



Leaving No One Behind in a Digital World

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About this report

The K4D Emerging Issues report series highlights research and emerging evidence to policy-makers to help inform policies that are more resilient to the future. K4D staff researchers work with thematic experts and DFID to identify where new or emerging research can inform and influence policy.

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1. Summary

In an increasingly digital world, relatively privileged people are able to use their access to mobile and internet technologies to access clear *digital dividends* including remote access to health and education information, financial inclusion and digital pathways to economic and political empowerment. However, already disadvantaged people have less access, agency and ability to reap these digital dividends, and are being left further and further behind. One third of the world's population do not own a mobile phone, and 50% of the global population have no internet. A series of digital divides is adding new digital dimensions to poverty in the twentieth century. This is not a binary divide: new classes of technology access and connectivity experience are leading to a range of different digital inclusions and exclusions. These digital dimensions of poverty often reflect, reproduce and amplify gender, racial and caste/class divides. As the relatively privileged upgrade to the latest generation of smartphones and connectivity speeds, and as ever more aspects of social, economic, and political life move online, the digitally disadvantaged experience widening inequalities. Development professionals require new diagnostic tools to analyse the digital access and everyday technology practices of those being left behind in their area of work. New research is necessary to understand the development implications in this dynamic space, including the impact of artificial intelligence (AI) on governance and work automation on employment and growth.

Key points covered in this literature review include:

- The digital revolution coincided with major reductions in extreme poverty during the Millennium Development Goal (MDG) era. Whether digital technologies contributed to poverty reduction is contested.
- A key criticism of the MDGs was that MDG targets focused attention on the “low-hanging fruit” rather than those most in need, and most at risk of being left behind.
- To address this failing the Sustainable Development Goals (SDGs) require development actors to specifically target the most marginalised in order to ensure that this time we “leave no one behind.”
- World Bank and private sector approaches to digital development will deliver clear digital dividends to this same low-hanging fruit, but cannot reach those with little or no income.
- Government and civil society actors will have to step in to specifically target the most marginalised, in order to avoid repeating this failing of the MDGs.
- Technology on its own cannot solve social, political, or economic issues but can only amplify existing human capacity and intent.
- Digital development actors must then identify and build the existing human capacity and intent of the most marginalised as a pre-condition for their development use of technology.
- Non-digital and digital elements will need to be blended in multi-dimensional programmes that are grounded in the felt needs and expressed priorities of those being left behind.

The second half of this report reviews evidence of these digital dimensions of poverty in four key domains: government, private sector, civil society, and digital futures. This section demonstrates how the use of digital technologies amplifies existing social and economic disparities, with particular reference to those being left behind. Key points include:

- e-Government delivers substantial efficiency and cost savings, but making service provision digital by default significantly disadvantages the least connected.
- e-Governance enables citizens to remotely participate in online policy decisions that affect their lives, but the voices of the most connected are the most heard.
- The private sector is key to delivering digital dividends at scale, including via mobile money and online commerce. However, there is no profit motive to include those with least income.
- Civil society is also increasingly turning to digital technologies to engage with beneficiaries. Whilst there are many positive examples of using digital technologies for women's empowerment and social inclusion, even when digital initiatives explicitly aim to reduce poverty, they can unwittingly amplify existing (dis)advantage and leave the poorest behind.
- The law of amplification also holds true for the future of work. Whether or not jobs are lost during the next wave of automation, the increasing use of digital technology in work reduces the employability and earning potential of the unconnected.

This literature review identified a wealth of examples of digital dividends coexisting with digital divides. In an increasingly digital world, existing (dis)advantage is being amplified in ways that give rise to new digital dimensions of poverty. Marginalised and vulnerable groups are least able to afford or apply the latest technology or highest connectivity speeds. As government, private sector and civil society organisations move more of the services and initiatives online, the unconnected and the least connected are being left further behind. Avoiding this requires a reorientation of digital development to “put the last first.” Development initiatives need to blend non-digital and digital elements in order to: (a) build the capacity and intent of the digitally disadvantaged (including their individual and collective agency, organisational capacity and political direction); (b) expand the capacity and intent of those already providing digital dividends to the most marginalised; and (c) curtail the capacity and intent of authoritarian and other malicious actors using digital technologies to manipulate elections and otherwise distort governance and discourse.

To our knowledge, this is the first literature review on leaving no one behind in a digital world. Finite restraints meant that we were not able to go as far or as deep as we would have wished. Dedicated literature reviews on digital gender, digital disability and on AI and the future of work are warranted. Among areas identified in which further research is necessary include: (i) understanding more about the everyday technology practices, access and connectivity experiences, and digital literacies of the least connected and unconnected; and (ii) understanding more about the new digital dimensions of poverty experienced by those with intersectional disadvantages, especially women, the disabled and the digitally illiterate.

2. Introduction

This literature review is designed to help development professionals to better understand exactly *how poverty is changing in an increasingly digital world*, with a particular focus on the implications of those changes for the sustainable development goal of *leaving no one behind*.

Since 2005 the number of people using the internet worldwide has quadrupled to four billion. Two thirds of the world's population now own a mobile device¹. The use of these new digital technologies has enabled exciting new possibilities for social and economic development. Mobile and internet technologies are being used, among other things, to increase income and employment opportunities, improve civic participation and governance, enhance the provision of healthcare and education, and include more women, people living with disabilities, and rural populations in development processes. However, 3.6 billion people still have no access to the internet². One third of humanity has no mobile phone. The *least connected* are rendered relatively disadvantaged to the precise extent that the *most connected* are advantaged by their use of digital technologies. It is also the case that as information, communication and service access increasingly becomes “digital by default,” those citizens who are the *least connected* risk becoming digitally marginalised.

The evidence shows that those fortunate enough to secure access to mobile money, mobile health information, and online employment opportunities are able to experience clear *digital dividends*. However, unequal patterns of technology access and digital literacies create *digital divides*, which are experienced by many others. Although some—including many poor people—are able to access digital dividends, the *unconnected* poor experience an increasing gap between themselves and those enjoying access to the latest digital technologies.

This literature review presents evidence that this relative digital (dis)advantage exists both between countries and between different demographic groups within countries. In rural populations where cellular and broadband connectivity are not available, there is no possibility of digital dividends. Those on the very lowest income are least able to afford smartphones and broadband or mobile data connectivity. Women in general are *digitally disadvantaged* in relation to men. People living with disabilities or who are not print literate in the language used in software applications also experience this new *digital dimension of poverty*. The literature review suggests that we should expect these structural dimensions of digital (dis)advantage to intersect and overlap, such that urban, professional men experience an *amplification* of their existing privilege, whilst rural, disabled women experience an *amplification* of their relative disadvantage. The existing research literature provides significant evidence of the digital disadvantage experienced by women, rural communities, and citizens on low income. More research is necessary to substantiate the anecdotal evidence that senior citizens, people living with disabilities and other marginalised groups experience similar digital disadvantage.

Although the literature provided clear evidence that *use of digital technology amplifies both dividends and divides*, there is little existing research that adequately explains how these divides change people's experience of poverty, or what policy or practice lessons arise. The everyday technology practices of the *least connected* are not well understood, which makes designing appropriate development programmes impossible. There is no value in developing smartphone apps or SMS platforms for populations that use WhatsApp and Facebook Free Basics. There is

¹ We Are Social 2018 <https://wearesocial.com/us/blog/2018/01/global-digital-report-2018>

² We Are Social 2018 <https://wearesocial.com/us/blog/2018/01/global-digital-report-2018>

insufficient research on the everyday digital lives and technology practices of the unconnected and least connected. Further research with non-users and minimal users of digital technologies is necessary to better understand what digital resources, skills and interests should inform digital programmes. Better diagnostic tools are also needed to help participants and development professionals assess the digital landscape in specific countries or target populations.

The digital terrain of development is changing so rapidly that more research is necessary to assess the development implications of technologies on the horizon. Digitalisation is impacting on almost every aspect of economic, social and political life, and yet we have insufficient knowledge about the development implications of technologies such as artificial intelligence, workplace automation, the internet of things, facial recognition and biometric IDs. Digitalisation is bringing digital dividends in the form of workplace efficiencies, new forms of transparency and inclusion, as well as whole new digital industries. The potential for instant citizen access to information and services, and the reduction in scope for bribery and corruption, are substantial. At the same time, as the Cambridge Analytic examples remind us, corporate and government use of data for micro surveillance and profiling, disinformation and media manipulation raises urgent new concerns for digital governance and democracy. The rapid pace of technological change makes the need for further research in digital work and frontier technologies an ongoing priority.

