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ARAŞTIRMA MAKALESİ / RESEARCH ARTICLE

THE EVOLUTION OF THE DIGITAL DIVIDE IN TURKEY

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Abstract

Disparities in information and communication technology (ICT) access and use usually correlate with demographics and socioeconomic factors. The term "digital divide" refers to demographic, economic, and social inequalities regarding access to and use of ICTs and has critical policy implications. A longitudinal analysis of the digital divide is particularly imperative to understand a country's progress toward digitalization at a high level. Bearing in mind that the full potential of digital advancements can be achieved with the widespread adoption of digital technologies, such analysis is of particular importance for emerging economies like Turkey. In this study, we aim to examine the evolution of digital gaps in Turkey to analyze the dynamics of the digital divide. By this objective, we examine the change in broadband penetration in Turkey and the evolution of digital gaps between different social groups over device access, Internet access, and Internet use between 2008-2020. The results of this study reveal significant digital inequalities between different social groups in Turkey. Although Internet access rates point to progress to some extent, the digital divide in terms of actual Internet use persists between different social groups and regions in Turkey.

Keywords: Digital Divide, Information and Communication Technology, Device Access, Internet Access, Internet Use, Digitalization, Inequality, Turkey
JEL Classification: D63, I3, J1

1. Introduction

A country's digitalization potential and capacity depend on the growth and penetration of ICTs in the region which is coupled with the concomitant rise in the even distribution of possession of the technologies within society. According to the latest data provided by the International Telecommunications Union (ITU, 2020), there are 4.6 billion Internet users worldwide, meaning that 59 percent of the population are Internet users today which was only 16 percent in 2005. The ITU estimates that 4.9 billion people, or 63 percent of the world's population, will be online in 2021. This represents a 17 percent increase over 2019, with 782 million people estimated to have

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used the Internet during that time. However, 2.9 billion people remain unconnected. Moreover, very few of those who are counted as Internet users can fully engage with all Internet services. Also, there are strong differences either by region or by different social groups.

Turkey is undergoing digital transformation and morphing into more innovative and technologically advanced organizations and systems. However, given the relationship between social connectivity and digital connectivity (Chen, 2013), the disadvantaged groups of the population would become more vulnerable to remaining socially and digitally excluded, which in turn would cause digital gaps between different social groups and regions. The digital gap, also known as the digital divide, is a new form of social inequality derived from the unequal access to and use of the modern ICT by individuals, households, businesses, and geographic areas at different socioeconomic levels. Scholars proved that ICT access and use are usually associated with socioeconomic and demographic characteristics, such as economic class, gender, race and ethnicity, age, disability, education, rural residency, occupational status, networks, and geographies, and the digital divide were found to be highly associated with these factors. Although technology becomes more integrated into everyday life and digital-intensive activities become an increasingly important component of the economies, foundational access inequalities continue to cause a gap between people who use the ICT and those who do not.

Although internet access in Turkey has been on an upward trend and smartphones are nearly ubiquitous among society, the digital divide is a critical issue in Turkey such that demographic and socioeconomic factors significantly affect Internet access and use in the country (Dalgic-Tetikol et al., 2022). The main objective of this study is to examine the evolution of digital gaps in Turkey by using longitudinal data from TurkStat's "household ICT use and access" survey for the period 2008-2020. Our hypothesis is that there are digital gaps for certain social groups in Turkey. Therefore, in this study, we aim to investigate whether and for which groups these gaps have widened, narrowed, or disappeared over the years. We look at different aspects concerning the digital divide namely, device access, Internet access, and Internet use, and present them by mostly using graphs in order to show the dynamics of the digital gaps and analyze how large the gaps are in each aspect along with different variables. The results also reveal that the digital gaps do not appear to be closing in the near future. This study thus provides the most comprehensive and detailed analysis to date examining the evolution of the digital divide in Turkey. For this reason, we believe that it provides a useful body of knowledge in the design of policies to address the digital divide in Turkey.

The particular emphasis of this article is therefore on how the digital divide in Turkey has changed over time. In accordance with the objective to study the evolution of the digital divide in Turkey, we particularly examine the change in Internet adoption in Turkey, and digital gaps between different social groups over device access, Internet access, and Internet use with respect to years. We investigate how each demographic and socioeconomic variable has progressed between 2008-2020 in terms of ICT adoption.

2. Literature Review

The widespread growth of information and communication technologies (ICT) in recent decades has created incentives for individuals to widen their participation in social, political, and economic areas of life. Notwithstanding such incentives for individuals, using ICT entails having access to technology and infrastructure, as well as learning how to deal with new ICT concepts. ICT access inequality which is referred to as the digital divide, exists among certain social groups and countries. As the Internet reaches critical importance, some social scientists are starting to investigate the demographic and socioeconomic patterns of ICT access and use. Scholars already showed that disparities in ICT access and use usually correlates with demographics and socioeconomic factors such as gender (Antonio and Tuffley, 2014; Gray et al., 2017; Korupp and Szydlik, 2005; Mumporeze and Prieler, 2017), age (Grishchenko, 2020; Peacock and Künemund, 2007; Selwyn et al., 2003), education (Bonfadelli, 2002; Chaudhuri et al., 2005; Talukdar and Gauri, 2011), income (Chaudhuri et al., 2005; Fuchs, 2009; Grishchenko, 2020; Korupp and Szydlik, 2005; Talukdar and Gauri, 2011), employment status (Robles and Torres-Albero, 2012; van Dijk and Hacker, 2003), and region of residence (Lucendo-Monedero et al., 2019; Ruiz-Rodriguez et al., 2018). On the other hand, Internet access opportunities as well as device access opportunities such that having access to various Internet-enabled devices such as computers and mobile devices, play a major role in explaining the diversity of Internet use (Lopez-Sintas et al., 2020; Reisdorf et al. 2022). In a developing country context, device access opportunities are also associated with demographics and socioeconomic factors (Lopez-Sintas et al., 2020).

