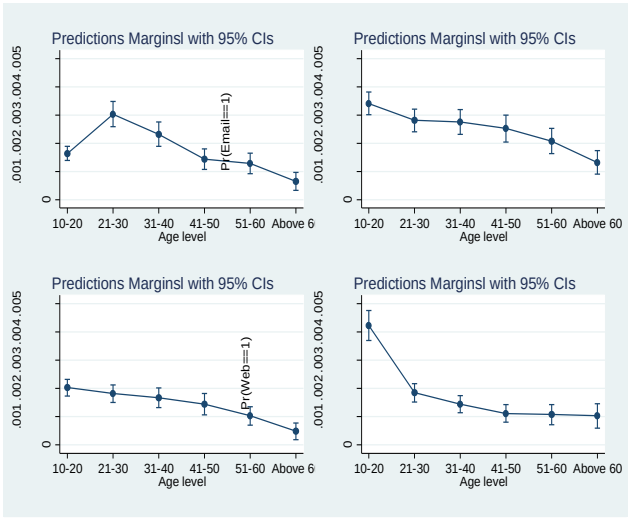

Figure 7a. Predicted probability of specific skill for age.

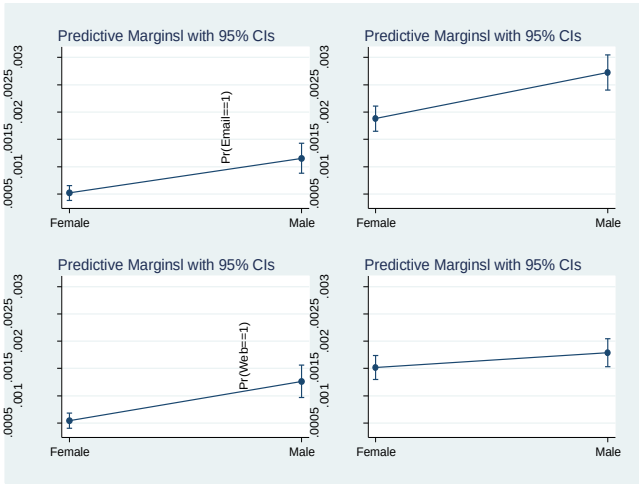

Figure 7b. Predicted probability of specific skill for gender.

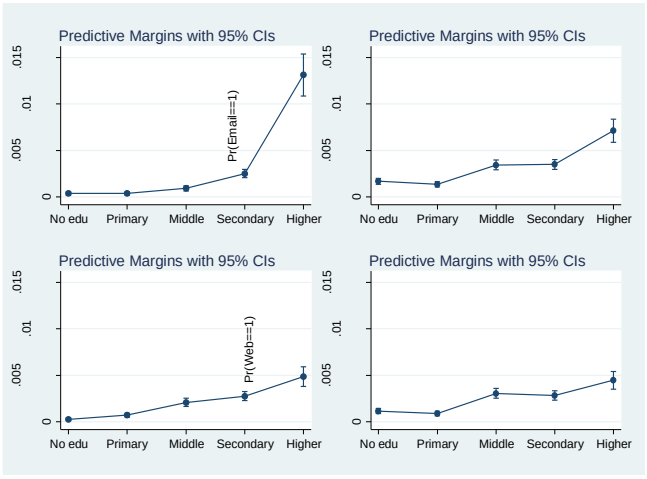

Figure 7c. Predicted probability of specific skill for education.

