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Information and communication technologies and mobility in the Horn of Africa: a review of the literature

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Cover image ©Peter Chonka. The cover image features Samia Yusuf Omar, who was met and photographed by one of the authors in Hargeisa (Somaliland) in 2010. Samia was one of two athletes who competed for Somalia in the 2008 Beijing Olympics. She left Somalia because of threats against her from Al Shabaab. By 2011 she was on her way to Europe with the hope of competing in the games in London the following year. In April 2012 she boarded a smuggler's boat in Libya, bound for Italy. Samia did not survive that journey and drowned in the Mediterranean (Krug 2016).

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1 Introduction and summary

This review examines how Information and Communication Technologies (ICTs) affect intentions and behaviours relating to mobility within the Horn of Africa (HoA). A recent review of literature conducted by the Research and Evidence Facility (REF) – a project of the European Union Emergency Trust Fund (EUTF) for Africa (HoA Window) – has highlighted a growing body of research examining the role of social media in driving HoA migration, and its use by migrants on their journeys (REF, 2020, p 27). However, there has been much less exploration of the broader role of ICTs in changing patterns of mobility, whether by promoting the growth of social networks that facilitate movement, distributing information that renders movement less necessary, or sharing the benefits of movement more widely. This rapid review draws on the general literature on the role of ICTs in migration and livelihoods to assess the extent to which these (global) research findings apply to different settings within in the HoA. The HoA region is defined here as encompassing Djibouti, Eritrea, Ethiopia, Kenya, South Sudan, Somalia/Somaliland,[1] Sudan, Tanzania and Uganda. We review the available literature from the region that examines people's access to and use of ICTs, and the impacts that ICTs have on various aspects of life in general and mobility in particular. This includes discussion of which ICTs are being used and by whom. ICTs here encompass basic, feature and smart mobile phones, computers, internet access, online services such as email, and multiple social media platforms.

The relationship between ICTs and human mobility is multifaceted and complex. ICT use can affect why, how and the scale on which people move. The movement of people can itself influence patterns of ICT uptake among those who are mobile, those to whom they are connected and those left behind. Different types of mobility may be affected by ICTs and distinctions are often made between internal migration within nation-states and international migration across borders. There are differences between long-term international migration and seasonal, local or regional labour migration, as well as between the forced mobility of refugees or internally displaced people (IDPs) and 'everyday' patterns of mobility around and beyond communities and workplaces. In a world characterised by socioeconomic inequality and cultural variation there are also differences between movements from the 'Global South' to the 'Global North' (and vice versa), and mobility within these zones. As such, labels of 'types' of migrant – such as those distinguishing 'refugees' and 'economic' migrants – are often problematic and may "fail to capture adequately the complex relationship between political, social and economic drivers of migration" (Crawley & Skleparis, 2018, p 48). Similarly, for HoA contexts characterised by long-term, conflict-influenced population movement, distinguishing 'refugees' and 'IDPs' from 'economic migrants' and 'urban poor' is problematic and over-simplifies the complex set of reasons why people move and settle in new places (REF, 2018).

Sensitive to these complexities and problems of categorisation, this review synthesises a wide range of research from different HoA countries (and beyond) within the following thematic structure. Section 2 of the review provides background context on ICT infrastructure, access and use in the HoA. Section 3 examines the relevant literature on the ways in which ICT use affects how people conceive of and undertake long-term migration. This section focuses primarily (but not exclusively) on international migration and highlights multiple functions of ICTs for migrants, as well a range of risks that are associated with ICT-mediated connectivity. Section 4 reviews the literature on the

[1] In relevant areas of this report we discuss Somaliland as separate from Somalia, given that much of its governance and infrastructure are separate from those in Somalia. This is in keeping with general practice by the EU and international community and is not intended to indicate a particular political position with respect to Somaliland's claims to independence.

impacts of ICTs on 'everyday' mobilities. This section looks at the wider socioeconomic changes brought by ICT connectivity to people's livelihoods and social networks, and the ways in which these affect different people's mobility – often unequally. Research on the ICT use of specific population groups in the HoA – pastoralists and displaced people – is examined here. Experiments, potentials and problematics of data collection on mobility via ICTs/digital platforms are explored in section 5, while section 6 surveys relevant humanitarian programming on the ICT use of mobile populations in the HoA and beyond.

Key findings of the review are provided in the conclusion and are summarised here:

1. Digital inequalities in the HoA are prevalent and multifaceted. They relate to geographical location, gender, social class and other factors. Many of the most vulnerable (mobile) populations in the region have only basic mobile phone access (if that) and no access to the internet. Cheap smartphone access is increasing, however, and in some cases refugee populations may have higher levels of access to these devices than national averages.
2. Basic phone access and use is often integral to mobile livelihoods and to processes of migration and displacement. In some contexts, mobile money is vital for displaced populations and plays a critical role in the everyday livelihoods in the wider societies in which migrants settle.
3. There is limited conclusive evidence to show that increased access to ICTs 'causes' increased internal or international migration. Migration is driven by multiple interrelated factors, and causation may work both ways, as mobility itself can accelerate the diffusion and use of technology to wider communities.
4. ICTs may both encourage and discourage mobility. People's needs to physically travel may be reduced as ICTs can connect them 'virtually' to local and distant opportunities. However, ICTs may also facilitate the growth of social networks that provide opportunities for people to move. In general, ICTs contribute to the increasingly complex intertwining of rural and urban livelihoods and connections.
5. Overall, ethnographic research shows that ICTs do not transform existing social structures; instead people adopt and adapt ICTs in multiple ways that support aspects of local cultures, solidarities and familial bonds.

Many of these findings are derived from literature that does not specifically focus on the HoA itself, but from other African or Global South contexts that are relevant to the region. The review identifies gaps in existing research in HoA contexts, where relevant studies are few or almost entirely lacking. These gaps relate to the following:

- *Specific everyday ICT use by rural–urban migrants, displaced people or refugees within the HoA*: mobile phones (and mobile money) are increasingly integral to the livelihoods of vulnerable displaced communities, and to their engagement with humanitarian and commercial actors. Better understanding of how displaced people use such ICTs could inform humanitarian programming and further illuminate emerging dynamics in the political economy of aid (where partnerships with, for example, telecom companies have become significant).
- *HoA pastoralist communities' use of ICTs*: there is existing literature on the effect of ICTs on pastoralists in Ethiopia, Kenya and Tanzania but more research is needed to compare these findings with under-studied contexts such as Somalia/Somaliland and South Sudan.

- *Local needs and capabilities of vulnerable, mobile populations in relation to access to and use of ICTs, and digital literacy*: more detailed ethnographic research is needed on how populations in under-studied countries or areas of the HoA access and use ICTs, their capability and difficulties in accessing and using these technologies, and their existing digital literacy skills.
- *The role of online platforms in the spread of content that contributes to conflict (and displacement)*: the changing information environment (in which social media play an increasingly large role) can contribute to insecurity and instability that create forced mobility. Examination of social media practices in conflict contexts is needed to understand how (and from where) content flows, is engaged with, and affects local security conditions.
- *Country-by-country research into national ICT policy and its consideration of mobility*: the extent to which governments and humanitarian actors in the HoA are formulating ICT-related policies that take into account migration and mobile populations remains unclear. Research on the future of regional ICT infrastructure (eg undersea and terrestrial cable links) could also illuminate future connectivity trends, with implications for rural ICT use and livelihoods mobilities.
- *The role of ICTs in monitoring, enforcing or circumventing Covid-19 mobility restrictions*: at the time of writing, the Coronavirus pandemic is having a profound impact on global regimes and patterns of mobility. It is unclear how long-term impacts will be felt in the HoA. Research is needed into the ways in which states and humanitarian actors have used ICTs to control HoA mobilities, the extent to which these have been effective, and the ways in which mobile populations have responded to them.

2 Digital connectivity in the Horn of Africa

Questions about who is (or is not) using ICTs – and how – are essential to understand the differing impacts of technology on mobilities across and within the different HoA countries. This section focuses on the main technologies and platforms being used in the region and the profile of users. It explores inequalities in ICT access between population groups in relation to social, economic, demographic and geographic factors. Also discussed are the current and future dynamics of ICT infrastructure development and policy making. Although the impact of the current Covid-19 pandemic remains to be seen, contemporary global societies have been characterised by generally increased mobility and intensified connectedness brought about by advancements in communications and transport technologies. The HoA experiences high rates of poverty, rural-to-urban migration, and displacement driven by conflict and environmental or climatic shocks. It is also a region affected by intensifying geopolitical interest, where ICT infrastructure development matters to regional and international governments and commercial interests. Significant variation exists within the region in terms of ICT infrastructure and use patterns; these differences affect the impacts of ICTs on mobile populations.

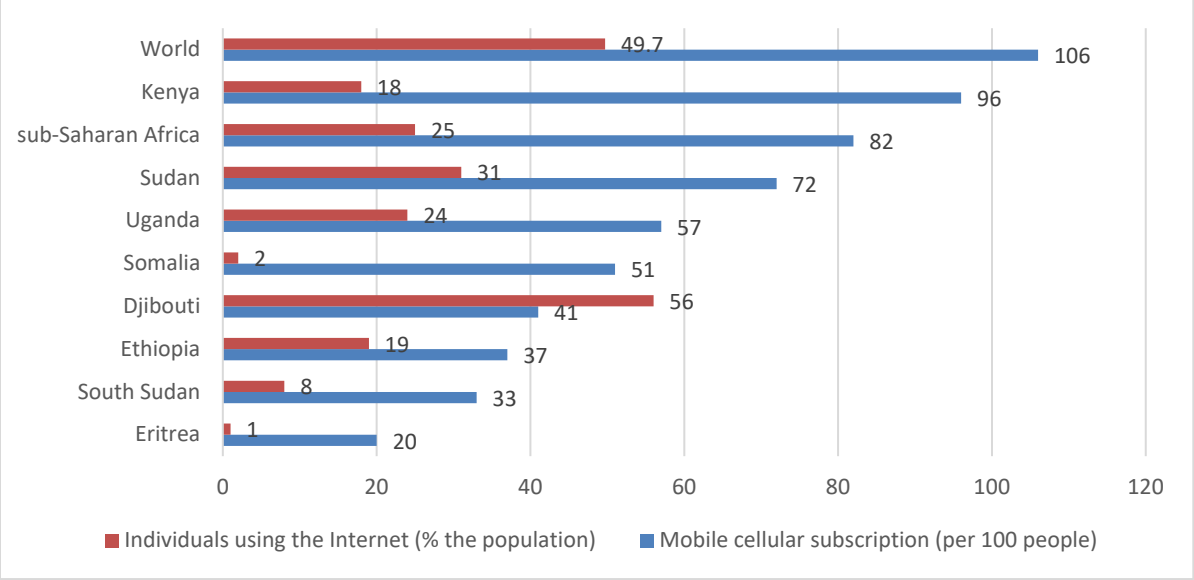
2.1 Regional ICT access

Access to and use of mobile phones and the internet are the most important indicators of contemporary ICT development. The most recent datasets of the World Bank (2020) and the International Telecommunication Union (ITU) (2018), indicate that globally there are on average 106 mobile phone subscriptions per 100 people. Aggregated data from these sources (Figure 1) show that the average number of subscriptions in the region (51 per 100 people) is far less than the global average and below even the Sub-Saharan average (82 per 100 people). Furthermore, disparities in the number of mobile subscriptions between the countries in the region are pronounced. While Kenya exceeds the sub-Saharan Africa average (96 per 100 people), Eritrea has only 20 subscribers per 100 people, followed by South Sudan (33 per 100 people) and Ethiopia (37 per 100 people). Mobile phone adoption is often limited to basic handsets, which are normally used for voice and short messaging services (SMS).

Smart phone use is still relatively limited, and a lack of infrastructure and affordability are key barriers to adoption. However, the increasing availability of cheap handsets is affecting this trend. For example, recent findings from camps in Kenya and Uganda show higher levels of smartphone ownership among refugees compared with national averages – in Kakuma camp research reported 44 per cent smartphone ownership, compared with the Kenyan national average of 26 per cent (Hounsell & Owuor, 2018, p 13). However, owning a smartphone does not always guarantee regular internet access, as this is often related to the affordability of mobile data and the availability of 2, 3 or 4G networks.

There is significant variation in country-by-county mobile money innovation and uptake. Kenya, Somalia/Somaliland and Uganda have various established and widely used SMS-based mobile money platforms. Ethiopia, Sudan and South Sudan are just beginning to see the emergence of similar systems, while no significant new developments are apparent in Eritrea.