There are a few studies investigating the digital divide within the Turkish context as well: Acilar (2011) discussed gender, age, education and geographic location aspects of the digital divide in Turkey based on a summary of 2010 data. Polat (2012) emphasized that digital inequalities are interwoven with other social inequalities, but existing policy initiatives fail to address the most disadvantaged groups, indicating the lack of a national strategy for digital exclusion. Köksal and Anil (2015) examined the determinants of broadband access and broadband usage in Turkey in 2012 and found that the digital divide is significantly associated with demographics and region. Dalgic-Tetikol et al. (2022) validated this result by empirically examining the digital divide from device access, Internet access, and Internet use perspectives with recent data (2020), and showed that although the majority of people have an Internet-enabled device (smartphones), age, household income and education are significant predictors of Internet access; in fact, even when access is available, large disparities exist among gender, age, income, education, and different employment groups in terms of Internet use. Also, region is another significant factor affecting both Internet access and use in Turkey. Moreover, Dalgic-Tetikol et al. (2022) and Köksal (2021) underlined the lack of coherent vision on the demand side policies in Turkey to increase Internet penetration in the country – that is, the demographic and socioeconomic factors have been disregarded while developing regulations and related policies.

It is widely acknowledged by scholars that the demographic and socioeconomic patterns of ICT access and use have critical policy implications. Thereof, several studies give particular emphasis

on how differences in ICT access and use in society change over time. The literature on the digital divide is vast across individuals, regions, countries, disciplines, and services (Pérez-Amaral et al., 2021). Grishchenko (2020) underlined that the study of the digital divide requires an integrated approach to analyze its dynamics and changes. Mack et al. (2021) highlighted the importance of a longitudinal analysis of the digital divide. The summary of the literature in this section focuses on the studies which investigate the changes in ICT adoption over time.

Hoffman et al. (2000) is one of the early studies that give particular emphasis on how differences in ICT adoption are changing over time. Polykalas (2014) analyzed the historic evolution of the digital divide across the Member States of the European Union between 2004-2013. The results show that a clear improvement has been achieved in terms of rural broadband coverage, however, the EU policies have not achieved quantitative targets to mitigate the digital divide across the Member States. Ragnedda and Kreitem (2018) shed light on the digital inequalities in the particular setting of East EU by comparing and contrasting the differences and similarities between East EU countries in terms of Internet access and online engagement by analyzing the period 2008-2017. Their analysis shows that Internet penetration is rapidly rising across Europe so the number of people with no connectivity opportunities is significantly diminishing. However, despite the narrowing digital gaps, the first level digital divide has not been completely bridged. With a similar aim that of this study, Nishijima et al. (2017) sought to fill the gap in the literature on the digital divide in Latin American countries and analyze four nationally representative survey data (of years 2005, 2008, 2011, and 2013) on evolution and determinants of the digital divide between 2005 and 2013 in Brazil. The results demonstrate a diminishing trend in the digital gaps; however, digital illiteracy still possesses challenges in ICT access, especially among the elderly. Jin et al. (2018) explored the trends of the digital divide in China between 2004 and 2016, and investigate regional and stratificational digital divides in particular, including the access divide and the usage divide, and found that regional access and usage divides in China have decreased over time. Grishchenko (2020) assessed the digital inequality trends in Russia between 2008-2018, and found that sociodemographic and economic characteristics are associated with uneven distribution of ICT access and use. Specifically, the most disadvantageous groups in Russia in terms of ICT access and Internet use are the low-income, the elderly, individuals with disabilities, and those living in rural areas. The results highlight the fact that despite overall positive trend in access and use of the Internet, those social groups still remain on the unpreferred side of the divide, which exacerbates social inequality. Garín-Muñoz et al. (2019, 2022) and Pérez-Amaral et al. (2020, 2021) examined the evolution of the use of ICT in Spain and analyze the Internet adoption patterns of selected Internet services. Garín-Muñoz et al. (2019) measured the effect of individuals' socioeconomic characteristics on the adoption of Internet services such as e-commerce, e-banking, and e-government by using logistic regression techniques. Pérez-Amaral et al. (2021) measured specific digital gaps which are mainly classified according to demographic and socioeconomic variables by using survey data for the period 2007-2019. The results show that most of the gaps are narrowing. In fact, in the case of gender, the gaps end up much smaller or even reversing in signs in some cases such that in the case of VoIP and social networks women

become more likely users than men. However, some gaps concerning older groups persist. Also, for low-education levels, the digital divide remains high.

Some of the contributions listed above use aggregate data, while others use cross-section, pool, or panel data. Some of them are limited to one dimension of the digital divide such as connectivity or usage or consider only one or a limited set of variables such as gender, income, race, etc. whereas, in this article, we cover a large data set such that a variety of demographic and socioeconomic variables and different aspects of the digital divide in the analysis.

3. The Data

The study draws upon annual data collected in Turkey as part of the Turkish Statistical Institution's (TurkStat) "Information and Communication Technology (ICT) Usage Survey on Households and Individuals", which is prepared and carried out in accordance with EuroStat's survey on "ICT Usage in Households and by Individuals". [1] The survey aims at collecting information about the information and communication technologies owned by households and individuals and their use every year since 2004 (except 2006). Due to missing and malformed data before 2008, this study covers the years from 2008 to 2020 and includes around 13,000-33,000 individuals of age 16-74 each year. Table 1 shows the number of individual and household participants each year with their gender distribution. The survey's questionnaire alters each year based on the evolving situation of ICT such that new variables emerge, and some variables are either renamed or omitted in some years. Therefore, the raw panel data underwent rigorous analysis, filtering, and harmonization to standardize the information collected throughout the observation period.