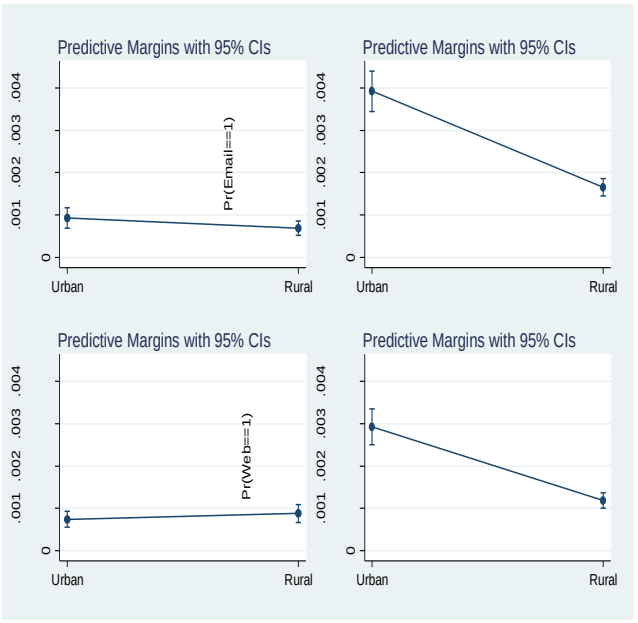

Figure 7d. Predicted probability of specific skill for area

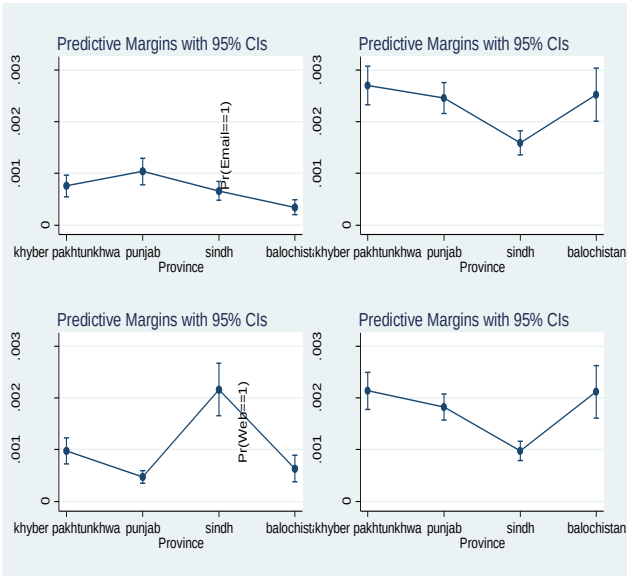

Figure 7e. Predicted probability of specific skill for province.

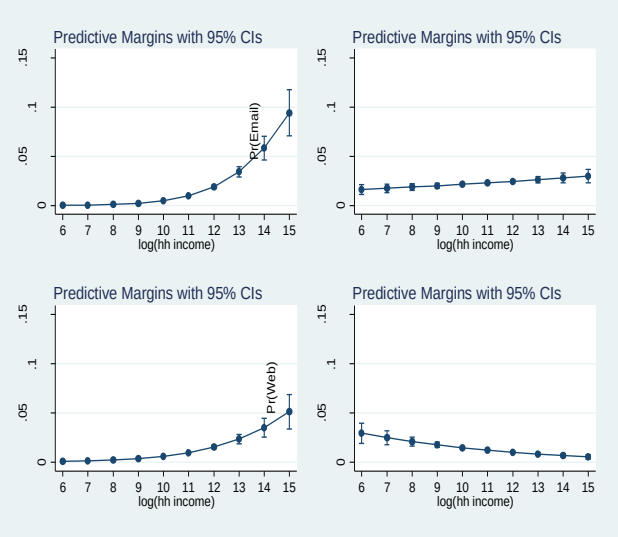

Figure 7f. Predicted probability of specific skill for income.

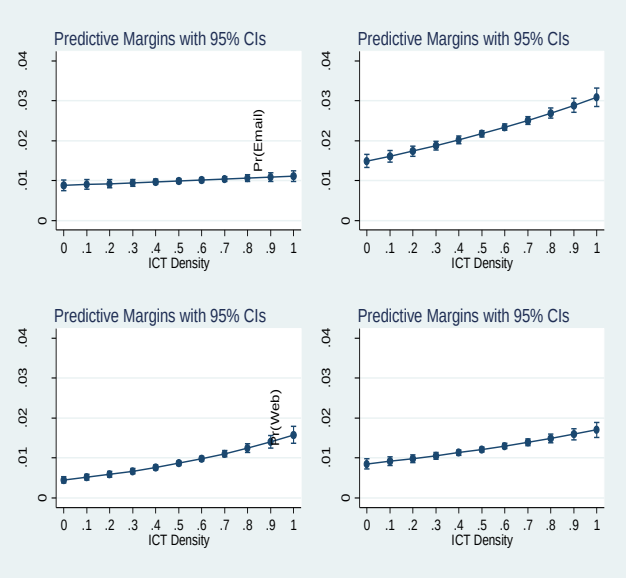

Figure 7g. Predicted probability of specific skill for ICT density.

REFERENCES

Abdullah, A., 2015. Digital divide and caste in rural Pakistan. Inf. Soc. 31, 346–356.

Ahsan, M., 2009. Digital Divide and Digitization Initiatives in Pakistan: A Bird's Eye View., in: ELPUB. pp. 515–520.

Asrani, C., 2021. Spanning the digital divide in India: Barriers to ICT adoption and usage. J. Public Aff. e2598.

Bertot, J.C., 2016. Building digitally inclusive communities: The roles of public libraries in digital inclusion and development, in: Proceedings of the 9th International Conference on Theory and Practice of Electronic Governance. pp. 95–102.