The remaining sections of this report are as follows. Section three will detail the methodology adopted in this literature review. Section four reviews key concepts for understanding how poverty is changing in an increasingly digital world, as well as what this means for the leaving no one behind agenda. We review Kentaro Toyama's *amplification thesis* in order to understand exactly what technology can and can never do. We then review the concepts of digital dividends and digital divides, before looking at the relationship between digital and gender, as well the evidence around other intersecting dimensions of disadvantage including income and disability. Having reviewed the conceptual literature, section five reviews evidence from three sectors—state, private sector and civil society—and looks at the future of work and “frontier technologies.” The final section pulls together the narrative that arises from the review and concludes that, in an increasingly digital world, leaving no one behind can only be achieved by *putting the last first*, and by designing bespoke “blended” programmes that combine both digital and analogue (offline and online) development approaches. The research evidence suggests that technology is an ineffective substitute where existing human capacity and intent are absent or weak. Therefore, identifying (and building) such capacity and intent are necessary “analogue complements” that must precede any digital development interventions. The most marginalised groups, including the disabled and rural women, have the most to gain from technology use. Ensuring that they do not continue to be left behind will require bespoke interventions sustained over the medium-to-long term to first build the necessary human capacity and organisational intent that is a pre-requisite for all digital development.

3. Methodology

Due to time and resource limitations, this literature review is designed to be illustrative of an emerging landscape and does not intend to be extensive or exhaustive. A purposeful sample of 15 semi-structured key informant interviews with DFID staff was carried out in order to identify focal issues and determine the scope of the review. Early drafts were shared with a smaller number of DFID staff, and the scope and focus was repeatedly adapted as appropriate. This informed several iterations of desk research, in which keyword searches were conducted on each of the ten review topics that emerged. Google Scholar, key reports forwarded by DFID and snowball references

from identified sources identified several thousand potential sources. Over 200 pieces of literature that were most closely aligned with the scope and focus of the research were reviewed and analysed. Over 100 are cited in this review. The review identified a number of gaps and promising areas for future research. A more systematic literature review is warranted, that allows time to develop key areas in greater detail.

4. Literature Review: Key Concepts

Poverty in a Digital World

Poverty is changing rapidly. Over one billion people have escaped extreme poverty since 1990³ and another person escapes it every second.⁴ Since the World Wide Web was launched in 1991, mobile and internet technology have spread faster than any previous technologies in history. The dramatic reduction in extreme poverty has coincided with the uptake of mobile and internet technologies. Despite the claims sometimes made that mobile phone penetration or internet adoption drives economic growth, any causal relationship is contested. A recent literature review by Galperin and Viacens (2017, p. 315) found that studies that are often wrongly cited as evidence of a causal relationship between ICT adoption and economic growth or poverty reduction—including Qiang, Rossotto, and Kimura (2009)—suffer from flaws that limit their validity. This is because they do not account for the possibility that economic growth could be causing ICT adoption, that growth and adoption could simultaneously cause each other, or that they may both be caused by a third variable (e.g. good governance). Some studies (Katz & Koutroumpis, 2012; Koutroumpis, 2009) have found the presence of threshold effects – that ICT adoption only has a positive effect on economic growth after a significant portion of a country’s population adopts them (Galperin & Viacens, 2017). The authors conclude that “while the evidence indicates that advanced economies are reaping significant benefits from internet investments, the returns for less advanced economies, and in particular for the fight against poverty in these regions, remains uncertain” (Galperin & Viacens, 2017, p. 315). Due to this uncertainty, this literature review does not take the direction of causation between ICT and poverty reduction as given – nor is it centrally concerned with this claimed relationship. Instead, the review focuses on how the experience of poverty is changing in an increasingly digital world, one in which mobile phones and the internet are rapidly diffusing and increasingly becoming the preferred—sometimes the default—medium by which political, civic, economic, social, and everyday activities are carried out.

Although there is a well-established narrative and evidence of *digital dividends* and *digital divides* which are reviewed here, there is less research evidence about how and why the two phenomenon coexist, and what the appropriate policy and practice responses are. Much of the existing literature is diminished in value by being the product of either digital evangelists or digital pessimists, and lacks the theoretical content that is necessary to understand the relationship between digital technologies and development impacts (Unwin, 2017; Walsham, 2013; Zheng, Hatakka, Sahay, & Andersson, 2018). There is a great deal of macro-economic research literature, but very few ground-level studies showing how digitisation is affecting the experience of poverty by those at risk of being left behind. This review brings together evidence across four areas (governance, the private sector, civil society and digital futures) to illustrate how inability to access and make effective use of digital technologies has become a new dimension of poverty, with particular

³ <http://www.worldbank.org/en/topic/poverty/overview>

⁴ <https://worldpoverty.io/>

implications for those at risk of being left behind. The next sub-section will discuss the genesis of the “Leave No One Behind” agenda and its relation to digital development.

Leaving No One Behind

Poverty reduction during the period of the Millennium Development Goals (2000-2015) was truly impressive in many respects. One common criticism of the Millennium Development Goals (MDGs) is that the targets focused development attention on the “low hanging fruit,” meaning those that were nearest to escaping poverty as opposed to the poorest (Burns, Howard, Lopez-Franco, Shahrokh, & Wheeler, 2013; Stuart & Samman, 2017; UNICEF, 2015). The poorest children gained the least, and as others improved they were left further behind relative to other children in their countries (UNICEF, 2015). Evidence shows that those left furthest behind are often the most marginalised, “including ethnic minorities, indigenous peoples, refugees and migrants” (UNDP, 2016, p. iii). Whilst better-off groups have made significant gains, marginalised groups still face basic deprivations, including: lack of voice, discrimination, exclusion, and prejudice (UNDP, 2016). Moreover, these groups are often the most difficult to reach geographically, socially, politically, and economically.

In order to avoid repeating the mistakes of the MDGs, the Sustainable Development Goals (SDGs) included a cross-cutting commitment to “Leave No One Behind,” by prioritising the most marginalised.⁵ The commitment to prioritise the poorest has precedents in the existing literature, including in the title of Robert Chambers’ (1983) book, *Rural Development: Putting the Last First*. There is an apparent clash between the aim of some governments, corporations and development agencies to reach citizens with “digital first” or “digital by default” programming, and the SDG aim to put the poorest first, because the poorest are least likely to have the capacity to make effective use of digital services. Digital service provision enables agencies to reach the digital low hanging fruit of people experiencing some aspects of disadvantage, but who have mobile or internet connectivity. This, however, again excludes those left behind by the MDGs and suggests that multiple channels (including offline and analogue channels) will be needed to be combined in “blended” digital/analogue programmes in order to leave no one behind.

This section has covered the concept of leave no one behind. The MDGs incentivised reaching citizens that were easy-to-reach, rather than the most in need. If digital development is to avoid repeating these results, it will have to develop strategies that specifically target the hard-to-reach. The following section examines how the use of digital technologies in development contains an inherent danger of amplifying existing social and economic disadvantage.