Table 1: Number of Observations throughout the Observation Period 2008-2020

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Number of participants	13314	12524	13236	26355	27394	23428	20150	19623	25058	29359	28888	28675	32955
Number of households	5161	4773	5094	10235	10605	11537	9814	9827	11268	12780	12822	12947	14498
Male	6380	6025	6392	12873	13255	10778	9259	8966	11699	13924	13719	13729	16420
Female	6934	6499	6844	13482	14139	12650	10891	10657	13359	15435	15169	14946	16535

The demographic and socioeconomic variables of interest are as follows: The sampling universe is respondents of ages 16-74, who are any type of Internet user from novice to experienced. Age, income, and level of education are included as categorical variables. We categorized age into four: 16-35 (young/early working age), 36-50 (prime working age), 51-65 (mature working age), and 66-74 (elderly); monthly household income into three: less than minimum wage (low income), more than minimum wage but less than twice the minimum wage (mid-income), and more than

1 TurkStat Household Information Technologies Usage Statistics Metadata, https://data.tuik.gov.tr/Kategori/GetKategori?p=Bilim,-Teknoloji-ve-Bilgi-Toplumu-102, accessed on 20.04.2022

twice the minimum wage (high income) [2]. To identify participants' level of education, they are asked about the highest level of education attained. We categorized the education levels into three: below high school, high school, and tertiary degree. [3] We assess individuals who are employed, unemployed, student, homemaker, and retired. [4] Finally, we include 12 geographical regions of Turkey to assess if ICT access and use vary among different regions of Turkey and categorized them into three namely, west, central and east according to geographical location. [5] [6]

In the survey, participants were asked if they had Internet-enabled device(s) and an Internet connection and whether they used the Internet in the past 12 months for various types of personal use. Also, they were asked to report how often they use the Internet. The devices considered consist of desktop, laptop, tablet, smartphone, smart TV, and game consoles that enable connectivity. Internet access measure includes access to the Internet from any "Internet-enabled" device via fixed or mobile broadband or both. Internet use indicates whether the individual used the Internet in the last 12 months. We only take individual and household access and use opportunities.

4. Internet Penetration in Turkey

The Internet penetration rate corresponds to the percentage of the total population of a given country or region that uses the Internet. An Internet user is defined as anyone with the capacity to use the Internet, which requires the person to have available access to an Internet connection and the basic knowledge that is necessary to use Internet technology. Turkey has a fixed broadband penetration rate of 20.07 percent and mobile broadband penetration rate of 76.40 in 2020 (Q4) which are below OECD averages of 33.19 percent and 118.40 percent, respectively [7] Despite the upward trend in broadband adoption in Turkey, the lower rates of fixed and mobile broadband penetration rates indicate lower level of ICT utilization in Turkey compared to many other OECD countries. The evidence therefore leads us to investigate whether social categories play a role in different Internet access and use patterns with lower adoption rates. The TurkStat survey data demonstrate the upward trend in Internet penetration in Turkey between the years 2008-2020.

2 The net monthly minimum wage in Turkey in 2020 is 2,324.71 Turkish Lira.

3 The classification is based on International Standard Classification of Education (ISCED) 2011.

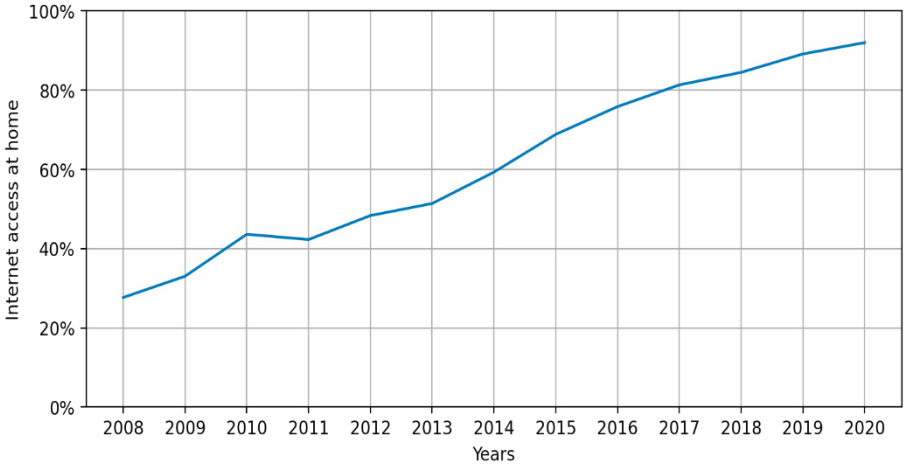
4 The classification is based on International Classification of Status in Employment (ICSE) 1993.

5 The geographical categorization of TurkStat for Turkey's regions is based on the European Nomenclature of Territorial Units for Statistics (NUTS).

6 *West:* Istanbul, West Marmara, Aegean, and East Marmara; *Central:* West Anatolia, Mediterranean, Central Anatolia, and West Blacksea; *East:* East Blacksea, Northeast Anatolia, Middle east Anatolia, and South East Anatolia