Figure 1: Mobile subscriptions and individuals using the internet



Source: Data from World Bank and ITU, as of 2018.

Although comprehensive global mobile subscription-based data metrics (such as from the World Bank and ITU) are useful in drawing general insights on technology adoption and uptake in a given region or country, they do not always give the most accurate account of actual use. For example, a single mobile subscription may be shared among multiple users or an individual may have multiple subscriptions.

Internet use trends follow somewhat similar patterns to those of mobile subscriptions. While Africa has the third largest number of internet users in the world next to Asia and Europe, internet penetration (the proportion of the population that have access to and use the internet) is low – only 40 per cent compared with around 80 per cent in the Global North (Business Insider, 2019). However, this divide appears to be narrowing. For example, data from Pew Research Center (2018) suggest that the number of mobile broadband subscribers in Africa is growing three times faster than the global average. Internet penetration is even lower in the HoA, despite some countries showing increases. Across the HoA, the average proportion of individuals using the internet is around 20 per cent, much lower than the global average (around 50 per cent) (Figure 1). However, this masks significant differences between countries in the region.

In the HoA, Djibouti boasts the highest level of internet penetration, above even the global average. The reasons for this need further investigation, as a state's monopoly of all telecom services (as is the case here) is not usually conducive to high internet penetration. This exception could be attributed to Djibouti's population (less than one million) residing in a small geographical urban area. Djibouti's geostrategic significance has endowed it with a high number of submarine fibre-optic internet cables, and the country boasts its own data-centre (including internet exchange), boosting local connections. According to World Bank/ITU statistics, access in Eritrea, South Sudan and Somalia is particularly low. For Eritrea, this is related to the political isolation of the regime, tight state controls on access to SIM cards (BBC, 2019) and limited or non-existent fibre-optic broadband infrastructure. Despite recent openings of the ICT market, South Sudan has historically lacked an effective communications infrastructure, and connectivity has been further compromised by recurrent conflict (Brinkman et al, 2017). For Somalia data collection is particularly challenging, given a lack of accurate overall census data, political fragmentation and multiple telecoms companies. Somalia has the cheapest mobile data rates in Africa and the seventh cheapest worldwide; and other metrics show higher rates of social media access – Facebook penetration at the end of 2019 was

estimated at 10.5 per cent, for instance. [2] This, combined with rapid (but unquantified) urbanisation and the presence of a youthful population, means that 'official' internet penetration rates for countries such as Somalia/Somaliland (2 per cent) may be lower than the reality, given that most users tend to be located in cities and are from younger generations. Across the HoA, social media and messaging platforms such as Facebook, WhatsApp, Viber, Telegram, imo and YouTube are prevalent. Research on social media has often looked at political 'public sphere' impacts, with a focus on urban populations (Bing, 2015; Chonka, 2019; Kadoda & Hale, 2015; Kamp et al, 2016; Srinivasan et al, 2019). Twitter tends to be less popular, with a more 'elite' user base. Research from Kenya does indicate wider social and governance uses of the platform, however, outside the biggest cities (Omanga, 2015).

2.2 Digital inequality

Digital inequalities are variations in accessing, using and benefiting from ICTs. Early research and policy making on digital inequalities focused on physical access to devices (possession of phones and computers, which has been referred to as a 'digital divide'). However, the global literature has shown that the mere provision of equipment without consideration of social, psychological and cultural factors does not deliver the benefits of the technologies (Heeks, 2006; Van Dijk, 2006; Kraemer et al, 2009). Digital inequalities relate to multidimensional factors beyond physical access to ICTs. Social disparities in access are also linked to inequalities in motivations (the will to have and use digital equipment such as computers), practical skills required to use and benefit from these technologies, and associated prerequisites for beneficial usage, such as time, affordable and efficient bandwidth, and necessary software or applications (Van Dijk, 2006; Warschauer, 2004; Boas, 2017; Steel et al, 2017; Summers et al, 2020). It is (in)equality in these multidimensional aspects of access to technology and capabilities for use that better explains the role of ICTs in changing people's livelihoods and mobility patterns. Research indicates that digital divides may reinforce existing multidimensional inequalities and – despite the lauded 'empowerment' impacts of technology – this often appears to be the case in the HoA. It is only those who have the means and capability to access and use ICTs who can benefit from them (Boas, 2017; Steel et al, 2017; Summers et al, 2020).

Groups with the highest levels of access and use have tended to be young (often male) urbanites with higher levels of education and income, who have been able to afford data packages and more advanced devices such as smartphones. They have also often been more capable of using devices' features to access distant weak social ties and expanding work-related networks and opportunities (de Bruijn et al, 2010). However, up-to-date large-scale empirical research is lacking on the extent and impacts of the spread of newer low-cost smartphones in the region (Dahir, 2018; Steel et al, 2017). Despite anecdotal evidence suggesting the further spread of smartphones, such technologies often remain inaccessible to large proportions of populations who fall into different cross-cutting categories of marginality: rural communities, the urban poor, displaced people, the elderly, ethnic minorities. Existing research often focuses on gendered digital inequalities. This is introduced here and discussed further in section 4 with specific reference to female mobility.

Geldof's (2011) study of ICT use among young people in Ethiopia (and Malawi) focuses on the constraints that women experience in accessing ICTs. These include significant gendered domestic responsibilities, a lack of time, limitations to mobility and sociocultural norms. These reinforce gender disparities in terms of women's knowledge about, use of and ownership of ICTs. There is little HoA-specific research into the apparent increased accessibility of smartphones for women. However, similar barriers to access are reported in a later study in Kenya that focused specifically on

[2] See 'Worldwide data pricing' [available at https://www.cable.co.uk/mobiles/worldwide-data-pricing/], accessed: 27 February 2020; and https://www.internetworldstats.com/africa.htm#so.

female access to mobile internet. Wyche and Olson (2018) juxtaposed the urban, male bias of 'Africa rising' narratives against the continued lived experience of rural women. They described how the predominance of second-hand basic handsets, gendered labour commitments and misinformation or rumours about the dangers of social media prevented women from being connected. They noted how overall figures for mobile internet access in a country such as Kenya do not usually capture gendered inequality. Research indicates that, when available and used, the benefits of ICTs can be more pronounced for those who are in marginalised positions, such as rural women (de Bruijn et al, 2010; Summers et al, 2020). As discussed in section 4, ICTs can address such barriers to physical movement (women's household labour, cultural surveillance) by offering an alternative 'virtual mobility' that allow users to expand and utilise network capital (Gwaka, 2018). However, lack of access is often the norm and ICTs may also introduce new forms of inequality and power relations (de Bruijn et al, 2010).

2.3 ICT policy making and future development

A nation's ICT policy directs the objectives, strategies and outcomes of ICT-related projects. Failures in African contexts are often attributed to a lack of consideration of local factors in attempts to reproduce ICT policies and solutions designed for the Global North (Gillwald, 2010; Kunyenje & Chigona, 2019; Makoza and Chigona, 2013; Thompson & Walsham, 2010). ICT policies, infrastructures and services in HoA are usually associated with national telecommunication sectors, some of which are state monopolies, some of which are competitive markets. In some HoA cases, low ICT development has been attributed to state monopolies and restrictive market policies. Gagliardone (2016) illustrates how Ethiopia's ICT development has been impeded by political interests, and documents how major national educational ICT projects were used to convey the ruling party's ideologies rather than achieving their stated intended goals. Recent political shifts in Ethiopia have precipitated moves towards partial ICT privatisation. Global telecom companies are now bidding to share 49 per cent of services that were under state monopoly. However, concerns have been raised about the readiness of the regulatory environment and the potential negative impact on state revenue (and poorer and rural populations) (Adam, 2019). There are fears of an exacerbation of the urban–rural digital inequality as ICT services, when led only by the market, tend to focus on profits and concentrated populations such as in cities. On the other hand, Kenya's success in innovative mobile money systems such as M-Pesa has been attributed to the liberalisation of the telecom market and public–private partnerships. However, a study in Uganda stated that privatisation has had a limited impact on the performance of Uganda Telecom Limited (Aryaija, 2018).

Some studies have highlighted external actors as the main influencers of African ICT policy through persuasion, facilitation, financial and technical assistance, standard-setting and international conferences (Chiumbu, 2008; Gagliardone, 2016; Kunyenje & Chigona, 2019). Major players are multilateral organisations such as the United Nations Economic Commission for Africa (UNECA), the World Bank and IMF, multinational companies and, increasingly, engaged states such as China (Wang et al, 2020). Some researchers highlighted the impact of such external actors on local participation (Chiumbu, 2008; Etta & Elder, 2005; Metfula, 2013). Western commentators have speculated that Chinese ICT investment in Africa will promote a 'China model' of internet surveillance and control. Gagliardone (2019) compared China's ICT engagement in countries such as Ethiopia and Kenya and argued that, while governments have been provided with tools for monitoring and limiting internet activity, Chinese investments have also improved overall access. Furthermore, investments have not specifically focused on regimes favoured by Beijing and do not explicitly promote a particular model of internet development. However, it is clear that some HoA governments have the capacity and willingness to shut down internet or social media access, and this has become a relatively common occurrence in places such as Ethiopia for security and political reasons.

Private sector companies, educational institutions, parastatals, local NGOs, civil society and media organisations also play a role in shaping ICT policies (Kunyenje & Chigona, 2019). Through advocacy and technology diffusion, activists and diaspora communities can influence domestic ICT policy, adoption and expansion (Avle, 2014; Bernal, 2014; Gagliardone, 2016). Across the HoA local tech innovation hubs are emerging, and the following organisations are active (the list is not exhaustive): Cipesa (Uganda); iHub (Kenya); iRise and Digital Shelter (Somalia); HarHub (Somaliland); Gebeya, Blue Moon, iCog Labs, ICEAddis (Ethiopia); and DefyHateNow (focused on social media and hate speech, initially in South Sudan, now elsewhere in the HoA). The extent to which these organisations operate beyond major cities varies, as does their engagement with mobile populations. However, the growth of such hubs indicates optimism about wider connectivity dynamics in the region.

Over the past decade, internet bandwidth in the region has increased thanks to connections from terrestrial and undersea fibre-optic cables. Djibouti is a crucial landing point for undersea cables and has its own internet exchange. Ethiopia's first terrestrial fibre-optic connections came from Sudan, although new links with Djibouti are following the path of the (Chinese-built) railway to Addis Ababa. Djibouti has been the source of a new terrestrial cable network into and through parts of Somaliland built by Somcable. That company had a monopoly on Somaliland cable rights, but this has been revoked as a result of commercial pressures and government concerns that it was hindering undersea cable access. Elsewhere along the Somali coast, Mogadishu was first connected to an undersea fibre-optic cable in 2013, while Bosaaso in Puntland now boasts another connection after the landing of cables from a Djiboutian-led initiative. Other port cities are due to receive undersea cables in the coming years as a result of projects led by Chinese actors and Western tech companies. Significant security and political challenges remain in expanding fibre cable access terrestrially across Somalia from the coast, or a terrestrial entry point from Kenya (World Bank, 2017). Eritrea has no undersea or terrestrial fibre-optic cable connections but rapprochement with Ethiopia may provide opportunities for the extension of cables across the border.

It has been widely argued that Africa has the capacity to 'leapfrog' stages of infrastructural development and enjoy technological 'latecomer' advantages, for example through the straight-to-mobile trajectory of phone and internet access. Many commentators have tempered their enthusiasm for the transformative impacts of connectivity, pointing out that underlying infrastructures (eg electricity supply) and educational capacities require further development for the benefits of connectivity to be realised (Pilling, 2018). Nonetheless, the socioeconomic impact of ICT availability in countries or regions with multifaceted challenges is still seen as significant. Analysing the internet, mobile and fixed-line telephone rates of 19 countries in East Africa, Deco et al (2019), for example, found that a 1 per cent increase in this 'telecom index' resulted in a 0.02 per cent increase in per capita economic growth, with greater impacts for countries with privatised telecom sectors. The authors' conclusion that telecommunications infrastructure fosters economic growth in East Africa is debatable, given that the analysis relies solely on official ICT statistics in isolation from other factors (Asenso-okyere & Mekonnen, 2012; Okello et al, 2020). Hinted at here – and emphasised throughout this review – there exist complex and multidirectional relationships between ICT access and socioeconomic change. These questions are addressed in subsequent sections of the review with regard to ICTs, economic growth and both international and internal migration and livelihoods mobility.