The Law of Amplification

It is common to come across claims such as “technology empowers women” or “technology increases accountability.” However, technology has no independent will and so cannot be the cause of anything. The ex-head of Microsoft Research, Kentaro Toyama (2011), argues convincingly that technology has no transformative capacity in and of itself, and that *technology use can only amplify existing human capacity and intent: it cannot act as a substitute where human capacity and intent do not exist*. The following example illustrates his point:

Research has shown that while technology (namely computers) can improve outcomes in schools, it only does so in well-run schools with good teachers and struggles to mimic

⁵ <https://unstats.un.org/sdgs/report/2016/leaving-no-one-behind>

positive outcomes in schools struggling with the basics of education ... In all cases, good (normally richer) schools do better, while bad schools do worse. (Warschauer, Knobel, & Slone, 2004, as cited in Toyama, 2011, p. 2)

Technology can amplify both positive and negative capacity and intent. This thesis holds true not only for digital development interventions, but also for market-based technology diffusion (e.g. mobile phones and the internet). Market-based technology diffusion provides preferential access to the newest and highest capacity versions of any technology to those with the largest disposable income – and leaves behind those with the least disposable income. Even when they own a mobile phone, those on the lowest incomes are disadvantaged because device ownership does not equal being able to keep it charged with electricity, topped up with call and data credit, and repaired when damaged (Faith, 2018). Again, existing capacity and intent is key. Even if a corporation or government provided the same phone to every citizen, disparities in capacity to make “effective use” (Gurstein, 2003) of technology would still shape development outcomes, as illustrated in the following quote:

Even if differential access to technology could be countered through a universal allocation of technology, disparities among people, such as better education, refined social skills, and influential connections all translate to a greater ability for the better-off to use technology for their own purposes ... The greater one’s skills and capacities, the more value technology has. (Toyama, 2011, pp. 3-4)

Moreover, Toyama also warns that even when technology is provided, it is not safe to assume that the most marginalised will intend to—or have the motivation to—make use of technologies in educational or empowering ways, rather than for entertaining or “frivolous” purposes. Instead, a person’s use of technology is likely to reflect their previous habits, self-esteem, or sense of agency, which may be deeply rooted in “a lifelong lack of experience with situations where effort leads to better circumstances” (Toyama, 2011, p. 4).

Stated otherwise, “Technology is merely a tool that multiplies human capacity in the direction of human intent,” rather than a substitute for them (Toyama, 2011, p. 3). Thus, digital technologies may “amplify the impact of good (and bad) policies” (World Bank, 2016, p. 4). It is therefore important to ensure that digital development policies avoid amplifying existing inequalities and leaving marginalised people behind. Moreover, because intent is directional (it can be benign or malicious), technology in the hands of governments or corporations with malicious intent and sufficient capacity can present new governance risks, such as the proliferation of disinformation, electoral manipulation or intrusive surveillance. More research is necessary to understand how these new digital threats impact on development and the least powerful citizens.

Given the above, doing digital development in a way that leaves no one behind requires three courses of action: (i) identify existing capacity and (good) intent on the ground and amplify it; (ii) seek to build capacity and intent (e.g. organisational capacity and political will) where they are lacking; and (iii) curtail or mitigate the use of technology by those with malicious intent and high capacity.

This section has covered the concept of amplification, which states that technology on its own cannot solve social, political, or economic issues but can only amplify existing human capacity and intent. This makes key the *identification and nurturing of existing capacity and intent*. Moreover, amplification theory lends weight to the argument that—all other things being equal—introducing technology in places with high levels of existing disparities is likely to amplify those disparities. The

leave no one behind agenda therefore requires that we specifically prioritise work with the most marginalised and excluded, and seek opportunities to amplify their existing capacity and intent. The following section examines the idea of *digital dividends*, as popularised in the 2016 World Development Report.

Digital Dividends

The World Development Report (WDR) 2016 has the title *Digital Dividends*, and provides examples of multiple ways in which the use of digital technology can be leveraged to reduce poverty, increase income and empower citizens (World Bank, 2016). It argues that this is possible through three main mechanisms: (i) inclusion – bringing down transaction and information costs and overcoming physical barriers to reach remote populations; (ii) efficiency – automating existing processes can bring down costs of existent services and transactions; and (iii) innovation – digital platforms can scale rapidly at near zero marginal cost. The positive development impacts, or “digital dividends,” include: economic growth, job creation, increased productivity, access to digital services, increased participation and feedback, and improved public sector capability (World Bank, 2016).

To maximise these digital dividends, the World Bank recommends that countries put in place “analogue complements,” including: (i) regulation to promote competition; (ii) accountable institutions; and (iii) digitally-skilled populations. The World Bank argues that failure to put these analogue complements in place will result in countries falling further behind. The WDR 2016 also warns that “these benefits are neither automatic nor assured” (World Bank, 2016, p. 11). It argues that although “digital technologies have spread rapidly in much of the world [,] digital dividends ... have lagged behind. [They] have boosted growth, expanded opportunities, and improved service delivery. Yet their aggregate impact has fallen short and is unevenly distributed” (World Bank, 2016, p. 2).

The 2016 World Development Report recognises that digital dividends are unevenly spread and that some people are being left behind (World Bank, 2016). The WDR does not provide an adequate framework for addressing these challenges. The World Bank’s model relies on digital technology stimulating economic growth and competition that progressively drives technology prices down, such that over time increasing poor sections of the population are included. This approach, by design, intends to reach the poorest last. This is at odds with the Sustainable Development Goal of putting the poorest first in order to leave no one behind. There is no doubt that competition and the market mechanism are enabling the private sector to extend digital dividends to progressively more people, including millions of poor people. The problem is that the profit motive will always steer corporations towards the low-hanging fruit, as it can only serve profitable markets. It cannot serve those without disposable incomes, or those living outside the cash economy.

This section has reviewed the concept of digital dividends and has argued that the profit motive and the market mechanism is insufficient to meet the SDG goal of leaving no one behind. Later sections will examine the role of the state and civil society actors in reaching the parts that the market cannot serve. In the next section we examine the “digital divide” literature, in order to better understand exactly who is being left behind.

Digital Divides

The term *digital divide* in its simplest form refers to the binary division between people who own, or do not own, digital devices such as mobile phones or computers. It is also used to refer to the

binary division between people who are connected to the internet and mobile phone networks and those who are unconnected. This binary understanding of access or inclusion has been subject to increasing scrutiny in recent years and the literature has sought to go “beyond access” to develop a multi-dimensional understanding of digital divides, as illustrated in Table 1 (United Nations, 2018).

Divide	Description
Access	It starts with access or the lack thereof: although Internet penetration has increased, it continues to be a key barrier as more people globally remain offline rather than online.
Affordability	The gap between rich and poor affects affordability of ICTs and serves as an important difference in adoption within countries as much as between them.
Age	Older people are generally using ICTs to a lesser extent than younger populations, despite the notion that they could benefit from online social and health services.
Bandwidth	International bandwidth and the capacity to transmit and receive information over networks varies greatly between countries but also within them, limiting potential useful endeavours.
Content	Relevant content in local language(s) is important to stimulate adoption.
Disability	Those with disabilities face additional hurdles to use ICTs if websites are not compliant with web accessibility guidelines.
Education	Like social divides, education and literacy rates are fundamental challenges to bridge digital divides.
Gender	There is a small but persistent difference in online usage between men and women.
Migration	Migrants may not possess the same levels of digital skills as the population in their new country and if they do, may be subject to content and language divides.
Location	Rural and remote areas are often at a disadvantage in terms of speed and quality of services as compared to their urban counterparts.
Mobile	Mobile devices provide opportunities to bridge the access gap but can also introduce new forms of divides in terms of technology, speed and usage.
Speed	The gap between basic and broadband access is creating a new divide as speed is important to reap the full benefits of a digital society.
Useful usage	What people do with their access is a key difference in whether users take full advantage of ICTs, such as e-government services.
<i>Note: The above table is intended to be illustrative and not exhaustive</i>	

Table 1. Digital Divides. Source: United Nations (2018, p. 34)

Digital divide scholars argue that digital divides can both reflect and reproduce social and economic disparities. There are spatial, socio-economic, and material digital divides (Ramalingam & Hernandez, 2016). Given that internet and mobile infrastructure is disproportionately concentrated in areas with the most buying power, disparities in ICT infrastructure often reflect economic and rural-urban disparities. As a result, people in urban areas are more likely to be connected than

people in rural areas, and within urban areas there are often divides between affluent centres and inner-city neighbourhoods (McKinsey Global Institute, 2014). There are also divides between device owners. Most new users now get their first taste of the internet via mobile phones. Smartphones are faster and provide more functions than feature phones. However, mobile phones are less suited to some complex tasks than computers. “Digital by default” and mobile-only approaches risk leaving the poorest behind. Moreover, the digital divide is not about income alone. Evidence shows that digital divides exist along dimensions of ethnicity, gender, education level, caste, disability and age (Goggin, 2017; May, 2012). In the same way that offline marginalisation is often experienced in multiple and overlapping ways, so are digital divides, which make individuals with multiple marginalised identities even more likely to be offline (Robinson et al., 2015).

Digital divides are not binary. Rather than neat divisions of usage between owners and non-owners of technology, there is evidence of the emergence of distinct classes of technology access and connectivity that mirror socio-economic classes, as illustrated in Table 2.