7 OECD, Broadband Portal, http://www.oecd.org/digital/broadband/broadband-statistics/

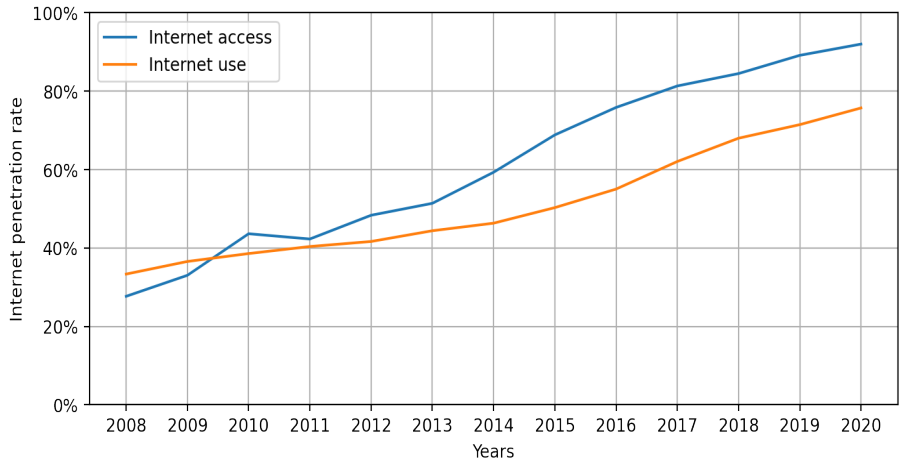
Figure 1: Share of Survey Participants with Internet Access between the Years 2008-2020



Source: Authors' elaboration based on TurkStat ICT Usage Survey

Figure 1 shows the trend of the share of TurkStat survey participants who reported having Internet access. There is a clear upward trend in the share of people with Internet access – that is, Internet penetration has increased in Turkey over years. As seen in the figure, the share was as low as below 30 percent back in 2008 but as of 2020, the share is over 90 percent. Except for the drop in 2011, the Internet penetration rate in Turkey has steadily increased. Bearing in mind that accessibility does not necessarily transform into usage, we look into the usage trends separately to see whether access and usage perform differently in certain periods.

Figure 2: Internet Access and Internet Use Trends between the Years 2008-2020



Source: Authors' elaboration based on TurkStat ICT Usage Survey

Figure 2 shows changes in the share of survey participants with Internet access and who actually use the Internet between the years 2008-2020 in separate trend curves. When we look at the Internet use curve in particular, we again see an upward trend starting from around 30 percent in 2008 up to almost 80 percent in 2020 with a constant increase. However, from the figure, we can deduce that access does not always transform into usage. Despite the continuous investments in infrastructure deployment and increasing infrastructure availability, there are other factors that limit actual usage.

5. Methodology

To analyze the evolution of the digital divide in Turkey, we measure the digital 'gaps' for each demographic and socioeconomic group. We adopt a similar method that is used in Pérez-Amaral (2021) which we believe enables us to understand whether the gaps are narrowing, widening, or remaining unchanged over time. Therefore, we used the following equation to measure the digital gaps:

$$Digital\ gap = (P_H - P_L)/P_H$$

where P is the percentage penetration of a given social group (gender, age, education, etc.).

Each group may involve two, three, four, or more categories in the sample. H and L refer to the best and poor-performing categories within the particular social group, respectively. Therefore, P_H refers to the rate of access or use of the most advantageous category in terms of Internet access such that for each social group the most advantageous categories as the following: men, 16-35 age, high education, high household income, student, west, whereas P_L refers to the less advantageous categories compared to the abovementioned categories. The equation thus refers to the difference in penetrations relative to the penetration of the highest category. As also claimed by Pérez-Amaral et al. (2021), the formula admits a straightforward interpretation since the calculations yield a value bounded between zero and one, denoting the percentage difference in the penetration for the category L of a given digital divide indicator (device access, Internet access, Internet use) relative to the penetration in the highest category H. Based on these calculations, in the following sections, we present a set of graphs illustrating the evolution of the digital gaps for each aspect of the digital divide in Turkey.

6. Results

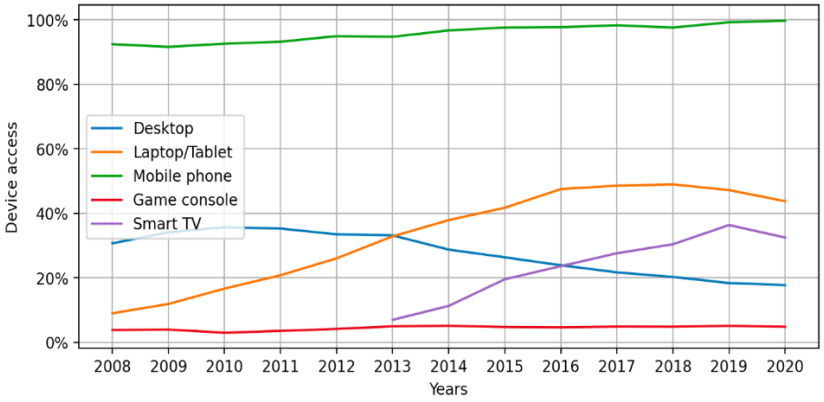
In this section, we present the results of our examination of the historic evolution of the digital divide in Turkey. The results are presented in a set of graphs that illustrate the change in various aspects of the digital divide over time and how each demographic and socioeconomic predictor of the digital divide has evolved. [8]

8 *All figures are authors' elaboration based on TurkStat's survey on ICT usage in households for years 2008-2020.*

a. The Digital Gap over Device Access

As a first step, we analyze the evolution of access to Internet-enabled devices in Turkey over the years. The TurkStat dataset contains sufficiently diversified information about Internet-enabled devices that allows for a comprehensive analysis of device ownership and device diversity among various social groups in Turkey over the years. Although access to an Internet-enabled device is necessary for connectivity, it is not sufficient by itself to connect to the Internet and maintain connectivity. Nevertheless, it is important to analyze the device ownership patterns in society to examine whether it has been a significant factor affecting connectivity. The analysis on device diversity, in particular, can give an indication of the change in Internet utilization by different social groups as one can diversify their Internet experience by using different types of devices (van Deursen and van Dijk, 2019).