3 ICTs and migration

Human mobility and ICTs are both integral and interlinked features of the networked globalisation that characterised the development of the 20th century world. Although complex global interconnectedness predated this period, the breaking down of spatial barriers accelerated in the second half of the century (Harvey, 1989). Driven by the demands of the global capitalist economy, it was facilitated by advances in technology – from intercontinental air travel to the development of the internet (Castells, 2009). A globalised world is characterised by higher intensities of movement of capital, goods, ideas and people. In 2000, an estimated 160 million people lived outside their country of birth; by 2019 this had risen to 272 million (United Nations, 2019). Some scholars have examined the extent to which such overall migration figures are influenced by increased global access to ICTs. Such studies have focused on 'high skilled' immigration into OECD countries (Czaika & Parsons, 2017) or aggregated official data on formal migration and ICT development (Kotyrlo, 2019). Findings from such studies are of limited relevance to the HoA, where migratory outflows are usually considered to be predominantly 'informal' or 'irregular'. These accounts are also complicated by the interrelationship of multiple variables of economic growth, access to ICTs, and decisions or compulsions to migrate. Emigration rates often increase as countries go through phases of economic growth (Castles et al, 2013; Skeldon, 2014); and expansions of ICTs often occur through similar periods, making it difficult to isolate the role of ICTs in driving outward or internal migration. Economic development can create feedback loops that simultaneously drive increased mobility *and* ICT development. The case of Chinese economic opening and development since the 1980s illustrates this in the context of globalisation. China became the 'workshop of the world', moving beyond the production of basic consumer goods to state-of-the-art electronics manufacturing. The concentration of industry in coastal cities precipitated massive (but controlled) internal rural–urban labour migration (Chan & Zhang, 1999). Workers began to access devices (such as phones) that they were producing and their position as migrants in urban industrial areas created new demands and markets for accessible ICTs for them to stay in touch with rural families (Cartier et al, 2005; Wallis, 2013).

ICTs have multiple impacts on different types of mobility around the world, which may both encourage and discourage migration. For example, one could consider differences between, 'white-collar' workers in the Global North, for whom broadband access may reduce the need to physically relocate for employment (Cooke & Shuttleworth, 2018), and vulnerable populations in the HoA, for whom ICT connectivity provides access to networks and information vital for livelihoods and mobility or migration. Regardless of differing impacts on population groups, scholars are increasingly recognising ICTs as a critical element of infrastructure shaping migration dynamics. Xiang and Lindquist define this infrastructure as "the systematically interlinked technologies, institutions, and actors that facilitate and condition mobility" (2014, p 122). Focusing on 'formal' labour migration within East Asia, they break this infrastructure down into five overlapping dimensions: "the commercial (recruitment intermediaries), the regulatory (state apparatus and procedures for documentation, licensing, training and other purposes), the technological (communication and transport), the humanitarian (NGOs and international organisations), and the social (migrant networks)" (2014, p 124). They highlight the ICT dimension as being most "obvious" but emphasise that none can be analysed in isolation. This is one reason why drawing causal links between ICT-prevalence and increase in overall migration is problematic.

Drawing on literature both specific and relevant to the HoA, and recognising the difficulties inherent in making generalised global statements about the impact of ICTs on mobility (and migration), this

section breaks down several interlinking themes from the literature on how digital connectivity conditions mobility for populations inside or from the HoA. It examines the ways in which ICTs affect people's aspirations to undertake long-term and long-distance migration (as opposed to 'everyday' livelihoods-related mobility); how ICTs are used on migration journeys to access information through different kinds of networks; how ICTs enable emotional connections and intimacies; and how ICTs may present risks or constraints to migrants in terms of surveillance and exploitation.

3.1 Information access and migration aspirations

People's aspirations for migration have long been associated with access to different types of information. Information allows people to make comparisons between 'here' and 'there', in relation to local, regional or global opportunities. This gives potential migrants insight into the transaction costs of migration, thereby informing their decision to migrate (Mahler, 2001; Massey & España, 1987). Flows of information are central to the phenomenon of 'cumulative causation' in migration studies: the tendency for migrants to move along particular routes and cluster in certain locations, based on social ties and networks in receiving countries (Massey, 1990). The 'network effects' of cumulative causation and the activation of different types of social ties between migrants are longstanding phenomena that pre-date ubiquitous mobile phones or the internet. However, the spread of ICTs and their use by migrants and diasporic communities have intensified these flows of information, making them both more visible and more dynamic (Diminescu, 2008).

Research in migration 'source' countries in Africa has shown how the use of ICTs can influence the ways people think about possibilities for mobility and their migration aspirations. Tall's (2004) study of the use of phones and televisions in rural Senegalese villages by returning international migrants was one of the first to address these issues in ethnographic detail. The study described the use of mobiles as collective instruments bringing villages out of isolation and facilitating global connections that could lead to increased desires for people to migrate. Remittances transferred through phone networks were important, as was the physical transfer of ICTs to home villages by returnees. Tall described how villagers might become more familiar with specific locations in European countries (thanks to their connections with the diaspora) than to cities in Senegal itself. He argued that this reflected new understandings of space, and the "globalisation of the domestic realm from the bottom up" (2004, p 44). Schapendonk and van Moppes' (2007) study also focused on Senegal and was one of the first to examine the role of television and early internet access in spreading (often misleading) images of Europe that heightened young people's aspirations to emigrate. Research on web cafes in Ghana demonstrated how ICTs "shaped the yearning for foreign contacts, travel experiences, and an entrenched notion of success as related to one's ties to abroad and to one's global mobility" (Burrell, 2012, p 7). These studies predated the wider prevalence of smartphones and social media.

The literature on migration intentions in the HoA increasingly mentions the role of social media (Ali, 2016; Wasuge, 2018), although there are fewer specific studies of how online platforms shape mobility aspirations. However, recent research by one of the authors of this literature review focuses on the experiences and perceptions of relatively affluent young people. Using a participatory screenshot-sharing method as a basis for group interviews with young men in Hargeisa (Somaliland), Chonka (forthcoming) discussed expectations of connections and mobility created by social media, in relation to their 'upward' and 'outward' mobility. This demonstrated the wider range of functions of social media platforms in potentially encouraging or facilitating migration. This occurred through the sharing of diaspora content that gave positive – if often misleading – impressions of life overseas (Mohamed, 2015). Also highlighted here were new forms of social media broadcasting – such as streamed transnational dating shows – which facilitated connections that could lead to mobility, and heightened youth aspirations around such possibilities.

3.2 ICT use on the move: access to information networks

Much of the existing literature on the impacts of ICTs on migrants' actual journeys has focused on refugees or other undocumented migrants who are moving from the Global South towards Europe. As the HoA is a prominent source of migration, much of this literature engages with communities who have come from (or have links with) the region. These studies increased substantially in the wake of the so-called 'European refugee crisis' of 2015–16. This period was distinctive in that it represented one of the first mass population movements where a large proportion of those moving had access to networked devices such as smartphones. This research often draws on the larger body of longer-established diasporic media studies, which has focused on the transnational lives and communications of migrant communities already resident in Western 'host' countries. As migration aspirations evolve into concrete plans, modern online networks allow migrants to access a wider range of people with whom they share social ties. They can use these networks to gain vital information about routes to travel, border crossing strategies, asylum procedures, accommodation and employment options. Dekker and Engbersen (2014) describe how social media platforms transform migrant networks and facilitate migration in four ways, by 1) helping migrants maintain strong ties with family and friends; 2) allowing access to weak ties relevant in organising the process of migration and integration; 3) establishing new potential networks of 'latent' ties (which can be activated when needs arise); and 4) offering sources of discrete and unofficial insider knowledge.

Even before the prevalence of internet-equipped smartphones, earlier research documented how the development of basic mobile phone networks had made regions such as the Sahara more 'transitable' for migrants. Schaub's account (2012, p 128) of the 'micro-coordination' of migrants' journeys shows the relevance of the wider literature on the impact of mobile phones on travel, indicating four salient features whereby phones: (1) allow the adding of actors to personal networks without the need for meetings; (2) help maintain social ties over distance; (3) enhance a social network's functionality by enabling the reachability of network members (Castells et al, 2009); and (4) allow for coordination of travel, obviating the need to pre-arrange (Manvell, 2006; Mokhtarian, 1990).

The 2015–16 Mediterranean-region refugee 'crisis' provided numerous examples of the apparent utility of internet-connected smartphones for migrants in the course of their difficult and dangerous journeys. Beyond interpersonal information flows and networks, researchers also highlighted migrants' frequent use of information from mapping and weather forecasting apps, their access to mainstream media content on dynamic changes to European border regimes, and connections with humanitarian or civil society organisations (Frouws et al, 2016; Gillespie et al, 2016). Much of this research has focused on Syrian or Afghan refugees, as opposed to migrants coming from the HoA. Nevertheless, a study on Eritrean migrants highlighted the similar indispensability of mobile phones on journeys (Horwood & Hooper, 2016). However, Eritrea's extremely low internet penetration rate and limits to SIM card access mean that many migrants acquire devices after they have crossed the border (Tesfanews, 2015; BBC, 2019). Recent survey data from the Mixed Migration Centre reported that in a sample of 1664 HoA migrants travelling to Europe around 85 per cent had access to a phone at some point on the journey, with 45 per cent having smartphones (Frouws & Brenner, 2019).

Research has shown that undocumented migrants moving towards Europe are much less likely to engage with online information provided by NGOs or governments (UNHCR, 2016). As such, information access is intertwined with interpersonal relations maintained through online and offline social networks. The practical functions of ICT connectivity for accessing journey-relevant information and maintaining social networks are also highlighted in studies looking at patterns of internal migration. For example, Boas (2020) considered the role of online social networking for Bangladeshis forced to undertake internal migration as a result of environmental factors linked to climate change. The article emphasises the complex multi-directionality of movement and the use of

social media and phones by those who need to move in order to maintain a wide and dispersed network of social ties (eg with family members in cities), which can be leveraged when necessary. As Boas (2020, p 1330) argued, "the use of mobile technologies does not necessarily lead to a drastic shift of social network structure towards the proliferation of weak ties. Rather … the impact is on how (often existing) ties that are geographically dispersed are utilised to enable mobility in a more coordinated manner, making mobility decisions more reflected on and to an extent less risky" . Phone/online access allows groups to micro-coordinate in emergencies and provides options for people to leave or return home. Underscoring the complexity of these internal mobility patterns, Boas (2020, p 1340) showed how mobile ICTs allow migration to take place step-wise, keeping families connected in the course of different movement phases that may take months or years. Where connectivity was available back in areas people had left, the use of phones and social media to share information could also be an encouraging factor in returns. Considering climate change-induced migration for already mobile pastoralist populations in the HoA, such accounts are useful in that they emphasise the complex multi-directionality of movement, relationships within immediate and dispersed family groups, and the centrality of ICTs to maintaining these networks and information sources.

3.3 Emotional connections and burdens

Much recent refugee-focused research has built on a broader diaspora media studies literature. This has looked at how ICTs have affected established diaspora communities' creation and maintenance of global and local connections (Belloni, 2020; Brinkerhoff, 2009; Charmarkeh, 2013; Hiller & Franz, 2004; Komito, 2011; Lindley, 2009; Oiarzabal & Reips, 2012) and their self-representation through digital media (Alinejad, 2011; Fazal, 2007; Georgiou, 2006; Kosnick, 2007). A central theme emerging from this broad body of literature relates to the ways in which new media technologies facilitate an ever-wider range of cross-border connections, identities and intimacies. This is evident in research on transnational caring – the ways in which modern ICTs can compensate for physical distance and be used to generate and receive emotional support, and fulfil family obligations (Baldassar, 2016; Brown, 2016; Madianou, 2016; Madianou & Miller, 2013; Nedelcu & Wyss, 2016; Peng & Wong, 2013; Vertovec, 2004; Wilding, 2006). Digitally mediated connections may influence physical international migration behaviours in different and complex ways. For example, the ability to 'mother' at a distance through online video calling could be seen to sustain (or even further encourage) a particular international flow of female domestic labour, and might reduce the frequency of return visits. The capacity of diaspora communities to remit money through communications networks to families back home may create obligations and relations of dependence that discourage (older) migrants from returning (Hunter, 2015). As noted above, an intensification of communications through new media can provide potential migrants in 'sending' countries with practical information and inspiration or aspirations to travel to join a diaspora community. Conversely, flows of information on dangers may discourage such journeys, and diasporas may themselves attempt to limit further migration (Phillips & Heiduk, 2019).