Class of technology access	Employment	Device	Connectivity	Experience
Upper class	Independently wealthy or urban salaried professional	Latest smartphone	<ul style="list-style-type: none"> • Post-paid monthly mobile contracts with maximum gigabit / month data; unlimited calls and texts • Wi-Fi at home and at work 	<ul style="list-style-type: none"> • Connected by default to all the fastest available services • Uses Internet extensively • Not frugal
Middle class	Teacher, civil servant, shopkeeper	Previous generation of smartphone	<ul style="list-style-type: none"> • Post-paid midrange monthly package of calls and text with limited data • Wi-Fi at work and coffee shops, but not at home 	<ul style="list-style-type: none"> • Always able to call and text • Uses web mainly on Wi-Fi • Uses mobile data mainly for instant messaging • Frugal with mobile data
Working class	Manual worker	Feature phone with touchscreen and Internet capability	<ul style="list-style-type: none"> • Prepaid call credit • Unlimited texts • Limited data • No Wi-Fi access 	<ul style="list-style-type: none"> • Text rather than voice calls • Frugal with data (instant messaging only) • Internet limited to Facebook and free basics
Underclass	Unpaid work, unemployed, underemployed, informal work	No phone or basic phone, with a non-touchscreen and physical keyboard	<ul style="list-style-type: none"> • Prepaid, but often has no credit • Phone often not charged • No data • No Wi-Fi access 	<ul style="list-style-type: none"> • Unconnected by default • Frugal with voice calls – mainly passive recipient of calls and texts

Table 2. Class of Technology Access. Source: Roberts and Hernandez (2017, p. 17)

Classes of connectivity range from a “digital underclass”, disconnected by default with limited airtime and no mobile data, to a “digital upper class” with the latest iPhone, unlimited mobile data and Wi-Fi at home and at work. Several levels of intermediate access and connectivity exist between these extremes (Roberts & Hernandez, 2017). This resonates with Qiu’s (2009) research with marginalised migrant workers in China and his concept of “working class technologies.” It also builds on research by de Lanerolle (2017), which found that “less connected” South Africans experienced “fragile connectivity” and had to adopt “frugal practices” to manage the limited connectivity that they could afford. Further research to understand the everyday technology practices of the least connected and unconnected are a necessary precursor to their successful incorporation into digital development programmes.

Digital divides are not static. The landscape of technology access and connectivity is fluid. Even if we imagine a future date when all those now left behind own a mobile phone and internet connection, by that time the most advantaged will have moved on to the next generation of technology, and corporate and government providers will be designing services to make use of every new function. This persistence of *relative* digital poverty points to the need to develop *multiple channels* of service delivery for non-users and users of different generations of technology, in order that no one is left behind. Research shows that although absolute divides in broadband access have decreased between countries, as more countries get fibre-optic connections, the relative divides in broadband speeds have actually *increased* (Hilbert, 2013). This means users in developing countries (and especially LDCs) have relatively low levels of access that significantly limit the activities they can undertake online relative to OECD countries, making the digital divide a moving target (UNCTAD, 2017).

Statistics overstate the extent of global connectivity. The widely-cited figure of four billion people now connected to the internet demands closer scrutiny. The United Nations International Telecommunication Union (ITU) data, which the figure is based on, counts “internet users” as anyone accessing the internet once or more in the last three months (ITU, 2014). This frequency would seem inadequate to substantively benefit from digital dividends, and certainly bears little comparison to frequency of access by urban elites. The ITU measure of “connected” also fails to discriminate between levels, speeds or qualities of access. An urban professional may experience “accessing the internet” as surfing websites, streaming video and sending emails and photos via their smartphone, using Wi-Fi or cellular data. However, for someone in a remote area on a low income, “accessing the internet” may mean searching for a weak and intermittent cellular signal to access SMS or a text-only version of Facebook Free Basics on a feature phone. Both count equally as having internet access for statistical purposes but the internet experience is radically different, as are the potential development applications that are made possible. It is equally unclear how reliable claimed social media user figures are. Facebook deleted half a billion fake accounts in the first quarter of 2018 alone – more than a quarter of its claimed active user base⁶. Significant gaps exist in our understanding of the size of the digital divide even at this aggregate national and binary level. Further research is necessary to better understand the real connectivity experiences and daily technology practices of the least connected, if designers are to accurately tailor new service provision to enable their meaningful inclusion.

A blended approach is necessary, in which technology may not be the first step. The research evidence is clear that access to a mobile phone or the internet is an insufficient condition for realising development impact. *Other resources need to be in place—including digital literacy,*

⁶ <https://newsroom.fb.com/news/2018/05/enforcement-numbers/>

disposable income, and agency—in order to make “effective use” of technology access in order to secure digital dividends. Understandably, industry sources like the GSMA⁷ tend towards a technology-first approach in which technology access is seen as a prerequisite to mobile-enabled education, entrepreneurship, and health outcomes. However, Toyama’s (2015) law of amplification suggests that—especially for those at risk of being left behind—a capacity-first approach is most likely to deliver development outcomes. Expanding technology provision without an understanding of the multi-dimensional nature of the digital divide comes with the risk that digital divides in access are bridged without the necessary capacities to translate access into digital dividends. Development professionals currently lack sufficient diagnostic tools to enable analysis of these capacity issues and the underlying social, political and economic factors that result in current technology use amplifying existing divides. One diagnostic tool that can help practitioners and researchers better analyse the multiple barriers to meaningful use of digital technologies is Roberts’ (2017) “5 ‘A’s of Technology Access,” as illustrated in Figure 1 (see also Roberts & Hernandez, 2017).

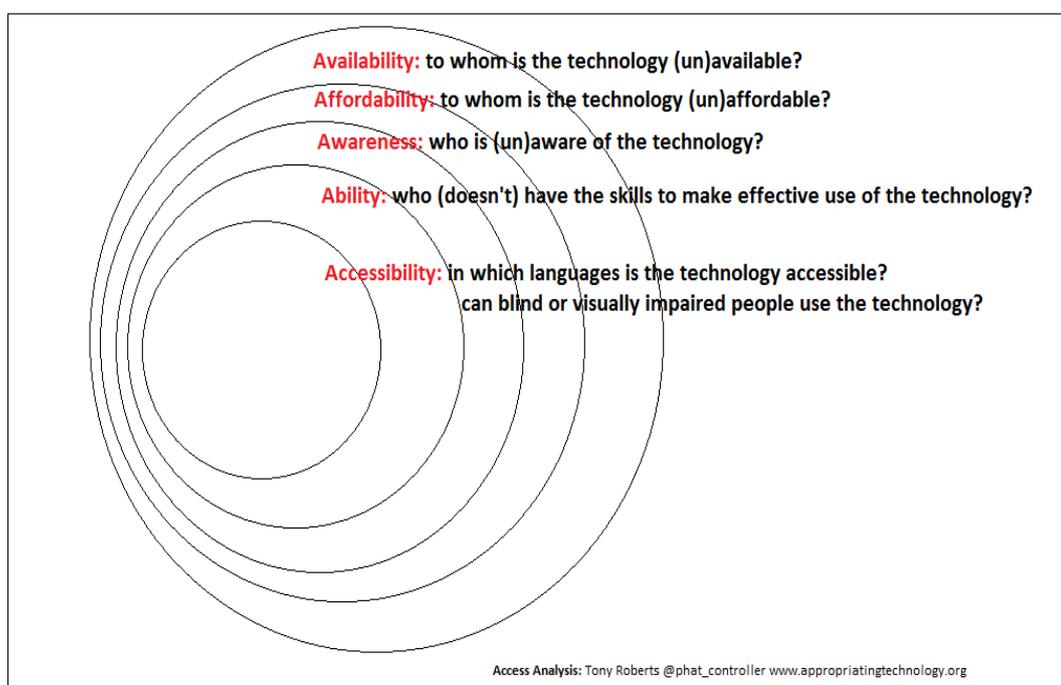


Figure 1. The 5 ‘A’s of Technology Access. Source: Roberts (2017)

More research is necessary to understand the multiple dimensions of the digital divide and how differential capacity and intent work to amplify existing inequalities.