Figure 3: Device Ownership with Respect to Years (Device Types)



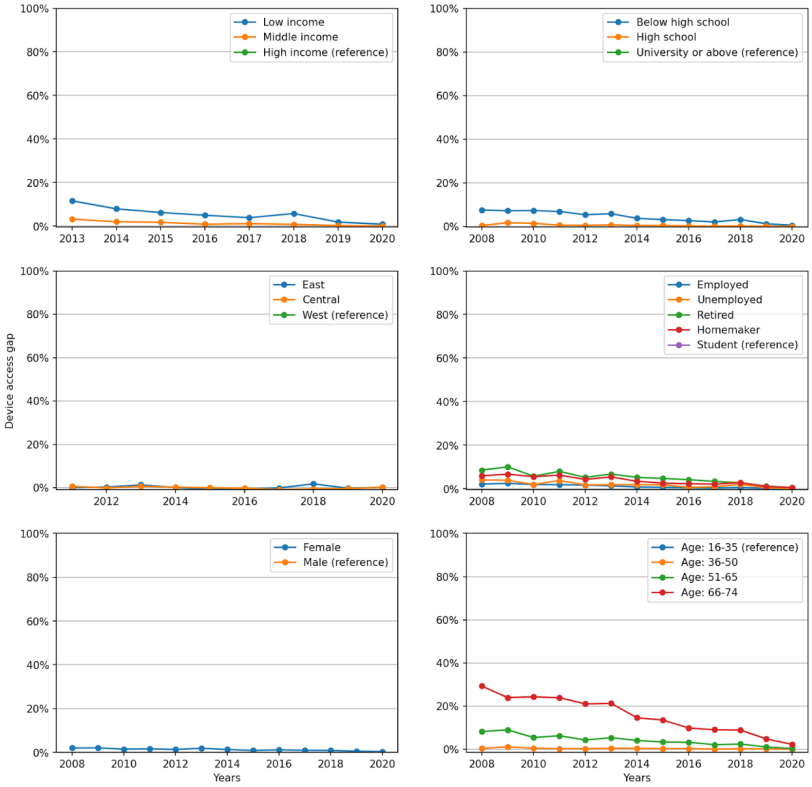
Source: Authors' elaboration based on TurkStat ICT Usage Survey

Figure 3 shows the share of the population using various Internet-enabled devices, throughout the years. This figure demonstrates that smartphones have been the most common type of device used to go online. As of 2020, almost everyone has a mobile phone that enables connectivity. Device availability at home does not necessarily enable connectivity for every household member. Many households do not have enough devices for everyone or not everyone can use all devices to access the Internet. Therefore, although device availability gives an indication of how the country performs in terms of device opportunities itself, it is particularly critical to detect which household members can actually access those devices and which cannot. Therefore, we try to uncover the digital gaps between social groups of different demographic or socioeconomic characteristics on device access.

Figure 4 includes six graphs that illustrate the gap between different social groups in terms of the share of people in each group that have access to an Internet-enabled device. Each curve

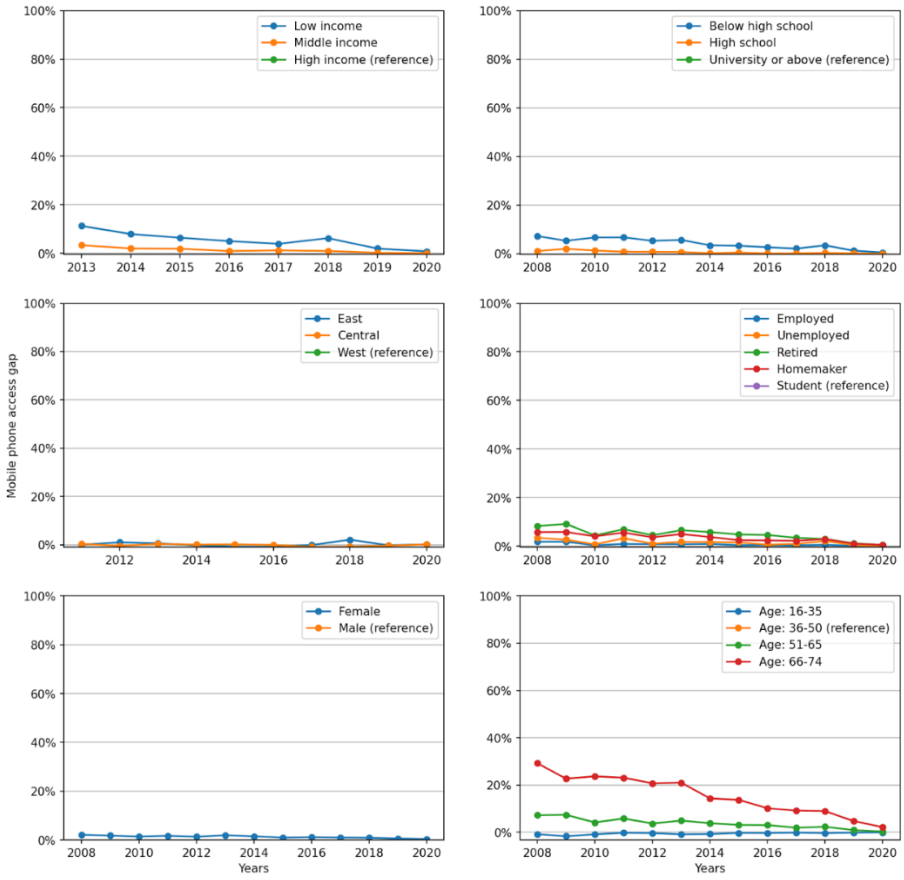
represents the social group and demonstrates how each category of the representative social group has progressed over time relative to the most advantageous category in that social group. Therefore, the y-axis represents the percentage gap between the categories with the best-performing category. For example, the first graph on the top left-hand side illustrates the change in the device access gap between different low – and middle-income households (represented by blue and orange lines, respectively), and high-income households.