Leurs (2014) explored the internet use of Somalis 'stranded' in Ethiopia – young people who had migrated from Somalia but were subsequently left in Addis Ababa by family members proceeding onwards to Europe in search of asylum and the hope of family reunifications at a later point. Leurs (2014, p 5) described the use of video calls and social media as means for young people trapped in a difficult and precarious period of limbo to develop "transnational affective capital" – the ability to be in contact with families and friends, exchange emotional support, manage anxiety and gain hope for improved future outcomes. The study hints at online practices seen by the respondents as *potential* means for physical onward mobility – for instance, the use of dating sites to find partners and opportunities to migrate.

In highlighting some of the emotional burdens of connectivity Awad and Tossell (2019) argued for a

move away from an over-simplifying 'utilitarian' account of how migrants use mobile devices. Research that emphasises the mobile phone as a 'toolkit' for migrants cannot capture the complexity and paradoxes of their use by individuals, and may (counter-intuitively) contribute to the 'othering' of refugees, who come to be viewed through a lens of compassion-based 'bare humanity', rather than as active rights-bearing actors. Their account detailed the emotional strain that migrants face after arrival in receiving countries through their use of social media to maintain connections with a conflict-affected homeland. Connectivity creates expectations among family members that arrivals in Europe will always be 'on call' to fulfil long-distance social and economic obligations. Wider research on digital cultures has increasingly detailed the psychological harms caused by social media use or addiction (Keles et al, 2020) and it should be no surprise that migrants too are affected by these phenomena. However, such issues are rarely investigated in research on African or HoA contexts, where the focus of research is often on more utilitarian uses of ICTs and their potential for fostering economic or human development.

3.4 Digital visibility, surveillance and border controls

As the devices used by many migrants have become more sophisticated, a tension has emerged between how smartphones affect external and self-representations of refugees. Some right-wing European commentators have seized on images of the use of such (relatively) advanced technology to delegitimise asylum claims through assumptions that access to such technology is incongruous with 'genuine' poverty and desperation. On the other hand, devices allowed for the documentation of migrants' experiences and created some opportunities for migrants to make themselves visible in digital media (Chouliaraki, 2017).

Globally, digital platforms render individuals visible through the extraction of their personal data, and the value generated by such data underpins the business models of social media platforms used by billions of people, including migrants. Commentators refer to these wider processes of extraction as 'data colonialism' (Couldry & Mejias, 2019) or 'surveillance capitalism' (Zuboff, 2019), something that increasingly intrudes into nearly every aspect of people's lives. Migrants have always constituted a category of people subject to particular forms of surveillance, and borders are spaces where mobile populations are made visible to states. In the post-9/11 world, research has explored the digitisation of border systems and the use of various ICTs to expedite certain types of elite mobility and constrain others associated with 'risk'. Modern border control systems draw data from multiple points and enact (often racialised) risk profiling of particular types of traveller (Ajana, 2013; Amoore, 2006). Vukov and Sheller (2013, p 225) described how digital technologies have helped transform the nature and location of borders in the modern world: "the current retrofitting and technological remediation of borders suggests their transformation away from static demarcators of hard territorial boundaries toward much more sophisticated, flexible, and mobile devices of tracking, filtration, and exclusion". These shifts are reflected in the ever increasing role of (shared) databases in migration management in Europe (Brom & Besters, 2010) and electronic surveillance of migration channels beyond Europe's frontier, such as in the Mediterranean (Jumbert, 2018).

Migrants into Europe are on what Latonero and Kift (2018, p 1) describe as "digital passages" – spaces where refugees, smugglers, governments and corporations interact with each other through new technologies. On these routes, travellers generate through their use of platforms and devices data that are of interest to authorities controlling movement across borders. To this end, various states have made legal moves to gain access to individual social media data from migrants' devices or to collect information on these platforms on human smuggling and trafficking networks (Brekke & Staver, 2019). Migrants' interactions with humanitarian organisations also generate large amounts of data, raising questions about how this may be stored, shared or used for non-humanitarian purposes (commercial or border-control related) by other actors (ICRC & Privacy International, 2018).

3.5 Human trafficking, extortion and other digital risks

As noted above, ICT use can make migrants visible to (digitalised) border regimes and thus constrain their mobility. From migrants' perspectives, these negative impacts exist alongside other risks of digital platform use, for instance exposure to inaccurate or purposefully misleading information. Borkert et al (2018) emphasised the high stakes of information-seeking for undocumented migrants attempting to pass European border regimes, and the various ways in which they assess the quality of information they have access to. Respondents in this research (83 Syrian and Iraqi refugees who had arrived in Europe in 2015) indicated that people smugglers generally did not act as 'infomediaries' helping migrants access information via ICTs, while other studies (Frouws & Brenner, 2019) have also noted that migrants who have phones may be less reliant on smugglers while on their journeys, as they are able to make other contacts to facilitate their travel.

Nonetheless, research has highlighted how human trafficking and people smuggling networks use the internet (Latonero, 2011). Given the increasing ubiquity of social media such as Facebook and WhatsApp (and the potential for relatively secure communications via the latter) it is unsurprising that such illicit networks use these platforms partly (but not primarily) to recruit migrants and more often to communicate with them and coordinate journeys (Frouws et al, 2016; UNHCR, 2016; Frouws & Brenner, 2019). However, there is a lack of specific research looking at digitally enabled smuggling networks operating inside the HoA, as most of the existing literature looks at later stages of migrants' journeys, often in the Mediterranean region. A research gap exists here with regard to the ways in which potential migrants inside the HoA make initial contacts to facilitate undocumented migration, and the role that ICTs play in these contexts.

Some studies have begun to highlight how phone calls, digital images and videos are used by groups that detain and torture migrants in transit countries such as Libya in order to extort ransom payments from distant family members (Van Esseveld, 2019; MacGregor, 2019). Research undertaken in Somalia (Bakonyi and Chonka, forthcoming) has shown how this extortion may play out in the HoA, and how it may affect already vulnerable populations. A female interviewee in this research described how her daughter had left Somalia for Europe and was detained by human traffickers in Libya. The traffickers contacted her mother (herself a displaced person in Bosaaso) via mobile phone, pressuring her to pay for her daughter's release. The woman indicated that her daughter was experiencing threats and acts of violence. Through significant effort she raised the funds (several thousand dollars) from contacts within a wide social network. She electronically transferred the money to part of the trafficker's organisation in Mogadishu to secure her daughter's release. As yet, it is impossible to quantify the extent of these extortion practices, but aforementioned research has shown their occurrence elsewhere and the centrality to this of ICT-enabled communication.

Other research on social media users in Somaliland (Chonka, forthcoming) highlights less violent but also harmful practices linked to misinformation and scams around migration opportunities. The young people who shared social media data as part of this study mentioned bogus competitions for foreign visas, or fake fee-taking employment agencies. These findings highlight the need for further research on supporting digital literacy efforts in the region with special reference to mobility and migration.

4 ICTs, livelihoods and everyday mobility within the Horn of Africa

ICTs affect not only long-term, long-distance and outward migration patterns but also 'everyday' mobilities linked to livelihoods and social relations in the HoA. As such, the review now moves away from migration and diaspora studies literature and pivots towards the broad field of 'ICT for Development' (ICT4D). Research here highlights changes to everyday livelihoods and social practices, access to information or finance, and the impact of ICTs on the 'empowerment' of marginalised groups. Many of these findings relate to mobility and derive from (or are relevant to) HoA contexts. A key problematic for research lies in identifying causal relationships between ICT uptake in a society, economic change and associated forms of (livelihoods) mobility. Do ICTs drive economic growth by providing additional resources and tools for people to move and take advantage of economic opportunities? Or is it economic growth (caused by other factors) that allows people access to new technologies? Do people find themselves in better economic situations because they are connected? Or are they connected *because* they are in better economic situations? Section 3's discussion of Asian economic growth, rural–urban migration and ICT use has already highlighted the interaction of multiple interrelated factors. Similarly, before looking at the impacts of ICTs on everyday (mobile) livelihoods, it is important to recognise that mobility itself may drive the growth of ICT use, with potentially transformative effects on communities. Research from rural Southeast Asia shows how poverty-driven rural-to-urban migration can have a positive impact on rural tech diffusion (the spread of mobile phones) through the remittance of devices and the return or knowledge exchange of migrants with ICT know-how (Hübler, 2016). Internal migration here was found to play a bigger role than international migration in this tech transfer process. However, the analysis also showed that if, migrants were better educated, this could have a negative impact on tech diffusion. As Hübler put it "migrants are supposed to foster technology diffusion via education, but a departure of young, educated emigrants can also create a 'technology drain' … effect" (2016, p 148). At the national level, elite diaspora tech-transfer to domestic industries has been posited as a counterpoint to the negative impacts of the 'brain drain' of educated migrants from developing countries (Kapur, 2001).

With these complex interrelationships in mind, this section highlights some key debates across the wide-ranging ICT4D field on the impact of ICTs on livelihoods, primarily in the HoA and other African contexts. It focuses on how ICT-conditioned socioeconomic change affects patterns of mobility; how ICTs are conceptualised as affecting the 'empowerment' of marginalised groups; and how this is relevant to various types of 'everyday' human mobility that usually occur within national borders. The section then reviews specific research focusing on everyday ICT use by mobile populations of pastoralists and displaced people in the HoA. Also highlighted here is emerging research on the ways in which ICTs may contribute to instability, which itself may be a driver of (forced) mobility. Overall, the findings in this section tend to correspond with earlier ethnographic research on the adoption of mobile phones in various African societies, emphasising that ICTs do not generally break up existing social structures, but instead become adopted and adapted by populations in multiple ways that support aspects of local culture, solidarity and familial bonds (Hahn & Kibora, 2008; Horst, 2006).

While ICTs may remove the need for certain mobilities in order to maintain social connections, they do not necessarily alter the character of those ties. In some cases, interpersonal relationships vital for economic exchanges and opportunities cannot be substituted by phone contact (Molony, 2007, 2009). Such accounts push against ideas of technological determinism (or 'solutionism') that assume unidirectional paths of ICT adoption, socioeconomic change and mobility patterns.

4.1 Livelihoods, social networks and mobilities

Increased access to economically-relevant information is often described as a key benefit of ICT use that can change how people undertake everyday economic activities and mobilities. An important debate on the role of mobile phones for rural producers' access to market information illuminates key challenges for research and programmes focused on mobility. Jenson's influential (2007) study of fishermen in Kerala (India) claimed that their uptake of mobile phones gave access to information about where they would receive the best prices for their catch. This influenced their choice of which market to sell at, leading to an overall increase in the prices they received and less wastage. Despite extensive citation, Jensen's approach has also drawn criticism that has highlighted how socio-cultural dynamics play a larger role in determining mobility patterns, and identified some of the methodological limitations of his approach towards fishermen's phone use. Sreekumar (2011) challenges the assumption that the fishermen were purely independent economic actors operating in a free market, highlighting local cooperative norms and institutions affecting their freedom around where to land their catch. Srinivasan and Burrell's (2013) research in the same location indicated that mobile phones were mostly used for non-economic purposes, and that the functioning of local markets depended on government regulations and collective management, thus determining where it was possible for the fish to be sold. Steyn (2016) argued that Jensen's explanation of how he asked fishermen about their phone use was possibly ambiguous. Without clear evidence that fishermen were using their phones *specifically* to gather market information, one could posit that the causal relationship might operate in the opposite direction, ie "because fish markets were better (due to a host of other possible reasons not related to mobile phones) fishermen could now afford mobile phones" (Steyn, 2016, p 8).

Despite difficulties in tracing clear causal relationships between ICT-use and changes to the ways in which people earn their living and move, numerous quantitative and qualitative studies elsewhere have highlighted broader impacts of mobile phones for livelihoods in the Global South. The various arguments made to show the benefit of (basic) mobile phone use for poverty reduction have related to: the ability to access information on market prices; the benefits of expanding and strengthening people's social networks; the cutting down of travel costs (removing the need to travel to communicate); maximising benefits of necessary journeys; the increased accessibility of rural producers; and improvements to general business efficiency (Aker & Ksoll, 2016; Donner & Escobari, 2010; Sife et al, 2010; Zaremohzzabieh et al, 2014).