Digital divides are not static, but relative divides have proven to be persistent. People experience a range of barriers to technology access and to translating access into digital dividends. Different classes of technology access are emerging which place real limits on meaningful inclusion in digital development initiatives for marginalised groups. These digital divides reflect, reproduce, and amplify existing social and economic divides. The poorest and most marginalised

⁷ <https://www.gsma.com/mobilefordevelopment/>

are the least likely to access digital technologies and the most likely to be left behind. The next sub-section focuses on one dimension of the digital divide – the gender digital divide.

Gender Digital Divide

There is ample evidence that the use of mobile phones can contribute positively to women's economic and political empowerment (Buskens, 2015; Buskens & Webb, 2009, 2014; Gillwald, 2010; GSMA, 2012; Gurusurthy, 2004; Sambuli, Brandusescu, & Brudvig, 2018). The use of mobile phones is valued by many women "by making them feel safer and more connected, and [providing] access to information, services and life-enhancing opportunities like health information, financial services and employment opportunities, often for the first time" (GSMA, 2018, p. 2). However, many women are being left behind; in low and middle income countries women have less access to digital technology than men and "unequal access to mobile technology threatens to exacerbate the inequalities women already experience" (GSMA, 2018, p. 2). On average, women in developing countries are 10% less likely to own mobile phones than men and even when they do own them, they are 26% less likely to use them to access the internet. This varies geographically. In Asia, women are 70% less likely to use the mobile internet than men (GSMA, 2018, p. 3).

Barriers to mobile phone ownership affect women disproportionately (GSMA, 2018). Cost remains the biggest barrier, but they also face barriers related to digital literacy, language literacy, safety and security. Women are less likely to be aware of the mobile internet, its relevance to their lives and to lack digital literacy. Social norms regarding what is acceptable behaviour often hinder women from owning a mobile device or going online, and may shape their ability to overcome education and literacy barriers to getting online (GSMA, 2018). The nature of the gender digital divide is about more than just technology access – it is multi-dimensional in nature, and analysis requires more than just counting women with access to technology. Addressing the gender digital divide will require addressing the underlying gendered social norms and power imbalances that act as barriers to women accessing digital dividends.

The gender digital divide is intersectional. The social category of women is multi-dimensional. The experience of an urban professional woman is likely to be distinct from that of a rural disabled woman. The broader development literature has begun to reflect the idea that multiple overlapping disadvantages make some women's lives particularly deprived (Burns et al., 2013; Gender & Development Network, 2017). Critical internet scholars have begun to document the ways in which the internet is a site of intersecting (dis)advantages (Noble, 2018; Noble & Tynes, 2016). However, to date the digital development literature has lagged behind and mainly focuses on divides based on singular identities (e.g. gender, class, etc.). One example of how gender and rural disadvantage overlap in digital development is that although urban women in Brazil are 2% less likely to use the mobile internet than a man, women in rural areas are 32% less likely (GSMA, 2018, p. 16). More research needs to be done to better understand the digital lives of women facing multiple forms of oppression, as these women are most at risk of being left behind. A dedicated literature review on this subject is recommended to identify more relevant knowledge and analysis.

This concludes the conceptual literature review. We have seen that absolute poverty has decreased, but that relative poverty has increased during the digital age. Use of digital technologies can amplify people's ability to secure digital dividends including economic growth, women's empowerment and organisational efficiencies. However, the already privileged are disproportionately reaping the benefits and a digital divide is continuing to grow between their experience and those of the unconnected and digitally deprived. Digital technologies have thus

added new dimensions to poverty. More research needs to be carried out to understand the digital disadvantage being amplified among rural women, the disabled and those on the lowest incomes.

The next section contains an evidence review of four areas, to illustrate how these concepts help us to understand practical development settings.

5. Evidence Review: Key Focal Areas

The next four sections contain an evidence review of four areas relevant to the changing nature of poverty in an increasingly digital world: government, private sector, and civil society, as well as an overview of digital futures. We use these four focal areas to examine the practical ways in which offline disparities are being amplified online by rapid digitisation of key areas of life. This section shows how the use of digital technologies amplifies existing social and economic disparities, with particular reference to those being left behind. The focal areas are intended to be illustrative rather than exhaustive. Additional time would enable a deeper review and analysis of key sectors or applications.

Government

Digital governance initiatives are sometimes categorised as e-Government or e-Governance. According to this distinction, the term *e-Government* refers to government-initiated (top-down) applications of digital technologies to deliver government information and services electronically. e-Government is often concerned with achieving efficiency and cost savings and refers to the apparatus of governmentality. *e-Governance*, by contrast, is more often initiated by civil-society actors (bottom-up) and is often concerned with using digital technologies to enable more transparent and participatory forms of decision-making between citizens and governors (Riley, 2003).

e-Government: Most governments now have website “portals” through which they provide information and services to citizens, accessible using computers and mobile phones via the internet. These services are often uni-directional (government to citizens), but increasingly they can be interactive, used to solicit citizen input and to provide feedback in ways that “close the feedback loop” (Gigler & Bailur, 2014). e-Government can range from communicating government decisions, laws, and policies rules and regulations, to interactive online services by means of which citizens can obtain licenses and visas, pay taxes, and report service defects and corruption.

“Governments are increasingly utilizing digital technologies to deliver advanced electronic and mobile services aimed at bringing benefits to all people” (United Nations, 2016, p. 79). All UN member states have at least a national portal. Citizens of 140 countries can now register an account to access more advanced facilities including paying utilities (140), submitting income taxes (139), register businesses (126), applying for social protection programmes (91), birth certificates (86), ID cards (59), and paying fines (11). Performing these activities online can provide digital dividends for government and citizens by reducing the time it takes to carry out transactions, reducing staff costs, and removing opportunities for inefficiencies, bribery and corruption. The number of countries providing online or mobile educational services doubled to 176 in the last two years, as did the number providing online or mobile health services (United Nations, 2018). Eighty percent of countries now have websites with information on services targeted to at least one vulnerable group, and the number of countries providing online services to the poor nearly tripled from 47 in 2016 to 120 in 2018 (United Nations, 2018).

Marginalised citizens are least able to make effective use of e-Government services. They are least likely to be connected, to be aware of services, or have the necessary digital literacy to make meaningful use of such services. As government services become “digital by default” there is growing evidence that the most marginalised are being left behind. A recent study on e-Government by the United Nations (2018) found that although there has been steady progress regarding improving online e-government and service provision across all regions (albeit with gaps between rich and poor countries), there is a negative correlation between digital use and exclusion. It found that digital technologies offer both the opportunities of e-inclusion, and introduce the risk of digital divides. The survey states that:

there has been a steady increase in the number of country websites with information about specific programmes benefiting women and children, persons with disabilities, older persons, indigenous people, and people living in poverty ... which increases the risk that vulnerable groups without Internet access will fall further behind in the rapidly progressing digital society. (United Nations, 2018, p. xxiv)

“Digital-first” strategies run the risk of leaving behind the most marginalised. “Digital First” and “Digital by default” strategies unconsciously repeat the MDG error of reaching the “low-hanging-fruit” at the expense of those in most need. The United Nations (United Nations, 2018) warns against emerging digital-first and digital-by-default approaches which privilege the most connected and lock out the least connected. The report warns that although digital IDs, for example, are providing more remote access to government services for those who have them, the already marginalised are least likely to obtain digital IDs and therefore risk falling further behind. The report concludes that “the public sector is inadvertently creating new digital divides by advancing e-government services at the expense of those who cannot take advantage of them” (United Nations, 2018, p. 38). The use of technology in this way amplifies existing divides, adding a new digital dimension to poverty. Digital-first and digital-by-default services add new advantages to the already relatively advantaged, and runs contrary to SDG commitment, made by all governments, to tailor services *first* to those *most* in need.