Figure 4: The Digital Gap over Device Access



As all graphs in Figure 4 show, the digital gap over device access has been nearly closed for all social groups, which appears to be a very promising outcome of the widespread use of Internet-enabled devices. However, it is worth mentioning that the measurement of device access here includes all Internet-enabled devices, namely smartphone (or mobile phone that enables Internet connection), desktop, laptop/tablet, smarttv, and game console. From Figure 2, we deduce that today smartphone is a prevalent type of Internet-enabled device used to go online. So, we predict that the narrowed device divide between different social groups appears to be due to the widespread use of smartphones. Therefore, we specifically examine smartphone access gaps in Figure 5

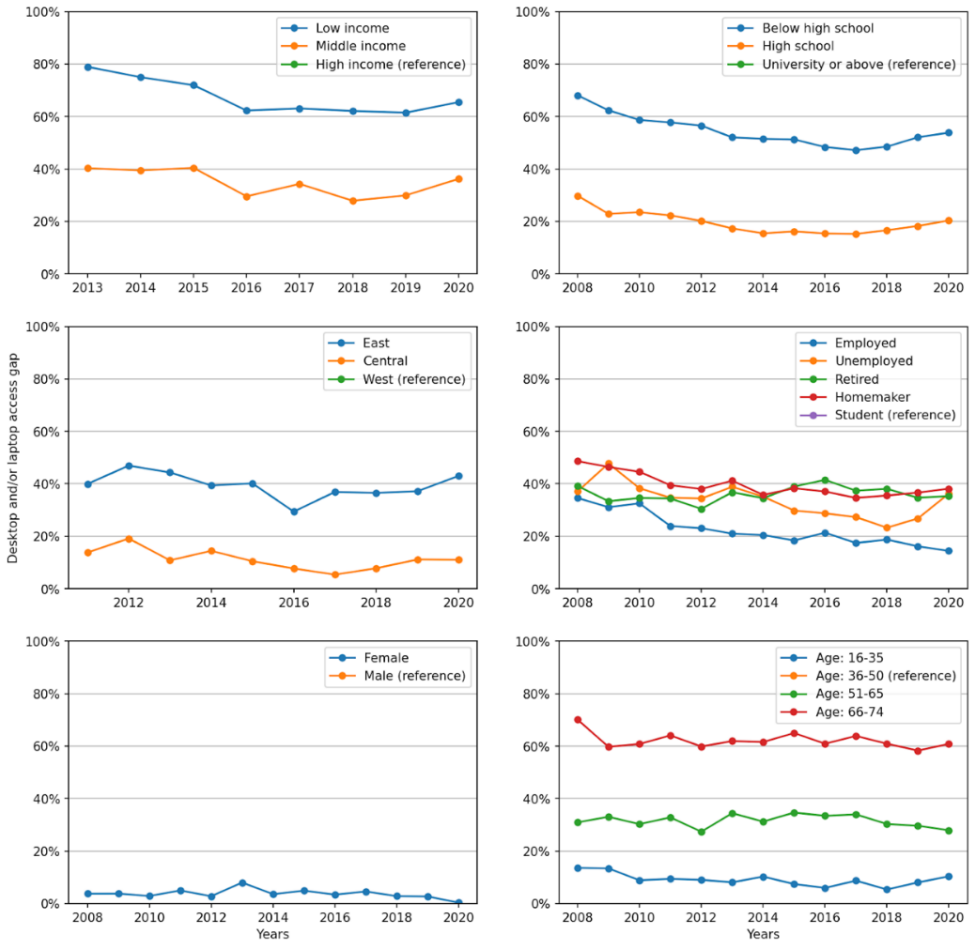
Figure 5: Smartphone Access Gap



In Figure 5, we see that smartphones are available to almost everyone, hence smartphone ownership can no longer be considered an indicator for the digital divide in Turkey in terms of device access. However, although smartphones are getting more powerful and functional each year, with larger screens, faster processors, and more memory and storage coupled with unlimited data plans offered more commonly by service providers and with relatively faster networks than before, they are still limited in convenience to perform some important and relatively more sophisticated tasks such as job applications and interviews, taking online courses, writing papers for school, etc. Furthermore, previous research shows smartphones are minority groups', such as "younger, poorer and less educated users", only mean of Internet access and that their online activity over smartphones remains limited to social activities (Tsetsi and Rains, 2017). Given the evidence from the literature, we, therefore, find it important to analyze the device divide in more detail. For such an analysis, we choose to particularly consider computers (such as desktops, laptops, and tablets) because they offer a different Internet experience than that provided by smartphones, while at the same time, they can be considered a more imperative tool of today's

social and professional life compared to other Internet-enabled devices like smarttvs and game consoles. Figure 5 shows the evolution of computer access gaps between different social groups.

Figure 6: Computer Access Gap



The evolution of the gaps and where the country stands with the computer access divide is apparently not the same as with the smartphone access divide which has been nearly bridged. As Figure 6 clearly illustrates that the gaps over computer access persist, indicating that the majority of the population is indeed deprived of Internet activities that can be performed effectively solely on a reliable computer as they are the primary current prerequisite for performing certain activities. On the other hand, it is worth noting that although device availability has improved, devices are of limited use without a proper connection. We, therefore, extend the analysis in the following sections to assess the evolution of Internet access and Internet use in Turkey over the years.

b. The Digital Gap over Internet Access

Based on TurkStat data, we showed that Internet penetration in Turkey has been on an upward trend (see Section 4) such that today the share of the population who reported having Internet access has exceeded 90 percent. While this points to progress, the digital divide persists among certain social groups.