Looking at the HoA region, most of the literature on ICTs and livelihoods has focused on Kenya and Uganda – contexts accessible to researchers where rapid adoption of mobile phones in the early 2000s was later followed by local (and internationally renowned) innovations in mobile money technologies. Many of the findings here relate to everyday livelihood and social mobilities, and to the dynamics of rural–urban migration. Muto (2012), for instance, explored the impact of mobile phone connectivity in Uganda on personal networks which (she argued) increased the probability that an individual would choose to migrate from a rural to an urban area. This study featured early mobile phone coverage and usage data (from 2003 to 2005) and focused on all regions of the country bar the North (because of insecurity). Her findings suggested that "mobile phone possession provides more opportunities to people outside of existing major networks and thus has a greater effect on their decision to migrate to find an urban job" (Muto, 2012, p 789). Looking at the global literature, specific impacts of mobile phone use on patterns and rates of internal migration are

difficult to quantify. Some studies suggest that phones may remove the need for journeys, and that jobs created in relation to mobile phones, and related products and services (eg repairs and airtime), may reduce rural-to-urban youth migration (Baro & Endouware, 2013). Survey-based research on rural youth in Indonesia found no clear difference in the internal migration intentions of internet users and non-users (Onitsuka & Hidayat, 2019). Overall, with urbanisation continuing across the African continent (UNDESA, 2018) – and through the period of uptake of mobile phones – it is difficult to see any straightforward impact of mobile phone use on overall rates of rural-to-urban migration.

Basic mobile phone use has connected urban with rural areas, further linking modes of production and livelihood strategies across distances. Porter et al (2012) conducted a mixed-methods study across 24 research sites in Ghana, Malawi and South Africa on the impact of phones on youth mobility. They demonstrated how mobiles offered young men and women "remarkable opportunities to leapfrog physical mobility constraints and the power relations with which these are bound, with potentially life-changing impacts, some highly positive, others more negative" (Porter et al, 2012, p 145). Positive impacts were related to young people's ability to develop 'network capital' – eg contacts with family in rural areas to access resources such as school fees, travel costs and jobs in cities. Subsequent studies further explored the gendered limitations of mobile phone-facilitated mobility, and we return to this below.

Localised ethnographic accounts of the arrival of mobile phones (and network coverage) in rural areas tend to avoid more general claims about macroeconomic or migratory change. Vokes (2018) looked at various stages of the introduction of mobile phones to a particular village in southwestern Uganda. He emphasised the importance of the circulation of devices *before* the provision of network coverage and the ways in which these created new exchange relations and "prolonged the social domain" of sectors like the taxi industry (in their role in transporting phone-related goods and ideas). Vokes highlighted "new imaginaries of physical and social mobility" (2018, p 274) and connections with external family, commercial or political patrons that might facilitate (often illusory) opportunities for people to move to cities or abroad. His account highlighted specific changes to social events such as burial practices brought about by the use of mobiles. Taking over from the (local) use of bonfires and (national) use of radios, mobiles are used to initiate direct contact with distant relatives and encourage more frequent attendance at the ceremonies held in villages.

Kusimba et al's study of family networks of mobile money in Kenya showed how such technical innovations have served to **"**reinforce pre-existing forms of emotional support and social relationships", and strengthen maternal kinship ties and sibling and cousin contacts (2015, p 1). However, although remittances of cash and consumer goods have long sustained connections between urban migrants and rural families, the introduction of mobile money has made it easier for city dwellers to transfer money *instead* of travelling to attend weddings and funerals (Morawczynski & Pickens, 2009; Mbiti & Weil, 2015). Kusimba et al's (2015) account demonstrates how mobile money family networks are often dense and multidirectional: instead of either being just 'senders' or 'receivers', people are often members of "groups who circulate value … siblings who pool resources for a father's medical needs, seamstresses or vegetable sellers who form a savings group, or community members who contribute to funerals" (p 3). Studies in Uganda have indicated that the use of mobile phones and money is associated with increases in household consumption (itself related to increased receipt of remittances) and reductions in food insecurity (Munyegera & Matsumoto, 2018; Murendo & Wollni, 2016).

Again, factoring in potential reverse (or simultaneous) causality is a challenge for researchers. Dramani's (2013) study on Senegal emphasised the importance of ICT access for facilitating the receipt of international remittances and the associated benefit to household livelihoods. The study

argued that the wellbeing of households was influenced by their degree of ICT use, and that this influenced the frequency of overseas remittance receipt. However, the extent to which reverse causality was accounted for is unclear – was increased ICT access itself a function of more frequent remittances and higher incomes? Using what they described as a novel (for development studies) copula-based statistical method Blauw and Franses (2016) showed a positive impact of the proportion of mobile users in a household on overall economic wellbeing, related to abilities to efficiently receive information and reduce travel costs. They also reported that "the duration of mobile phone ownership of the head of the household significantly impacts household development" because it may take time for individuals to learn how to use the phone in the most efficient ways and the beneficial effects of device use may take time to translate into observable outcomes (Blauw & Franses, 2016, p 327).

Recent ICT4D literature has focused on the impacts of a wider range of mobile phone functions. This has corresponded with the development of innovations such as SMS-based mobile money, experimentation with 'app'-based development interventions, and the wider accessibility of more sophisticated devices with internet access. Kim et al (2018) reviewed the literature on mobile financial services, financial inclusion and development. They identified a bias in this body of work towards the study of institutional and individual preconditions for services, rather than supply and demand for users or impacts on society. They argued that there remains a general lack of research demonstrating *how* and *to what extent* financial inclusion is improved. Evans and Pirchio (2014) examined why mobile money schemes have proliferated around the world, but only seem to 'ignite' in particular cases. They cited the negative impact of regulation and the insistence on the continued centrality of formal banks as primary reasons for schemes not reaching critical mass. Kenya – famous for the emergence there of M-Pesa as a collaboration between local and international telecom companies and UK aid – is a context where mobile money has 'ignited' and features prominently in the global ICT4D literature. One of the most influential studies on the impact of mobile money on overall reductions of poverty in Kenya is Suri and Jack (2016). The authors estimated that M-Pesa has increased per capita consumption levels and lifted 2 per cent of Kenyan households out of poverty. These impacts, they argued, are more pronounced for female-headed households, and relate to changes in financial behaviour (financial resilience and saving) and the moving of many women out of agriculture and into (small) business. Such findings are contested by Bateman et al (2019) who argued that this macro-picture of poverty reduction did not account for the 'exit' of businesses (only the entry of new businesses), the displacement of existing business, or increased indebtedness.

Although the use of M-Pesa in Kenya is extensive, the familiar impediments of digital inequality also explain why there is relatively little evidence for overall improved financial inclusion. On one hand, some research demonstrates that smallholder farmers who use mobile financial services tend to have higher profits than those who do not (Kikulwe et al, 2014). This is related to the increased ease of receiving remittances from distant family members. On the other hand, potential reverse causality is not always fully addressed: for example, having family members in urban areas who can remit money may itself have an impact on the use of devices. Furthermore, the extent to which the poorest or most marginalised communities can leverage mobile technologies is limited by localised and device/app/network-specific factors. Wyche and Steinfield's (2016) study of Kenyan farmers' interactions with a commercially available mobile market information system (MIS) showed a "mismatch between the design of MIS and smallholder farmers' perceptions of their mobile phones' communication capabilities" (p 320) as well as problems with the design of such services that relied on users' literacy and basic, damaged handsets. A recent review of the literature on the use of mobile commerce tools in the informal sector across African economies (where the majority of employment is so classified) found that there was still no widespread adoption of such technologies (Pankomera & van Greunen, 2019). Despite remaining financial, technical, social and cultural barriers to uptake and use of phones for a wider range of services, the increasing prevalence of internet-

connected devices and sector-wide enthusiasm for ICT4D-type interventions and initiatives means that experimentation will continue, and academic research may not have entirely caught up with developments.

Considering broader socioeconomic changes and mobility, Steel et al (2017) brought together findings from Cameroon, Rwanda and Sudan to make a nuanced case for the impact of digital technologies on connected modern African livelihoods. They described how "rural and urban livelihoods are increasingly shaped by the physical movement of people, goods and ideas bridging the rural–urban divide" and the ways in which ICTs "have facilitated new connections and decreased the physical and psychological distance between the city and the countryside" (2017, p 148). They emphasised some historical continuity in that many Sub-Saharan African livelihoods have always been based around forms of mobility (2017, p 153; see also de Bruijn et al, 2010). This certainly also applies to the HoA. At the same time, Steel et al also argued that this link between livelihoods and mobility had been intensified as a result of the increasing prevalence of ICTs and the ways in which devices allow for interpersonal connections across space and time. Although agriculture remains the predominant feature of rural livelihoods, these are "more and more organised within larger socio-economic and spatial contexts" (2017, p 153). For some people this may mean increased physical movements across this space, while for others virtual connection removes the need to travel. However, modern rural African mobilities are often much more complex than uni-directional movements towards cities, and are relational in that the movement of one person may rely on the immobility of another. For example, despite remittances, the movement of family members to cities may create extra labour burdens for those left behind, thus limiting mobility. The authors also pointed out that there are few empirical studies on the livelihoods impact of increasingly accessible smartphones. Their case study of Sudanese female entrepreneurs using social media to market products far beyond the capital shows how this may become a growing livelihood strategy on the continent, even for countries (like Sudan) which have lacked an effective mobile money system. These are business practices that further entangle urban and rural economies, even if online interaction and digital connectivity are sometimes replacing physical travel between areas. However, physical mobility of the transport companies or traders/wholesalers will remain vital for these transactions.

4.2 ICTs, mobility and gendered empowerment

The previous sections have hinted at how the ability to leverage potential benefits of ICTs is related to wider inequalities. Research demonstrates how mobilities and ICT access and use may be determined by gender norms, and how such technologies may provide opportunities for renegotiations of and challenges to existing power relations. We highlight several studies addressing the 'empowerment' potential of ICTs with specific reference to mobility and migration. Cases globally and from the HoA show a mixed picture. ICTs present new socioeconomic opportunities for some women, but remain out of reach for many others. Other studies emphasise how ICT-based innovations and interventions may themselves reinforce patriarchal gender relations to the detriment of women.

Women's use of new technologies has often been constrained by wider digital inequalities relating to poverty, gendered power relations, and (male) control of limited financial resources needed for access. The physical location of computers in public cyber-cafes or village telecentres (the creation of the latter being a common early ICT4D intervention by development actors) could be a limiting factor, particularly in societies where local gender norms have made it difficult for women to spend time in open, public spaces (Terry & Gomez, 2010). With cyber-cafes being superseded by smartphone mobile internet (including in the HoA) some of these spatial constraints may have diminished. Research points to the significance of women's ICT use in private spaces and new abilities to maintain and grow social networks, pursue romantic relationships beyond the

parameters of traditional familial control, gain access to a wider range of media for entertainment or educational purposes, and engage in online political discourse (Radsch & Khamis, 2013; Sané, 2014; Mutch, 2016).

Oreglia and Srinivasan's ethnographic study (2015) of female ICT users in rural China and India emphasised that the ability of (migrant) women to renegotiate gender roles was less directly related to their individual use of digital devices, but rather connected to their emerging position as mediators of others' access. Rural–urban female migrants acquire devices and know-how in the course of their move to cities, which they then bring back to their places of origin. In gifting phones to relatives and imparting knowledge about their use Oreglia and Kaye (2012) highlighted how this might positively affect young women's standing and power status in communities. Wallis' (2011, 2013) research in China showed that phone access for female migrants in cities might not be the sole determining factor in young women's upward social mobility, although extensive ICT use has the capacity to both reproduce and restructure women's opportunities for agency, in concert with multiple other socioeconomic and cultural factors. Other studies demonstrate that digital access to formal educational resources for female labour migrants increases their 'perceived employability', whereas informal resource use (eg on social media) had a stronger relationship with improvements in literacy (Chib & Wardoyo, 2018).

Other research looks at the ways in which female labour migrants use ICTs to organise, challenge injustices, or resist their marginalised status in different places. Platt et al (2016) examined the use of online platforms by Indonesian domestic workers in Singapore and outlined both the empowering and disempowering aspects of this group's use of ICTs. On the one hand, social media is a useful tool for isolated domestic workers to obtain information about shared issues, and mobilise or raise awareness about discrimination or poor working conditions. On the other, (local) employers retain significant amounts of control over their access to ICTs, and negotiation over mundane rights (WiFi passwords in the homes in which they work) become central sites where power relations are contested. There is very little research that focuses on ICT use by HoA labour migrants working outside or inside the region. An exception is Busza et al's (2017) study on returned female Ethiopian migrants from the Gulf. Interviewees emphasised the importance of phones for maintaining external communications and struggles with employers over their rights. The study calls for further sharing of the knowledge gained by migrants to inform policies promoting potentially safer labour migration.