Where public service delivery is electronically mediated, there can be a substantial digital dividend in the form of cost-savings and speed of delivery. At the same time, the ability to verbally discuss or dispute can be a significant loss – especially to those with low literacy levels. Nigerian immigration requires citizens travelling internationally to notify the government via its National Immigration Service (NIS) web portal. However, Nigerian women, those living in rural areas, and those with low levels of education, disproportionately lack connectivity and the necessary digital literacy (Okunola, Rowley, & Johnson, 2017). Automating service delivery has been found to improve cost-efficiencies, but to effectively exclude beneficiaries without the means (devices, digital literacy or agency) to electronically dispute eligibility decisions (Eubanks 2018). Examples of digital-only service delivery in developing countries are scarce, but are accelerating as governments continue to digitise their processes and services. More research is needed to understand how, in an increasingly digital world, rapid digitalisation of government services is changing the nature of poverty for people trying to access entitlements and services.

e-Governance refers to the use of mobile and internet technologies by citizens to take a more active role in corporate or state decision-making. Examples include contributing to public consultations or policy development processes, participatory online budgeting, or even crowdsourcing constitution writing – as happened in Iceland (Landemore, 2014). e-Governance is often motivated by the aspiration to increase inclusion and participation in policy, decision-making

processes and service design and delivery. In their ideal form, e-Governance platforms can help generate a shift in power, where citizens are enabled to determine priorities and co-construct solutions with government. Making government, corporate and development agency data open to all citizens is seen as an important means to share knowledge and learning and increase transparency and accountability. The Open Government Partnership (OGP, 2018) has taken a lead in this respect. However, the questions of “Open to Whom?”, “Open for What?” and “Open to What End?” arise, as a limited number of people have the technical skills and connectivity necessary to make effective use of open data, and governments are open to limited outcomes (Gurstein, 2011).

Few Open Data initiatives actively promote the inclusion of the most excluded (Web Foundation, 2017). The Open Government Partnership is a well-known governance initiative with the goal that “governments genuinely serve their citizens, rather than serving themselves” (OGP, 2018, p. 10). Over 70 governments have signed up to the Open Government Partnership to increase accountability and act on policy reform. However, the Web Foundation (2017) finds that although use of open data is equipping some citizens with the information and evidence they need to demand change, “few open data initiatives actively promote inclusion” (p. 20). While the better-off, better-equipped and better-skilled are able to amplify their relative advantage with digital technology, people with low incomes, literacy and little political power are left behind. It is also the case that marginalised groups are less likely to be consulted in the design of data policies and initiatives, or to be accounted for in official stats in the form of disaggregated data (Web Foundation, 2017). If trends are not reversed, existing power imbalances will be amplified in an increasingly digital world, impairing the ability of marginalised citizens to advocate for and demand change.

In an increasingly digital world, governance will be increasingly mediated by technology. Making All Voices Count (MAVC) was a five-year programme of more than 140 digital innovation and research projects in 12 countries, exploring the role of technology to improve transparency and accountability in governance. The synthesis report found that project designs frequently overestimated citizen’s digital access and digital literacy levels, and that “the drive to digitise the processes of governance threaten[ed] to deepen the disenfranchisement and disempowerment of those who ... can’t ... engage with ICTs and tech-enabled forms of governance” (McGee, Edwards, Anderson, Hudson, & Feruglio, 2018, p. 22). Participatory digital budgeting, for example, was found to “exclude the voices of the digitally marginalised and increase the risks of co-option of the relatively powerless by those who already enjoy relative power and influence” (McGee et al., 2018, p. 17). In other words, digital participatory budgeting was found to amplify disparities between by providing the better off with digital dividends while the least well experienced a growing digital divides and a sense of being left behind.

The MAVC final report evidenced that use of digital “solutions” was insufficient, but that where political will and capacity did exist then the introduction of technology was able to add value. This resonates with Toyama’s (2015) amplification theory. This is true whether the government’s intent is positive or negative. There is growing evidence from MAVC and beyond that in places where governments and powerful actors have malign intent, new technologies amplify their capacity for surveillance, repression and the manufacture of consent (McGee et al., 2018). The World Development Report makes a related point when it states that “in the absence of accountable institutions, [digital technology can] amplify the voice of elites, which can result in policy capture and greater state control” (World Bank, 2016, p. 3).

Digital technologies are being used to manipulate voting behaviour. Social media is an increasingly important arena for policy debates especially, leading up to elections (Woolley & Howard, 2017). Governments, military units, terrorists groups, special interest groups and political aspirants have spent at least half a billion pounds trying to manipulate this space by hiring troll and bot armies to shape behaviour and influence voting (Bradshaw & Howard, 2018). Critical media skills are not taught in many schools and research suggests that the least well-off may be most vulnerable to misinformation, by virtue of reliance on “zero-rated” internet services like Facebook’s Free Basics. These services lack the ability to follow links in order to assess article validity (Global Voices, 2017). In developing countries, disinformation is also increasingly spread over chat applications like WhatsApp, Telegram and WeChat (Bradshaw & Howard, 2018). Corporations have tried to expand their market share in developing countries, by zero-rating popular apps like Facebook Free Basics (Lyons, 2016). There is very little empirical research evidence about the ways in which these changes are affecting governance, political empowerment and the ability of marginalised groups to participate in public discourse and policy debates. Further research is necessary in this area.

Crowdsourcing is amplifying relatively powerful voices. Crowdsourcing platforms have increasingly been used for an array of development functions, including: corruption reporting (Kukutschka, 2016; The Engine Room, 2012); election violence reporting (Makinen & Wangu Kuira, 2008; Moreno, Garrison, & Bhat, 2017; Roberts & Marchais, 2017); and humanitarian “crisis mapping” (Gao, Barbier, & Goolsby, 2011; Meier, 2012). The *I Paid a Bribe* corruption crowdsourcing app in India has received over 160,000 reports of bribery, amounting to over £320 million in bribes since 2010.⁸ Crowdsourced mapping using the Ushaidi and Aggie platforms has been effectively used to monitor election violence in Kenya, Sierra Leone, Nigeria, and Ghana (Roberts & Marchais, 2017). However, research shows that social media crowdsourcing amplifies already powerful voices, while already disadvantaged individuals go underreported or remain invisible – amplifying existing divides (Kukutschka, 2016; Roberts & Marchais, 2017; The Engine Room, 2012).

Marginalised voices are least likely to be heard. In an increasingly digital world it is important to remember that digital platforms systematically over-represent specific demographics and exclude others. Digitally-enabled voting (such as in Rio Grande do Sul in Brazil) and digital citizen engagement initiatives (such as U-Report in Uganda) tend to be dominated by young, educated, relatively wealthy, males (Berdou & Lopes, 2015, as cited in World Bank, 2016, p. 16). e-Governance participation is highly correlated with university education, employment, urban residence, male gender, and broadband access; EU citizens in the top 20% of income distribution are 45 times more likely to participate online than the bottom 20% (World Bank, 2016). Digital technology reliance amplifies disparities by both benefiting some (disproportionately the better off) voices and silencing marginalised and excluded ones. Digital development initiatives need to be alert to the possibility of excluding “those who do not Tweet.” A study of a South African SMS platform for reporting water and sanitation grievances found that although elderly, disabled, and infirm individuals in a township faced significant barriers in accessing water and sanitation services, they also lacked the technical capacities to communicate their issues via mobile devices, thus preventing their participation (Hill, 2015).

This section has demonstrated that e-government and e-governance initiatives have provided clear digital dividends, especially for those with the best access and most capacity to use digital

⁸ <http://ipaidabribe.com/#gsc.tab=0>

technologies. However, across a range of applications and settings, the evidence also shows that that digital divides have been amplified and that those already left behind are now experiencing a new digital dimension of poverty.

Private Sector

The private sector has played a major and valuable role in extending mobile telecommunications, connectivity infrastructure and digital services to the majority of the world's population. It continues to be at the forefront of research and development, innovating new digital products and services. However, Jaiswal (2008) and others have argued that although there may be a profitable market in the middle and lower middle sections of the pyramid, those living at the very bottom of the pyramid (the extreme poor) cannot be profitable for the private sector, as they have insufficient income to meet even their basic needs. While the private sector can be expected to extend digital dividends to many millions more, those benefiting will be primarily the "low-hanging fruit," rather than those at most risk of being left behind. The examples in this section illustrate how the private sector is enabling millions of people to access digital dividends, as well as identifying who is being left behind.