Borg, K., Smith, L., 2018. Digital inclusion and online behaviour: five typologies of Australian internet users. Behav. Inf. Technol. 37, 367–380.

Campos-Castillo, C., 2015. Revisiting the first-level digital divide in the United States: Gender and race/ethnicity patterns, 2007–2012. Soc. Sci. Comput. Rev. 33, 423–439.

Chakraborty, J., Bosman, M.M., 2005. Measuring the digital divide in the United States: Race, income, and personal computer ownership. Prof. Geogr. 57, 395–410.

Derso, D., Mamo, Y., Haji, J., 2014. Analyzing socio-economic factors affecting the use of information and communication technologies among farmers in central highlands of Ethiopia. African J. Agric. Sci. Technol. 2, 163–171.

Dodel, M., Mesch, G., 2018. Inequality in digital skills and the adoption of online safety behaviors. Information, Commun. Soc. 21, 712–728.

Fernández-Portillo, A., Almodóvar-González, M., Hernández-Mogollón, R., 2020. Impact of ICT development on economic growth. A study of OECD European union countries. Technol. Soc. 63, 101420.

Giglia, E., Galimberti, P., 2009. ELPUB 2009. Rethinking electronic publishing: innovation in communication paradigms and technologies. D-Lib Mag. 15.

Hargittai, E., 2007. Whose space? Differences among users and non-users of social network sites. J. Comput. Commun. 13, 276–297.

Jamil, S., 2020. Journalism for sustainable development: The imperative of journalists' rights to freedom of expression and access to information for promoting sustainable development in Pakistan. J. Appl. Journal. Media Stud. 9, 271–291.

Jamil, S., 2021. From digital divide to digital inclusion: Challenges for wide-ranging digitalization in Pakistan. Telecomm. Policy 45, 1-16.

Nelson, C.R., Plosser, C.R., 1982. Trends and random walks in macroeconmic time series: some evidence and implications. J. Monet. Econ. 10, 139–162.

Nemer, D., 2015. From digital divide to digital inclusion and beyond. J. Community Informatics 11.

Park, Y.-M., 2008. The missing gap between internet use and benefits: Seniors limited internet experiences and social marginalization. Dev. Soc. 37,97-115.

Rabelo, R.J., Gusmeroli, S., 2008. The ECOLEAD collaborative business infrastructure for networked organizations, in: Working Conference on Virtual Enterprises. Springer, pp. 451–462.

Reder, S., 2015. Digital inclusion and digital literacy in the United States: A portrait from PIAAC's survey of adult skills. AIR PIAAC Comm Pap [Internet].

Riggins, F.J., Dewan, S., 2005. The digital divide: Current and future research directions. J. Assoc. Inf. Syst. 6, 298-337.

Shair, W., Majeed, M.T., 2020. Labor Market Outcomes of Non-migrant Members in Response to Remittances: Evidence from Provincial capital of Punjab and Khyber Pakhtunkhawa (KPK). Rev. Socio-Economic Perspect. 5, 1–22.

Shair, W., Tariq Majeed, M., Ali, A., 2021. Labour Participation Decision and Preferences towards Different Employment Status in Response to Remittances: Evidence from the Provincial Capital of Punjab and Khyber Pakhtunkhawa (KPK), Pakistan.

Song, Z., Wang, C., Bergmann, L., 2020. China's prefectural digital divide: Spatial analysis and multivariate determinants of ICT diffusion. Int. J. Inf. Manage. 52, 102072.

State Bank of Pakistan, 2020. The State of Pakistan's Economy. First Quarterly Report of 2019-20. Pakistan.

Teece, D.J., 2014. The foundations of enterprise performance: Dynamic and ordinary capabilities in an (economic) theory of firms. Acad. Manag. Perspect. 28, 328–352.

Van Deursen, A., Van Dijk, J., 2011. Internet skills and the digital divide. New media Soc. 13, 893–911.

Van Deursen, A., Van Dijk, J.A.G.M., 2010. Measuring internet skills. Int. J. Hum. Comput. Interact. 26, 891–916.

Vosloo, S., 2018. Designing inclusive digital solutions and developing digital skills: Guidelines. Paris United Nations Educ. Sci. Cult. Organ. Digit. Libr. Text available website https//unesdoc. unesco. org/ark/48223/pf0000265537. Accessed January 13, 2019.

Zafar, T., Aftab, K., 2007. Digital divide: an econometric study of the determinants in information-poor countries. Pak. Dev. Rev. 63–96.

Zhou, Y., Singh, N., Kaushik, P.D., 2011. The digital divide in rural South Asia: survey evidence from Bangladesh, Nepal and Sri Lanka. IIMB Manag. Rev. 23, 15–29.