Figure 7: The Digital Gap over Internet Access

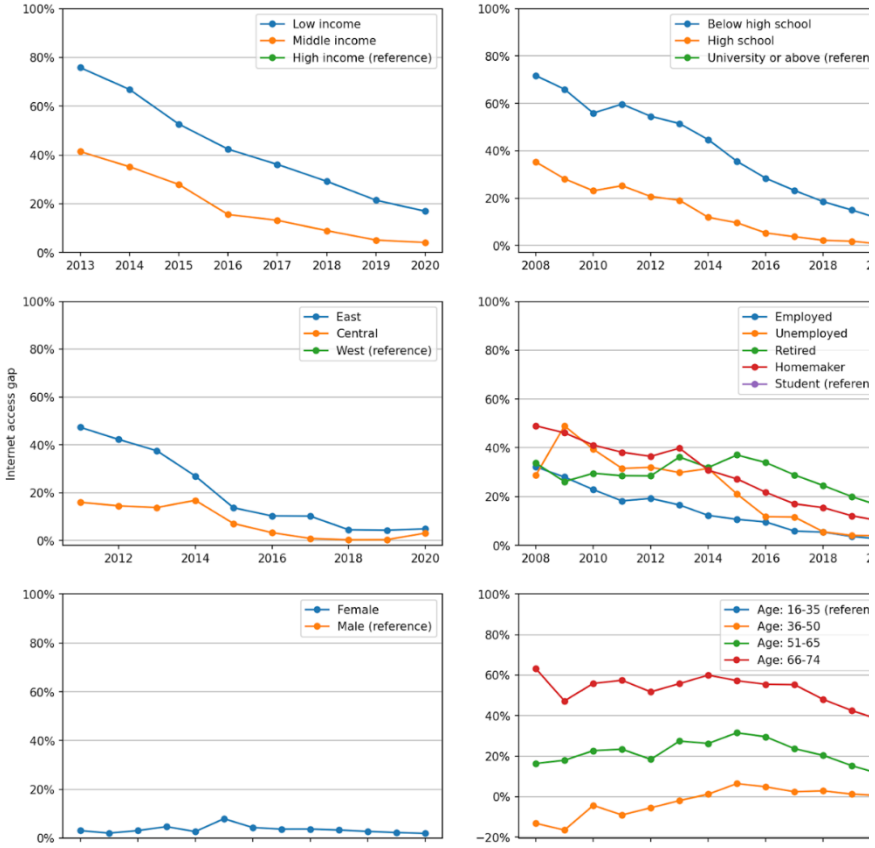


Figure 7 illustrates the gaps observed in Internet access over the years concerning demographic and socioeconomic differences. The gaps are generally decreasing over time, insomuch that the gaps between some groups are nearly closed. For example, the gap between regions is considerably small towards the end of the period (2020) compared to 10 years ago. For different income and age groups, although the gaps have been substantial among the different categories earlier, today, only the second most advantageous categories, namely middle-income and middle-education categories, could catch up with the most advantageous categories whereas low-income and low-education, are still behind of others. On the other hand, older age groups have made much slower,

even stagnant, progress over the years. Despite the relative improvement in recent years, there is an almost 40 percent gap between the older and younger age groups in terms of Internet access. As for gender, there have often been small gaps between women and men, but they have always been unfavorable for women since 2008. Finally, for different employment statuses, homemakers and retired have usually been at the margins among their group, yet homemakers have made relatively better progress than the retired, who are now the least advantageous in terms of Internet access among other occupations.

c. The Digital Gap over Internet Use

Access to an Internet connection is a necessary but not a sufficient condition for Internet use. It is therefore critical to analyze how the gaps over Internet use have progressed over time, given increased and improved Internet access and Internet use in general as well as narrowing gaps over Internet access.