Mobile money use extends digital dividends to previously underserved populations. Digital technologies have helped companies to achieve lower transaction costs and to overcome geographical barriers to reach many marginalised communities (World Bank, 2016). This has led to the proliferation of new ways to offer services to the poor digitally. Two thirds of Kenya, Rwanda, Tanzania, and Uganda are now "financially included" via mobile money (GSMA, 2017). M-Kopa has connected over half a million off-grid African homes with solar power using a combination of "pay as you go" mobile payments and photovoltaic panels with sensors.⁹ However, research shows that cash deposits for solar panels and the requirement to have a mobile phone prevent the very poorest from gaining energy access via this channel (Atela, 2017). When it comes to mobile savings, researchers Dubus and Van Hove (2017) found that those who would benefit most (the poorest, non-educated, and women) have the least access and are the least likely to use the service. Given that mobile money is becoming a platform to other services like mobile-insurance, mobile-credit and savings and mobile-solar power in an increasing digital world, it is a matter of concern that this is another area where the most excluded are experiencing a new digital dimension to their existing poverty and where existing divides are unwittingly becoming amplified.

Digital services are often more expensive for the poorest. Pay-as-you-go mobile call and data charges are generally more expensive per minute and per gigabyte than monthly contracts, and many of the most expensive countries in which to use a mobile phone are located in the global South (A4AI, 2017). A recent analysis of mobile money pricing practices by researchers at Innovations for Poverty Action found that the majority of mobile money providers had regressive pricing policies, in which the smaller the transaction, the more that is paid in percentage terms (Holloway, Rouse, & Cook, 2017). It seems that in an increasingly digital world, when the poor are digitally included, they are included on disadvantageous terms compared to the better off.

e-Commerce is enabling a range of digital dividends. These include reducing coordination costs, boosting efficiency, accelerating innovation, expanding markets internationally for SMEs, creating jobs and helping us all find cheaper products online (World Bank, 2016). UNCTAD (2017,

⁹ <http://www.m-kopa.com/>

p. 28) finds that products and services are increasingly purchased and delivered using electronic networks but the digital economy is spreading unevenly. Although over 70% of the population purchases goods and services online in several developed countries, only 2% of citizens do in LDCs, and SMEs are less likely to sell online than national and multinational firms (UNCTAD, 2017). The report warns that “policymaking at the national and international levels needs to mitigate the risk that digitalization could widen existing divides and create new gaps” (UNCTAD, 2017, p. iii). These divides exist between countries and within countries, since rural areas tend to suffer from smaller markets and logistical difficulties. Beyond geographical disparities, disparities related to age, income, availability of internet signal, language and digital literacy, access to broadband, and gender have been identified as divides relevant to e-commerce adoption in developing countries (Kshetri, 2018; UNCTAD, 2017) and UNCTAD (2017) warns of the amplification of income disparities if these divides are not addressed. Beyond simple access to mobile networks, 3G and 4G networks have been identified as particularly important to access “more sophisticated and value-added content” (UNCTAD, 2017, p. 17) for businesses, but the diffusion of mobile and fixed-line broadband have lagged behind 2G networks. The 2016 WDR argues that widespread internet adoption is a prerequisite to the value of e-commerce in developing countries due to network effects.

Developing countries lack data on e-commerce (UNCTAD, 2017). China is one developing country with an emerging e-commerce sector where data is available, and thus serves as a rare case study for how e-commerce is changing the experience of poverty in developing countries. China has the most internet users and the fastest growing e-commerce sector in the world (Wang, Lau, & Gong, 2016). The amount of WeChat users initiating purchases via the app doubled from 2015 to 2016. It is estimated that by 2020, 31% of retail sales in China will be online (The Economist, 2017). Although rates of adoption have been increasing across all segments of the Chinese population, online shoppers were found to be disproportionately well educated, male, wealthier, and between the ages of 20-30 (Cai, 2016). Previous studies have found that Chinese rural to urban migrants are less likely to use the internet than people who have lived in urban cities their whole lives (Zhu & Chen, 2012). Although rural areas account for 43% of China’s population, less than 10% of all Ali Baba e-marketplace shipments were made to rural areas (Kshetri, 2018). If these patterns hold true for other countries, we might anticipate e-commerce delivering increasing advantages to already-privileged urban, educated, men whilst amplifying the relative disadvantage of poor, rural women.

This section has shown how private sector services are providing citizens with clear digital dividends including financial inclusion, energy security, and access to services or goods that they might not otherwise access, and at cheaper prices. However, enjoying these dividends requires access to a mobile phones, mobile credit, and an ability to pay fees. It is easy to forget that a full one third of humanity does not have a mobile phone and 50% have no internet access – many others lack the disposable income necessary to afford these digital dividends even when they are available. Little research in this area has been concerned with the changing experience of poverty for those who are not users of new digital services. Understanding more about exactly who is excluded, and why, would be of benefit to private sector providers as well as to development sector professionals seeking not-for-profit alternatives. Having considered government and private sector programmes, the next section looks at civil society initiatives.

Civil Society

The use of technology in development is as old as international development itself. In President Truman's 1949 inaugural address he promised to transfer the advanced technologies from the USA to developing countries, and established the first technical assistance programme. In the intervening seventy years the focus of technology transfer programmes has included tractors and farm machinery, seed varieties and chemical fertilisers, trains and planes (Worsley, 2005). In the digital era we have seen civil society organisations promote and fund: telecentres, laptops-in-schools, open government data, crisis mapping, market price platforms, mHealth apps, and now drones and the blockchain. This section will review evidence of the civil society contribution to the changing nature of poverty in a digital world.

In the 1990s the telecentre was the first posterchild of ICT for Development (ICT4D). Telecentres were places in rural or deprived locations where those on low income could access digital dividends via internet access, printing and scanning services. Often funded by grants, telecentres struggled to become independently financially sustainable (Toyama, 2011). Many became financially sustainable only by charging fees that made them unaffordable to the originally intended beneficiaries. Thousands went bankrupt and closed down. Moreover, research suggests that telecentre users were disproportionately educated men who could speak English (Toyama, 2011). Thus, telecentres had a tendency to amplify existing experiences of offline disparities between relatively better off (even within rural and poor populations) and the least well off whom may experience multiple forms of oppression (for example, poor indigenous rural women who do not speak the languages that dominate internet content).

There was a point in the 2010s where it seemed like there was a mobile app for everything. Whatever the development problem, someone was organising a one-day hackathon to solve it with an app, and developing countries were awash with people piloting them. mHealth apps were particularly overblown. In 2012, the Ugandan Ministry of Health became so overwhelmed by a tidal wave of app developers demanding the time of health officials that they imposed a complete moratorium on all mobile health apps (Greeley, Lucas, Chai, & Cummins, 2013). One study looking at the mHealth landscape in Bangladesh found that university students were most likely to be aware of and use online health information, whilst the poorest women were the least likely (Bloom Berdou, Standing, Guo, & Labrique, 2017). Such mHealth evaluations have found that the apps tended to amplify the capabilities of the already advantaged, with the most marginalised left behind.

The increasing use of mobile technology, including by the poor, has stimulated interest in using mobile apps and SMS-based systems to create accountability feedback loops between donors and citizens (McGee et al., 2018). A DFID-funded, seven country pilot aiming to improve beneficiary feedback for maternal and child health projects found that for those who provided feedback, the programme provided digital dividends in the form of "real-time adaptation of projects to the needs of their target groups and context" (Feedback Mechanisms, 2016, p. 1). However, women tended to have their access to mobiles mediated by men and lacked digital literacy, with the result that they were underrepresented in calls (Feedback Mechanisms, 2016). Women in the pilot experienced not just access divides but also divides regarding literacy, autonomy, and gender norms, lending weight to the suggestion that a multi-dimensional analysis is necessary to a comprehensive understanding of digital disadvantage. In places where these divides were pervasive, face-to-face feedback mechanisms were preferred by beneficiaries, and one of the key findings from the pilot was that providing blended initiatives (offline and online) aided inclusion.

This section has shown that even when development agencies devise digital initiatives with the explicit intent of reducing poverty, the use of digital technologies can unwittingly amplify existing advantage, leaving the poor even further behind. It also provided more evidence that digital development initiatives that seek to put the last first need to use blended approaches that incorporate analogue methods alongside digital technologies. More research is necessary to help development professionals to accurately diagnose existing levels of (dis)advantage and digital literacies, in order to facilitate appropriate interventions.

The next section looks to the future: it will examine the horizon of digital development, to assess early evidence about the next wave of digital technologies that are likely to affect the changing experience of poverty in an increasingly digital world.