Looking at livelihoods and empowerment within the HoA, Komunte et al (2012) described the benefits of mobile technology for female Ugandan and Kenyan 'micro entrepreneurs' in terms of affordances for marketing, sales, customer service delivery and productivity. Porter et al (2020) presented comparative data on mobile phones and female empowerment from multiple sites in Ghana, Malawi and South Africa. In general, their findings on the interplay between phone ownership and use, female empowerment and chronic poverty do *not* show mobile phones to be instruments of positive transformative change. They noted how the use of phones for women's negotiation of sexual relationships often limits their agency, with potentially negative impacts on educational and entrepreneurship strategies. They reported multiple stories of men's random calling, power dynamics around airtime purchases and who calls whom in courtship, management of multiple romantic relationships, and the surveillance of women's phone use by partners and consequent break-ups (Porter et al, 2020, p 188; see also Soleil Archambault, 2011). Again, mere possession and use of ICTs does not appear to be the determining factor for increased freedom or mobility (Gwaka, 2018). However, Porter et al show that, for those women who have found better jobs or set up businesses, phones can play a significant role. They noted that "while many women now perceive the phone as an essential tool for promoting work opportunities, there is little convincing evidence that it has transformed their livelihoods. But how can we expect otherwise, given prevailing intense competition for jobs and business opportunities among women with few

skills and little capital?" (Porter et al, 2020, p 188; see also Awotwi et al, 2011; Kibere, 2016). Wyche and Olson's (2018) aforementioned study of rural Kenyan women's gendered ICT access constraints highlighted the 'feminisation' of the countryside, as more men were tending to migrate to urban areas for work. If new technologies and widened social networks are facilitating rural-to-urban mobilities, the ways in which these are gendered may have impacts on the mobility (and the ICT knowledge and access) of those often left behind (ie women).

Digital inequalities aside, the emerging literature reminds us that access to ICT platforms and apps is not necessarily 'empowering'. Natile (2020) provides a gendered critique of digital innovations in Kenya, and highlights how mobile money platforms (and commercialisation strategies) push neoliberal entrepreneurial norms onto users. Responsibility for upward mobility is shifted onto the shoulders of digitally connected economic actors (eg female micro-entrepreneurs using mobiles), potentially saddling them with additional burdens. As depoliticising narratives of technological solutionism fail to challenge historical, colonially inherited and patriarchal power structures, women's responsibilities simply increase: expectations of them using technologies to earn for families *and* continuing to do the majority of domestic labour and social reproduction. This has negative impacts on women's mobility.

Emerging critiques are also starting to challenge the extent to which new digital 'fin-tech' applications are genuinely empowering populations who were previously excluded from finance. Critics describe the 'data-fication' of poverty – where analytics of big data aggregated from users generates value for fin-tech companies – while potentially encouraging increased indebtedness (Bateman et al, 2019). As more data is generated in the use of such applications by (poor) citizens of HoA countries, it is conceivable that credit scores are assessed by a wide range of digital metrics beyond the knowledge or accountability of users or regulators (Gabor & Brooks, 2017). The impact of 'datafied' financial 'inclusion' for development on mobility patterns is not currently addressed in the literature, but it is possible that it may emerge as a new area for research.

4.3 Pastoral livelihoods/communities

Prevalent across the HoA, pastoral livelihoods are inherently mobile. Pastoralists move with their livestock (goats, sheep, cattle, camels) in seasonal patterns to access water, grazing and markets for trade. In many cases patterns of mobility follow historical routes and often cross borders. Movements are also affected by conflict and drought, and pastoral populations are often some of the most susceptible to the growing impacts of climate change. Since around the mid-2000s, the use of mobile phones has become commonplace within pastoral communities across the region. Pastoralists may be affected in similar ways by the dynamics described in previous sections around livelihoods and the potentials for or limitations on 'empowerment' of marginalised groups. Nonetheless, distinctive features of pastoralist livelihoods deserve specific attention and there is some research focused on the HoA that examines how ICTs are affecting livestock-related mobility. This literature has focused on pastoralists in Kenya, Tanzania and Ethiopia. Most of these studies note the actual and potential use of ICTs by pastoralists to dynamically obtain information that would affect mobility patterns. This information comes both from wider social networks and from state and development initiatives. It relates to: the availability of forage and water in certain areas; weather forecasting for the planning of livestock movements or planting of crops (for agro-pastoralists); access to veterinary services; and market information about livestock prices (Asaka & Smucker, 2016; Baird & Hartter, 2017; Butt, 2015; Debsu et al, 2016; Ngowi et al, 2015; Tofik, 2014). The fact that (often conservative) pastoral communities across the region have quickly adopted mobile technologies as they have become available indicates their utility for finding this information, and the wider social benefits of communication.

The extent to which these technologies have 'transformed' pastoralism in the HoA is a more complicated question. Butt's research with Maasai pastoralists in southern Kenya is careful to avoid unhelpful technological-determinist narratives and instead emphasises how the adoption of mobiles has taken place alongside wider shifts in livestock-rearing practices. This study described an increased use of hired herders by households and moves towards night-time grazing. The latter is – in part – related to more frequent conflict with wildlife reserve rangers, who attempt to keep herders out of protected areas often visited by tourists (Butt, 2015). Under these circumstances mobile phones are increasingly relied on, and Butt discussed the various ways in which phone contact between herders allowed them to avoid rangers' patrols. When cattle are moved to temporary camps in times of drought, herd owners are often in touch with herders more frequently to make enquires about their situation. This may mean that these owners travel less often to such temporary camps, although Butt (2011) noted that this might be more closely tied to a household's ability to meet the cost of transport. Although mobile phone use for herding is prevalent, Butt notes that "the extent and efficacy of information sharing is strongly influenced by pre-existing social struggles to gain access to prohibited grazing locations" (2015, p 1). While Maasai pastoralists emphasised the utility of phone contact, around 40 per cent of Butt's respondents described phone-gathered information on grazing as inaccurate. Some also complained about the possibility of deliberate deception from rival herders, for instance lying about pasture over the phone to preserve another group's exclusive access (2015, p 8).

Asaka and Smucker (2016) conducted a similar study with Samburu pastoralists in northern Kenya over the same period. They focused on how phone communications affected the decisions made by herders to move to 'refuges' (where grazing and water was available) by comparing group interview data on droughts in 1999 and 2009 (before and after widespread adoption of mobiles). Overall, they found that phones had not substantially changed pastoralist mobility patterns. This was a result of the complexity of pastoralists' assessments of forage opportunities and a continued preference for in-person communication and scouting out of prospective grazing and watering opportunities. As with Butt's (2015) findings, Asaka and Smucker's respondents described how a lack of social trust could limit the utility of phones for expanding social networks and obtaining mobility-relevant information. Phones were used extensively by pastoralists in the 2009 drought, but not necessarily in ways that were directly related to forage assessments. A smaller number of refugee sites were used than in 1999, but this was primarily because of a desire to avoid increased levels of conflict, raiding and instability in certain areas, as opposed to the impact of new communication dynamics.

Debsu et al (2016) examined how Borana pastoralists in southern Ethiopia were increasingly using phones to connect with livestock traders. Mobile coverage to remote rural areas is limited and came late in Ethiopia (around 2006). Their study reported inequalities in access to devices or to connectivity, despite phone-sharing practices (common across Africa) mitigating some of these impediments. The authors argued that the new technology "supplements rather than replaces customary practices of information gathering [and] also complements the mobile lifestyles of both pastoralists and livestock traders" (Debsu et al, 2016, p 36). They illustrated how it was mostly traders who benefited from the various functions of mobile phones, for instance in terms of access to SMS-based market price systems. Nonetheless, phones enhanced traditional Borana information-exchange practices and reduced travel costs. Although the traders at the interface between pastoralists and domestic and international markets appeared to be benefiting the most, their attempts to maximise profits and meet external livestock demand meant that they were broadening their geographic areas of operation. Phone-facilitated contacts led to increased sourcing of livestock from more remote areas and connected more herders to high value markets (for instance export to the Middle East).

Baird and Hartter (2017) looked at the relationships between access to information via mobile

phones and livelihood diversification among Maasai pastoralists in northern Tanzania. Their findings from group interviews and surveys with household heads indicated that phones were being used in ways that supported existing activities rather than transforming them, and that there was a positive, non-linear and significant relationship between livelihood diversification and information diversity. They reported widespread use of phones for gathering information on livestock rearing, grazing, forecasted rainfall, wildlife locations, requests for assistance and coordination of agricultural activities. They identified the emergence of a figure described by some respondents as the 'phone *laibon*'. Analogous to traditional *laiboni* (spiritual authorities), certain older men with specific technical know-how (eg about internet use for weather forecasting) would be consulted by people from all over the region (2017, p 466). The pastoralists also highlighted other practical functions of mobiles – from the basic function of flashlights and calculators, to the role of shared photos of animals for potential buyers. Overall, the authors described how wider livelihood diversification brings people into new socioeconomic networks and provides greater access to a wider range of information. Mobile phones, they argue "may simply catalyze this ongoing process" (2017, p 469).

Socioeconomic changes interact dynamically, and opportunities for livelihood diversification may be brought by the introduction of phones as commodities in and of themselves. In the Southern Ethiopian context Debsu et al (2016, p 50) describe new enterprises that have sprung up to provide accessories and services to new phone users, eg recharging points, SIM and airtime sales, etc. In a relevant non-HoA context Djohy et al (2017, p 129) reported similar findings on changes to the lives and livelihoods of Fulani pastoralists in Benin. Although young people are increasingly engaged in small-scale phone-related businesses, this doesn't necessarily shift livelihoods entirely away from pastoralism, as capital raised is often reinvested in livestock. This study also highlighted various social changes influenced by new communication practices and devices. For instance, the authors discuss how young people were finding opportunities to engage in more direct interpersonal contact with their elders, particularly when they offered instruction and advice on mobile use. Illiteracy among the pastoral Fulani is common; however, the researchers described how various symbols are being employed by mobile users (eg to save contacts) and mitigate obstacles to use (2017, p 122). Research elsewhere in West Africa has drawn links between increased ICT use and broader improvements to literacy, as users increasingly come into contact with written interfaces (Naffet, 2015). Djohy et al also discussed increased access to religious media through mobiles: "mobile pastoralists are stereotyped as less actively practicing the Islamic faith than the sedentary Fulani. The mobile phone appears to reduce this religious gap by connecting mobile herders with religious traditions shared and practiced in sedentary communities" (2017, p 126). In Baird and Hartter's (2017) Tanzania study livelihoods and information diversity was also linked to changes in social norms, particularly in terms of increased potential 'empowerment' and female resistance to polygyny. The authors noted how younger women married to older husbands (with multiple wives) were increasingly able to use mobile phones to pursue other romantic relationships.

Despite various shared trends across the literature, locally informed consideration of cultural norms, infrastructures, and political economies remains essential to understanding the wider position and role of new mobile technologies – whether for displaced, sedentary or pastoralist populations. Important variables here relate to the presence of mobile money systems (absent in the Benin and Ethiopian cases), and the level of fragmentation of network providers. For instance, Djohy et al (2017) reported on how different levels of network coverage between different telecom providers in Benin prompted Fulani herders to use multiple SIM cards, or make choices of pasture based on the availability of signal there for those different networks. Moving away from analyses of how ICTs exert impacts 'on' populations, other research has highlighted the relationship between livestock and ICTs as export/import commodities. In the Somaliland–Ethiopian borderlands for instance, livestock is the dominant export moving out of Ethiopia through the rapidly developing Berbera corridor, while (smart)phones are a prominent import moving in the other direction (Kefale, 2018).

Considering the wider literature that this section has covered, a need remains to expand these political-economy-focused analyses of societies in the region increasingly characterised by complex digital networks. At the same time there are still significant gaps in ethnographic research on everyday (rural) communications practices among populations in places where research access is challenging.