Figure 8: The Digital Gap over Internet Use

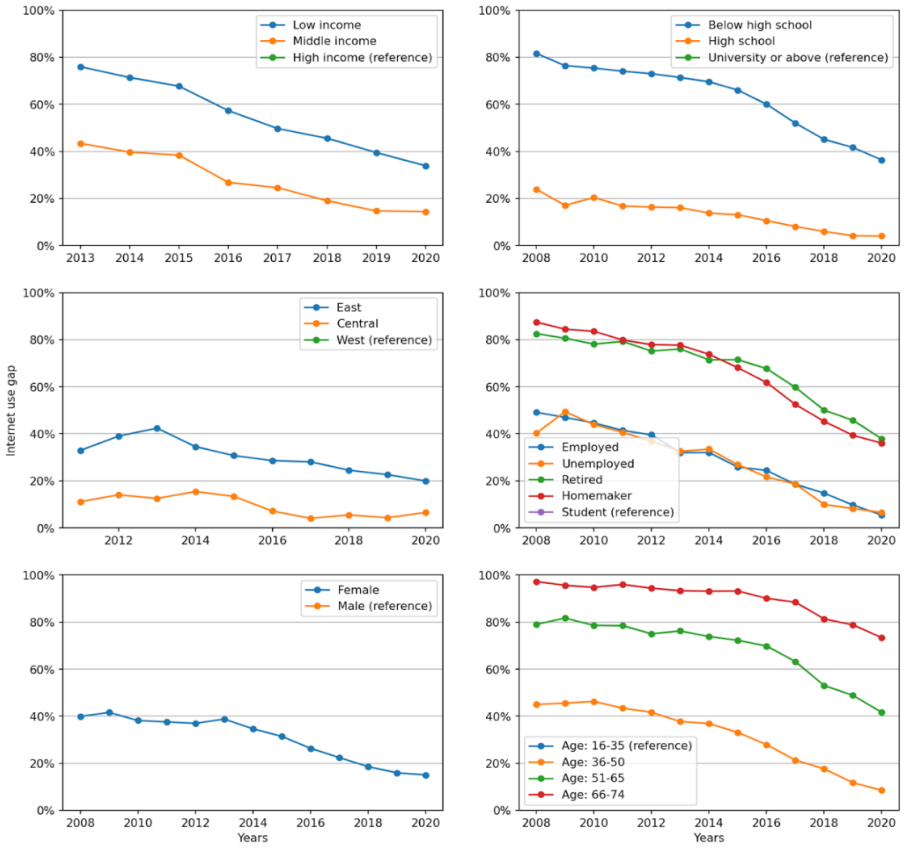


Figure 8 illustrates the evolution of digital gaps over Internet use and shows a more precise picture concerning the differences in Internet adoption in Turkey over the years. Although access divides have been mostly narrowed, high differences in usage remain for all social groups considered. Figure 8 presents a picture drastically different from Figure 7. Despite the overall increase in Internet access (Figure 1) and the decrease in access gaps for most social groups (Figure 7), in Figure 4, we see how terrible the usage gaps between certain groups still are. The increase in the number of individuals with Internet access has not been sufficient to close the digital divide. Despite a decline, especially in recent years, there is still a notable gap between the older and younger age groups. Younger adults are usually more likely than their elders to be earlier adopters of innovation and digital technologies [9], which explains the large gap of almost 100 percent in the initial year. However, the Internet adoption rate by those in the oldest age group, although it has been increasing for the last five years, is not at the desired pace to catch the younger adults up in a short time. A similar situation is also valid for education and income, particularly for those with the lowest education and income. In terms of regions, the gap between them appears to continue steadily. This might be due to region-specific factors like more rural areas where access to (high)connection is low or cultural dynamics that constrain certain social groups' linkage with the digital realm. In terms of occupational status, the gap between the students and employed and unemployed groups has been significantly narrowed. However, retired and homemakers still use the Internet much less than other employment groups. The gap indeed appears to need time to narrow if the adoption by these groups continues at similar rates. Our analysis regarding the gender gap in usage points to an interesting result. Unlike in the case of Internet access, the gender gap in terms of Internet usage, albeit has dropped compared to earlier persists – that is, female users are 20 percent less than men users despite having access opportunities alike. Moreover, the gender gap has barely improved since 2017, which is an indication of the presence of various barriers preventing a group of women from going online.

7. Conclusion

This study focuses on the digital gaps in Turkey for the period 2008-2020. For that, we investigate how the digital divide in Turkey has changed over time; particularly examine the change in digital gaps between different social groups over device access, Internet access, and Internet use. Unlike many other studies in the literature that focus solely on one variable or one aspect of the digital divide, in this article, we try to convey a detailed analysis by taking different aspects of the digital divide. This comprehensive approach fills the gap in the literature by providing an accurate body of knowledge in the design of policies to address the digital divide in Turkey.

Closing the device divide is the first integral step to closing the digital divide. There is an upward trend in device access, that is, the share of people with device access has increased over time so

9 Faverio, M. (n.d.). Share of those 65 and older who are tech users has grown in the past decade. *Pew Research Center*. Retrieved July 29, 2022, from https://www.pewresearch.org/fact-tank/2022/01/13/share-of-those-65-and-older-who-are-tech-users-has-grown-in-the-past-decade/

the vast majority of the population now has a device that can connect to the Internet. However, smartphone ownership has increased at a faster rate compared to other Internet-enabled devices. It appears that people in Turkey use smartphones as their primary means of online access. Although the increase in smartphone ownership is valuable progress towards the digital divide, reliance on smartphones for connectivity and online engagement cannot perfectly aid in mitigating the problem. On top of that despite the increased computer penetration over years, unlike smartphone access gaps, computer access gaps are still substantial. The socioeconomically disadvantaged groups have very low access rates compared to the advantaged groups. The results indicate that their Internet experience is limited to their capability to utilize what smartphones offer them.

The results reveal that Internet access gaps have been narrowing over time, and in several cases they become small. There has never been a significantly large gap between women and men. In the case of regions, income, and education, their mid categories in particular, although large at the beginning, the gaps have ended up considerably small. There is also a diminishing trend in the gaps between other social groups. Nevertheless, the elderly, retired, and low-income and low-education people are still far behind in terms of Internet access. The results point to the need for demand-side programs intended to stimulate broadband adoption widely by those groups. The policymakers' attention should not remain exclusively on the supply side. Instead, they should pay increasing attention to the demand side policies alongside supply side policies if greatly expanded adoption of broadband is the policy goal (Hauge and Prieger, 2010). Although Internet access points to progress to some extent, the digital divide in terms of actual usage persists between different social groups and regions. The lower levels of online engagement overall along with larger gaps in actual usage indicate lower and uneven digital participation in society. As shown in the Figures, not all groups are homogenous such that their digital engagement has been associated with their demographic and socioeconomic characteristics.

The Internet has become an imperative in the lives of individuals. The results in the present paper point to the need for accelerated policies targeted at inferior social groups. Given the gaps among society in terms of ICT access and use, the gaps between individuals who can access and use the technology and those who cannot, will continue widening unless the necessary actions are taken today. There are a number of ways to improve ICT access and use and provide individuals with the opportunities of a stable and open Internet. This includes strategic objectives such as expanded digital infrastructure which enhances availability and accessibility, reduced telecommunications costs, improved network efficiency, more competitive and diverse broadband markets, strengthened digital literacy through a restructured education system, empowering human capital that can use the technologies effectively and implementing policies at the local level. Each of these measures contributes to narrowing the digital gaps. The right policy should particularly target disadvantaged groups such as women, senior age, low-income, low-educated groups, homemakers, and retired people. In conclusion, reducing the digital divide in Turkey requires a combination of policies which concentrate on the underlying demographic and socioeconomic factors that contribute to the digital divide.

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