Digital Futures

The future of work will be increasingly virtual, digitised, automated and robotic. Employers are increasingly using new information and communication technologies and global digital networks to usher in virtual organisations. This makes possible the outsourcing of back office processing and microwork to destinations like India, the Philippines and South Africa. This has provided digital dividends for women and people with disabilities to work from home and at flexible times convenient to them. However, there are concerns that this work is often poorly paid and precarious in nature. According to a United Nations study, workers tend to lack overtime compensation, maternity/paternity leave, sick leave, health or insurance, are not protected by minimum wage law, and are unable to bargain collectively (UNCTAD, 2017). There is growing concern that as more companies contract workers online, there could be a race to the bottom, further depressing wages and conditions on these platforms. There are risks that the temporary and unstable nature of these opportunities may trap the poor in poverty, especially if it is their only source of income (DFID, 2018).

Many new digitally-enabled jobs are themselves likely to be susceptible to automation. Given the low-skilled and repetitive “click-based” nature of much of the data entry work offered on micro work platforms, these jobs are susceptible to automation in the near future. The fact that the majority of the work available on these platforms requires fluency in English means there is also concern regarding the demographics that will be (dis)advantaged (World Bank, 2015). In an increasingly digital world, online work platforms like Amazon’s Mechanical Turk and Samasource will provide digital dividends for many, but there are also significant risks that they become platforms for digital exploitation where low wages and poor employment conditions do not represent “decent work” (SDG 8). The use of digital work platforms can be interpreted as amplifying corporations’ capacity and intent to identify and contract the cheapest available global workforce.

The next wave of automation technologies could make millions of workers redundant. Artificial intelligence and machine learning are making it possible to replace workers with robots and computer-controlled automated processes (Brynjolfsson & McAfee, 2014; Cowen, 2013; Hernandez, Faith, Prieto Martín, & Ramalingam, 2016). The use of these technologies by the private sector will make it possible to automate routine manual *and cognitive* tasks, meaning that not just blue-collar but white-collar jobs are at risk of disappearing (World Bank, 2016). There is also growing evidence that low-skill work is most vulnerable to automation (World Bank, 2016) in ways that will amplify the existing advantage of the highly educated, as the following quote from Brynjolfsson and McAfee (2014, p. 11) illustrates:

There's never been a better time to be a worker with special skills or the right education, because these people can use technology to create and capture value. However, there's never been a worse time to be a worker with only "ordinary" skills and abilities to offer, because computers, robots, and other digital technologies are acquiring these skills and abilities at an extraordinary rate.

Developing countries may be worst-affected by automation. Low skilled jobs in agriculture, textiles and industry will be the most susceptible. According to the 2016 World Development Report, the impact of the next wave of work automation may be felt hardest in developing countries where two thirds of all jobs are vulnerable to automation – and as high as 85% in Ethiopia. These figures are contested, with some scholars arguing that these estimates have been overstated (Kapoor, Sawada, Latortue, & Cabrol, 2018). Others argue that whether automation results in net job losses or not, it will still amplify earning disparities between employees with high and low skill levels (Acemoglu & Restrepo, 2018). Much of the research attention thus far has focused on the private sector. However, as structures are digitised, these effects are likely to go beyond the private sector. For example, the introduction of Intelligent Transport Systems based on big data and real-time tracking in one Indian state-run transport system made five entire divisional offices redundant, employing up to 400 people including an entire layer of management (Rakesh, Heeks, Chattapadhyay, & Foster, 2018). We cannot know for certain what the outcomes for the future of work will be—how many jobs will be automated and how lives will be affected—and any predictions are necessarily speculative. Further research is necessary to collate and analyse the experience of early adopters, in order to draw out lessons for other countries.

Automation will negatively affect women most of all. World Bank research suggests that women in developing countries will be hardest hit of all (World Bank, 2016). Women tend to be employed in low skill and less productive sectors, giving rise to concern that automation, premature deindustrialisation and reshoring will disproportionately affect women (Faith, 2017). For example, over nine million people work in the textile, clothing and footwear sector in South East Asian countries – over 70% of whom are young women with low education levels. A study found that 88% of textile jobs in Cambodia and 86% in Vietnam are at risk of automation, as well as 89% of Business Process Outsourcing (BPO) call centre staff in the Philippines – an industry that disproportionately employs women (Chang, Rynhart, & Huynh, 2016). Further work is needed to better understand the gender implications of automation, as well as for others at risk of being left behind.

New 'Frontier Technologies' may have dramatic impacts on the changing nature of poverty. Beyond mobile phones and the internet, development actors are in deploying "frontier technologies" to improve development outcomes (Ramalingam, Hernandez, Prieto Martin, & Faith, 2016). Emerging frontier technologies, such as 3D printing, drones, artificial intelligence and blockchain, are increasingly presented as potential solutions to development challenges. The United Nations has argued that at a structural level, "if policy-makers are not proactive technological disruption can entrench inequality, further marginalize the poorest, and fuel reactionary movements against open societies and economies" (UNCTAD, 2018, p. iii). However, to date, little research attention has focused on the implications of using frontier technologies for those at risk of being left behind. The blockchain, for example, has been presented by major development actors such as the World Bank as a "disrupter of gender inequality," and inequality in general due to a democratising of transactions (Hammond & Young, 2018). History shows that these type of claims are not new. As early as 1991, some were referring to the internet as "the great equaliser" (Rheingold, 1991). However, as the examples in this literature review have evidenced, digital technologies have spread unevenly and their use has disproportionately

amplified the voices of the already advantaged. There is no clear reason to think that blockchain, or any other new technology, will be any different.

This section has argued that the claims for digital dividends currently being made for frontier technologies deserve critical evaluation. Like all of the digital technologies discussed in the review, frontier technologies have potential both to produce digital dividends and digital divides. More critical research is necessary to assess in which contexts and under what conditions such frontier technologies hold the potential to close digital divides and amplify the ability of those currently left behind to realise their full potential.

6. Conclusion

This report has presented an extended literature review designed to answer the question of how the experience of poverty is changing in an increasingly digital world, and what the implications are for the leave no one behind agenda. We have used the law of amplification and the concepts of digital dividends and digital divides as a conceptual lens to interpret the existing literature.

The review provided evidence – over a wide range of applications and contexts – that the use of mobile phones and the internet is adding new digital dimensions to the experience of poverty, including (a) amplifying the disadvantage of the most marginalised by excluding them from technology-enabled digital dividends, and (b) amplifying the advantage of the already privileged by enabling them to secure digital dividends. The overall effect is to widen the social and economic divide between the unconnected and the most connected. Newly forming classes of technology access have widely different capacities to make effective use of digital technology for development, with the effect of amplifying pre-existing social and economic divides. Given the co-existence of digital dividends and digital divides, how do development actors make technological choices that avoid amplifying relative poverty and that leave no one behind?

There is nothing inevitable about these trends. These outcomes are not determined by the technology itself, but rather by the capacity and intent of human actors, which can then be amplified by using digital technology. If the distribution of capacity is determined by market-forces alone then the already privileged will continue to be the early adopters of each new generation of technology, and the under-privileged will continue to be left behind. Achieving the goal of leaving no one behind requires the political will to *prioritise building the capacity and intent of those that are being left behind*. Although picking the low-hanging fruit allows programme managers to scale-up sooner, and report higher beneficiary-counts and value-for-money, this is not compatible with “putting the last first” or leaving no one behind. Repeating the error of the MDGs would be at the expense of the most marginalised.

In an increasingly digital world, unless policy and practice is consciously designed to address the specific needs of the most deprived, then the use of digital technologies risks excluding and further disadvantaging those already being left behind. If it did become politically possible to work with those at most risk of being left behind, then this literature review provides evidence that meeting the needs of these groups requires a *blended approach* that uses non-digital as well as digital approaches. Such blended, multi-channel, and multi-dimensional programmes offer the best prospect of enabling currently marginalised groups to amplify their capacity and intent and to secure digital dividends.

Further research is necessary in a number of areas identified by the literature review. In order to (a) address the identified digital dimensions of poverty, (b) enable those currently being left behind to secure digital dividends, and so (c) close the digital divide, we need to:

- Understand more about the connectivity experiences, technology practices, digital literacies, needs and priorities of those currently being left behind.
- Understand more about the digital dimensions of poverty experienced by those experiencing intersectional disadvantages, especially women, the disabled and the digitally illiterate.
- Develop new diagnostic tools to assess digital access barriers, opportunities and approaches, and design both analogue and digital development initiatives tailored to specific realities.

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