4.4 ICTs, displacement and conflict

The literature surveyed above has mainly focused on the use of ICT in contexts of labour migration and everyday livelihood mobilities: whether for primarily sedentary or pastoralist populations. Mobilities in crisis situations (eg climatic or conflict-related) are also affected by access to the functions of ICTs. This section explores the limited literature on displaced people's use of ICTs in HoA/Global South contexts. Again, there is overlap with the research findings described above – as displaced people also use ICTs in their migration and livelihood strategies, and constitute a diverse population experiencing different types of marginalisation. Nonetheless, some specific characteristics of conflict- or climate-induced displacement and displaced people's settlement patterns in the HoA (and other contexts) warrant specific analysis. This section therefore also demonstrates how ICT infrastructures may be intertwined with wider political economies of displacement, and concludes with comments on emerging research agendas that link increased ICTs such as social media to instability and conflict, which itself may drive (forced) mobility. This limited existing research on displaced people's use of ICTs inside the HoA raises potentially important new questions about their digital interactions with humanitarian, state and commercial actors, their particular vulnerabilities, and the wider dynamics of communication in society that may have implications for conflict-related mobility.

Although there has been very little research on general ICT use in South Sudan, one notable exception frames the introduction of mobile phone connectivity there in relation to a wider context of displacement. Brinkman et al (2017) argued that research on ICTs needs to move beyond a linear focus on the 'effects' of devices to appreciate instead how "(new) communication technologies become entangled with mobility, politics and entrepreneurship in a 'post'-war setting and displacement economy" (p 323). They note that the widespread popularisation of mobile phones in South Sudan roughly coincided with the interim period between the end of the second Sudanese Civil War (2005) and South Sudan's independence in 2011. In the conflict of the early 2000s, mobile use was uncommon, and those who did use devices risked being suspected of being aligned with the SPLA forces fighting against the North. Conflict and pastoral livelihoods have historically predisposed many South Sudanese communities to high degrees of mobility, and large-scale displacement (eg towards the new capital, Juba) heightened post-2005 demands for new means of communicating with distant relatives within the country and abroad. South Sudanese communications infrastructure more generally was either non-existent or seriously damaged by the effects of armed conflict. At the same time, hopes for development and the return of the diaspora following 2011 drove the perception among international telecoms companies that South Sudan could emerge as a highly lucrative market. Brinkman et al emphasised how migrant traders (often young men returning from the diaspora, Sudan, or migrating within South Sudan) have become dominant in the rapid growing phone business – "despite difficulties in the network, or perhaps precisely because of them, the diversity of the wares and services on offer is extensive" (2017, p 333). This type of historical–anthropological approach eschews focus on a single population group or 'effect' of ICT and instead paints a more holistic picture of the position of phones in a wider environment of conflict-related displacement and postwar reconstruction. For the most vulnerable in this political economy – IDPs living in urban camps – the analysis discusses how phones are used to manage people's everyday security, a theme returned to in the analysis of Somali cases.

Dahya and Dryden-Peterson (2017) focused on the refugee camps of Dadaab in Kenya to explore the

ways in which ICTs were influencing the creation of support networks and access to external opportunities (such as higher education) for female Somali refugees. Their analysis of women's virtual social networks showed "exceptions to what are otherwise highly restrictive realities with regard to women's opportunities to pursue higher education" (2017, p 286). They illustrated how women's engagement with transnational online social networks could help shift cultural norms, and provided some with useful contacts and information. Nonetheless, they cautioned against over-optimistic readings of the changes ICTs might bring for women: "ongoing communication with educators and administrators in the region indicate[s] that access to these tools is still limited, connectivity is inconsistent, and space is still subject to the patriarchal norms of the community" (2017, p 289). Gendered digital inequalities remain prevalent (and potentially even more acute) for refugee populations.

For Somali refugees in the region transnational ICT-facilitated connections are not solely linked to more recent digital technologies. Horst (2007) has previously documented the role of radio and mobile/satellite phones for displaced populations, and the importance of international remittances (for perspective from the diaspora, see Lindley, 2009). Technological advancement in the devices used to communicate has changed (and broadened) the means by which resources reach mobile populations, and the use of SMS notifications and web-based tracking facilities has become a central part of '*hawala'* transfers that displaced Somalis (and wider populations) rely on (Duale, 2011). Receivers of remittances are alerted by SMS, and phone numbers are used to verify individual identities, alongside 'official' documents and clan-based methods. In the Somali HoA context, mobile populations remain connected to remittances through old and new ICTs, and such transfers have long been vital for the wider economy of the region (Ahmed, 2000). However, not everyone benefits from the receipt of cash from relatives overseas. Urban populations, those hailing from dominant groups, and those particularly in northern Somalia/Somaliland are more likely to be regular recipients (Majid, 2018).

One of the authors of this review was involved in a recent project that engaged displaced people in Somali cities to discuss in interviews (and present through participatory photography) different aspects of their experiences of urbanisation and 'security on the move' (Bakonyi et al, 2019). Although the project did not focus on ICT use specifically, interview data demonstrated the prevalence of (basic) mobile phone use in processes of migration, settlement and movement within cities (Bakonyi & Chonka, forthcoming). Phones were important for people undergoing displacement to arrange contacts in cities – either to locate family members who were already there or to find camp leaders ('gatekeepers') who manage informal settlements and take a proportion of incoming humanitarian assistance. Phones were used for frequent contacts with family members back in rural areas, although few interviewees reported receiving regular international remittances. Displaced people often hail from marginalised minority groups who are less likely to have family members abroad. However, the use of mobile money was prevalent. Many people appreciated the convenience and relative security of being able to carry and receive money by SMS. However, others reported being denied (or given reduced) pay through mobile money for domestic labour in cases where they had agreed with employers to receive what they were owed after they had returned to their camps. Although mobile money is often considered more secure for vulnerable populations than carrying cash, displaced people frequently spoke of their fear (and experience) of robbery, phone theft and violent coercion to hand over their PIN numbers for accounts. As mobile money becomes more ubiquitous, wider swathes of the population are choosing or compelled to use these systems. Many elderly displaced people noted how their lack of literacy made it difficult to engage with interfaces. This produced a reliance on others to access their accounts on their behalf to receive or spend money. While such help was often provided by trusted family members, it raised questions about wider data and mobile money security in a context where many users are not traditionally or digitally literate.

The penetration of mobile phones among displaced populations has precipitated a shift by humanitarian actors in the Somali context (and elsewhere) towards cash assistance through SMS mobile money systems. Jaspars et al (2019) describe how this development has over the past decade had wide-ranging impacts, not only at the micro level of vulnerable populations' access to aid, but also in relation to the broader political economy of humanitarian assistance, business and conflict. In Somalia, aid agencies characteristically give out SIM cards and phones to displaced people and load these with mobile money. Mobile cash or electronic vouchers can then be used at registered retailers to buy essential items, often in combination with biometric ID systems. This requires large-scale and close cooperation between aid agencies and telecommunications companies –the latter increasingly also being involved in the nascent formal banking sector. Jaspars et al calculated that 90 per cent of cash aid transfers in Somalia flow through Hormuud telecom company, which takes fees from mobile transfers and supplies hardware for aid organisations (2019, p 18). Hormuud arguably wields significantly more power than the Somali federal government. The company is a major investor in food imports and rural land acquisition for export-orientated cash-cropping. These dynamics have contributed to a decline in local food production, rising rural land prices and subsequent displacements of farming populations (Jaspars et al, 2019, p 44). This also occurs in a southern Somali context still characterised by armed conflict and the Al Shabaab insurgency, itself contributing to the forced mobility of historically marginalised groups. Jaspars et al (p 34) discussed corruption in the cash aid system and the lack of attention paid by humanitarian actors to the wider political economy of assistance. Their report paints a picture of endemic displacement and external aid dependence, intimately intertwined with broader dynamics of land-grabbing and shifts to export-orientated cash-cropping. The fact that telecommunications companies have become dominant players in this complex political economy demonstrates how the impact of ICT development cannot be adequately conceptualised solely through a micro-level focus on individual uses of devices by mobile populations. There is an urgent need for further research in this area focusing on ICT investment and infrastructure and the wider conflict, which continues to generate significant forced human mobility.

Similarly, the use of ICTs themselves should be considered a factor in conflicts that drive displacement. In the West, the impacts of the internet and social media on societal cohesion and political communication have been significant. Scholars are increasingly exploring how platform algorithms create 'filter bubbles' or 'echo chambers' and undermine wider national public spheres of debate (Bennett & Pfetsch, 2018). The circulation of fake news or other forms of disinformation is linked to political rupture and violence. As yet, there is little academic research on how such social media dynamics affect countries that are rapidly coming online through mobile internet, but also have recent histories of sectarian violence or social cleavages. These are issues relevant in certain HoA contexts, as demonstrated by the emergence of online fact-checking initiatives in South Sudan (211Check.org and HagigaWahid.org). In the Somali context, a diaspora–local initiative led to the creation of an effective Somali language WhatsApp chatbot to answer questions and counter common misinformation about Covid-19 (Hagaha_Covid19).

In 'fragile states' political scientists have attempted to trace the relationship between mobile phone coverage and violence (such as insurgent attacks). This is often understood as resulting from ICTs' facilitation of collective active (Bailard, 2015; Pierskalla & Hollenbach, 2013; Shapiro & Siegel, 2015). Caution is required for studies relying on large-scale data sets for statistical analysis because increased mobile coverage in a particular area may make it more likely that an act of violence will be reported in local and international media, thus making its way into the data on which the model is based and producing a positive bias (Dafoe & Lyall, 2015, p. 403). Those authors surveyed various contradictory hypotheses about whether ICTs contributed to the prolonging or shortening of conflicts. Increased use of ICTs by belligerents could shorten wars through the dissemination of

accurate information about each side's capabilities (encouraging negotiation or abandonment of the cause). 'Narrow-casting' to specific audiences could speed up defections, or the dissemination of knowledge might increase insurgents' combat power relative to the state. In contexts of rebel governance, ICTs could facilitate external financial flows or strengthen capacities for local taxation. New media access could allow subjugated populations to raise awareness about state or rebel abuses, while such forces might be able to exert control over those same populations' ICT use. These are all potentially important dynamics, although the overall pattern with regard to conflict and increased ICT use will remain challenging to pinpoint, given the wide range of other socioeconomic, cultural and political factors that determine the evolution of conflict.

Nonetheless, recent global examples highlight the power of social media platforms to contribute to mass sectarian violence through the rapid spread of hate-speech. Myanmar is a context where mass smartphone connectivity occurred rapidly. Journalistic investigation illustrates the lack of capacity (or interest) of platforms such as Facebook to 'moderate' (often local-language) content that partly precipitated genocidal violence against the Rohingya, leading to mass internal and international population displacement (Rajagopalan et al, 2018) . Some evidence from South Sudan and the Somali territories (UNMGSE, 2017, p 76) highlights the role of external producers in diasporas, who engage in contentious online discussion that mobilises violence from a distance. WhatsApp is emerging as a central platform in the context of instability and political contestation across the African continent, but remains one that is extremely difficult for scholars to gather data on, given its closed nature (Omanga, 2019; Hitchen et al, 2019).

5 Digital methods for studying mobility

The end of the previous section demonstrated both the needs and difficulties associated with gathering data from a rapidly expanding HoA social media environment. This section looks at how the increasing ubiquity of ICTs provides new opportunities for gathering data on mobility (and migration). Mobile devices generate multiple forms of data: phone records and embedded GPS technologies allow users to be 'geolocated'; electronic payment using phones similarly reveals locations of purchases; and the use of social media platforms leads to the creation of myriad data-points (text inputs, images, reactions, clicks, browsing habits) that can show mobility patterns. Some of these data are being used to draw inferences about the ways in which people move. Almost none of this emerging literature has engaged specifically with countries in the HoA; however, it does discuss ICT devices and platforms that are used in the region. This survey of selected methodological literature includes analysis of the extent to which techniques are likely to suitable for studying HoA mobility.

5.1 Mobile phone (call) data

Early studies on the potential for digital data to uncover mobility patterns focused on the call function of mobile phones. Blumenstock (2012) used records of calls made in Rwanda to infer patterns of internal migration in that country in the late 2000s. The dataset for this study consisted of phone records for 1.5 million Rwandans and was obtained from the predominant telecom company in Rwanda. The dataset was anonymised but 901 interviews were also conducted with individuals whose numbers were included. The study found relatively low levels of permanent internal migration in Rwanda, a finding that corroborated data from government surveys. The analysis also revealed, however, "more subtle patterns" that were not reflected in official statistics – namely high levels of circular and temporary migration and significant diversity in the mobility patterns of Rwandans (Blumenstock, 2012, p 107). Despite the overall size of the dataset, the group of Rwandans represented was skewed towards the wealthier in society (who were more likely to have mobile phones). As mobile penetration rates have since increased across a wider spectrum of society, such issues around the representativeness of datasets maybe less relevant today. Arguably, there are other more pressing factors and issues that would determine whether this type of data use would be feasible (or ethically appropriate) as a tool for identifying human mobility in the HoA. Rwanda is a small country with (at the time of that research) one dominant mobile telecoms provider. For larger countries in the HoA, and particularly in contexts where multiple providers compete across fragmented territory, the value of similar datasets may be questionable. It is not clear from this paper how access to the Rwandan data was negotiated; given its proprietary nature it is difficult to assess the possibilities for similar access in other HoA contexts. Blumenstock's paper discusses ethical concerns around access to this type of dataset, and its use for measuring or modelling people's movements. Despite the apparent anonymity of the dataset, various actors are increasingly concerned about the vulnerabilities of anonymisation and the potential for metadata (data about data) to allow for the granular de-anonymisation of individuals by others with that intent and technical capacity (ICRC & Privacy International, 2018).

5.2 Internet and social media data for migration studies

Initial research on the use of online data for migration studies focused on email. Zagheni and Weber (2012) estimated age and gender-specific migration rates with a large anonymised dataset of Yahoo! emails. The research produced estimates of age profiles of migration that were consistent with existing official data sources and showed apparent increases in human mobility, with faster paced increases for women. For each email in the dataset the researchers were able to identify the sending date, and where it was sent from. The sender could also be linked to demographic information reported in that person's account profile (Zagheni & Weber, 2012, p 349). One of the co-authors of that paper was an employee of Yahoo!, which doubtless influenced access to the data. In addition to the methodological difficulties with analysing email data (multiple accounts, different global rates of internet penetration), the authors noted concerns around privacy. This may explain subsequent shifts in this type of web data-mining research towards 'public' data on various internet and social media platforms. Messias et al (2016) gathered public data on 'places lived' from millions of Google+ users in order to examine migration clusters: sets of countries in which users had lived sequentially. Zagheni et al (2014) used geolocated Twitter data for around 500,000 users in OECD countries (2011–13) to evaluate geographic movements within and between countries. They argued that, while the data are not representative of wider OECD populations and cannot be used to infer migration rates at a single point in time, such methods can be used to predict particular turning points in migration trends. Mazzoli et al (2020) used geolocated Tweets to indicate migration flows, focusing on large-scale outward Venezuelan migration.

Specific features of social media platforms have also been used to monitor 'stocks' of migrants in particular countries. Zagheni et al (2017) used advertisers' tools on Facebook that estimate the size of potential audiences to instead estimate populations of non-nationals. Estimates based on the socio-demographic characteristics of users correlated with official figures on a US state-by-state basis. The same method for a wider range of countries (including some in Africa) produced estimates that were further away from World Bank-estimated figures of migrants. Facebook has been criticised for allowing advertisers to target or exclude certain racial groups (Tobin, 2018) and it is unclear whether such tools can still be used by external researchers posing as advertisers. More broadly, the accessibility of Facebook's API (application programming interface) has become significantly more limited for academic researchers in the wake of the Cambridge Analytica scandal. Given the prevalence and penetration of platforms such as Facebook in the HoA, it is likely that user data could provide valuable insights, particularly on certain (eg younger, urban-based) demographics. It is also likely that the expansion of these types of data capture through commercial social media platforms will accelerate faster than local increases in capacity for official data collection (Zagheni et al, 2017, p 729). However, there are widening divides in the field of 'big data' analytics between in-house tech company researchers, academic institutions and scholars who have (doubtless mutually beneficial) relationships with those companies regarding data access, and those researchers who do not (Bastos & Walker, 2018).

Very few studies have employed digital methods to analyse large-scale social media data derived from populations inside (or connected to) the HoA. An exception is Kok and Rogers' (2017) study on self-identified Somali diaspora groups on Facebook, which undertook social network analysis based on 'like' relationships between these groups. A replication of the methods used in this study could be challenging, as some of the tools they deployed are no longer functional on Facebook. The paper presents findings on some of the structuring of Somali diaspora cyberspace. The authors argue that, although "the Somali diaspora's engagement has a specific multi-territorial topology … Somalis' online engagement, however, is mainly directed towards community-based practices and social integration in their host-land, as opposed to transnational advocacy for the homeland" (Kok & Rogers, 2017, p 23). The language of the data gathered (Facebook groups or pages) is not discussed directly, although the examples given would suggest that the majority of such data was in English or

other European languages. It could be argued that self-defined diaspora groups would naturally be expected to orientate activities towards 'host-lands' in that their language choice marks a predisposition to speak to wider (non-Somali) audiences. If other types of diaspora online engagement are excluded from analysis, then different patterns might be observable in terms of cultural, social political or economic engagement with 'homelands' in the HoA. Earlier studies have also made claims about the nature and impact of Somali diasporic online engagement based on English-language data (Brinkerhoff, 2006) and we would emphasise the need to account for different online languages and their impact on digital methods datasets more broadly, particularly considering burgeoning African language use on social media platforms (Salawu 2019).

This section of the literature review has provided a brief overview of the types of research that leverage the data generated through ubiquitous global ICT use to study different aspects of mobility. The extent to which these methods are applicable and/or ethically appropriate for HoA contexts depends on different factors, including the nature of datasets, the ways in which access to the data is negotiated, availability and accessibility of data-harvesting and analytics tools, and complicated questions around the genuine anonymity of aggregated (meta)data. The representativeness of any everyday usage data in the HoA for wider trends in human mobility is also dependent on who exactly within these societies has access to ICTs, and which types of platform or service they use.

6 ICTs, mobility and humanitarian programming

The 'refugee crisis' affecting Europe and the Middle East in 2015–16 prompted a wave of tech-based humanitarian responses to the migrants' concerns. It stemmed from a realisation by humanitarian actors that migrants in the Mediterranean zone were equipped with mobile devices through which they could be engaged, leading to a veritable 'app-ification' of responses. Overwhelmingly, these innovations were focused on migrants who were already on their journeys into Europe or had entered potential 'host' countries. Various applications sought to enhance migrants' already expanded capacity for access to relevant information, and to link them with humanitarian action or sympathetic civil society groups, and to facilitate community integration for asylum seekers (TechCrunch, 2018). There are questions around the efficacy, sustainability and ethics of such app-based interventions and the extent to which they actually benefit migrants who already have access to a bewilderingly large set of information options. Other critics point to the pitfalls of 'tech-solutionism', whereby digital applications become fetishised as quick fixes to complex socioeconomic problems. They also suggest that such responses represent a 'techno-colonialism' (Madianou, 2019) which reinforces inequalities and renders migrants vulnerable to extractions of data.

Regardless of these critiques, this type of app-based response to connected migration has not yet emerged as a prominent feature of humanitarian action on migration *within* the HoA itself. Organisations such as the International Organisation for Migration (IOM) have 'rolled out' general apps in the region that are theoretically available to migrants there, although their level of use in those contexts is unclear. IOM's global MigApp is designed to provide migrants with relevant information and with opportunities to file reports or complaints. However, its interface is almost entirely in English, with the exception of a medical translation function that supports a limited number of HoA-relevant languages (Somali and Arabic).

Other relevant ICT-based interventions in the region typically focus on refugees in camps and build on wider narratives around the entrepreneurial capacity of displaced populations. Such programming often attempts to leverage the potential benefits to livelihoods and education opportunities that ICTs can provide (Hatayama, 2018), as surveyed in section 4. Critics of the 'resilience' discourse (which such innovations feed in to) describe such programming as shifting responsibility for refugee welfare onto refugees themselves, perpetuating a status quo of precarity through remote engagement with populations (Duffield, 2019). Irrespective of these critiques, while such programming engages with potentially mobile populations (refugees in camps) it does not generally address the dynamics of mobility or migration themselves. This is related to the fact that concentrated camp populations are relatively easy for humanitarian actors to access, and in some contexts may have higher rates of smartphone ownership than local communities (Hounsell & Owuor, 2018). An emphasis within this type of humanitarian and policy-focused research is on the expansion of connectivity through engagement with telecom providers for affordable mobile data and enhanced infrastructure (for connectivity and power supply), and further use of ICTs in vocational educational training (Hounsell & Owuor, 2018, p 5).

7 Filling research gaps to inform policy on ICT use by mobile HoA populations

Thanks to the unevenness of research coverage on ICT-related issues across HoA countries, many of the gaps in knowledge of the role and impacts of ICT-enabled connectivity are specific to certain locations. However, many of the places where research on ICTs and mobile populations are lacking are precisely those where issues of forced mobility are most acute and prolonged (eg Eritrea, Somalia and South Sudan). We summarise here various current research gaps, and make a set of recommendations for policy objectives. These are informed by the literature covered in this review and would enable different mobile populations to leverage ICTs – either to improve mobility experiences or to reduce vulnerabilities in contexts of forced displacement.

1. *Further research is needed on the specific everyday usage patterns of basic ICTs by rural–to-urban migrants, and displaced people who have moved to urban areas in the HoA*: This would explore how phones are used to manage relationships and livelihoods opportunities in places of settlement and to maintain connections 'back home' (eg in South Sudan, Somalia or areas of Ethiopia where displacement is prevalent). The use of mobile money among the poorest migrants in Somali contexts would be worthwhile exploring in detail, for instance in relation to its use for access to humanitarian assistance; payments for work; payments of bills and debt; or in self-organised micro-finance schemes. An intersectional appreciation of vulnerability and marginalisation would need to be built into such studies, accounting for gender, generational, and race-, ethnicity- and caste-based differences and challenges.
2. *Additional research is also needed on the role of ICT/telecom companies as key actors engaging with mobile populations in the HoA*: In the Somali context, for instance, telecommunications companies have emerged as powerful actors in the wider political economy of aid, conflict and displacement. They engage heavily with humanitarian organisations to facilitate cash and voucher-based financial aid, and have ever-increasing investment portfolios in commercial agriculture, banking and remittances. With much publicised 'corporate social responsibility'-style activities, they are also emerging as humanitarian actors themselves, particularly in crisis situations which may precipitate displacement.
3. *Wider research is merited into pastoral communities' use of ICTs*: Illuminating studies of herders' and traders' use of mobile phones have been undertaken in Ethiopia, Kenya and Tanzania. Similar studies in South Sudanese and Somali contexts (where fieldwork is possible) could yield valuable comparative insight into market dynamics and opportunities for positive policy engagement.
4. *Research into the role of online platforms in the generation and spread of content that contributes to conflict (and related displacement) would be valuable*: Our understandings of the ways in which new media platforms are facilitating hate-speech or other inflammatory discourse in conflict contexts would be strengthened by on-the-ground research with communities on their perceptions of the impact of increased local use of platforms like WhatsApp, Facebook and YouTube, as well as of the role of diasporas in these spaces.

Regional case studies could focus on particular conflict contexts in Somalia, Ethiopia and South Sudan.

5. *Country-by-country research into national-level ICT policy and its consideration of contextual socioeconomic changes and mobile livelihoods and displacement issues is warranted*: In light of the new potential for greater HoA connectivity (telecoms market liberalisation in Ethiopia, projected fibre-optic cable connections in Somalia) there is a need for contextualised research into different methods of ICT policy making, and an assessment of the extent to which national plans are considering diverse local conditions in terms of livelihoods, mobilities and displacement. For the two aforementioned contexts, research would need to assess the key players in ongoing Ethiopian telecoms privatisation, and the various (and fragmented) administrations of the Somali territories and multiple ICT providers. This research could explore effective ways for external actors and local stakeholders to engage in partnerships, and set and monitor the outcomes of said policies.
6. *Urgent research is required into the role of ICTs in monitoring, enforcing or circumventing COVID-19 mobility restrictions*: The coronavirus pandemic will probably have a significant impact on global regimes and patterns of mobility. It is unclear how this impact will play out in the HoA. Research is needed on the ways in which states and humanitarian actors have used ICTs to control HoA mobilities, the extent to which these have been effective or disruptive, and the ways in which mobile populations have reacted to them.

Research in the above areas is necessary to inform policy making and humanitarian programming in the region, which up until now have not substantially engaged with the links between mobility and ICT use. *Research in these areas needs to obtain direct input from mobile and migrant populations themselves in order to gain insight into people's current capabilities and most pressing needs*. Taking into account these perspectives, different kinds of everyday movement and migration, as well as particular local socioeconomic and cultural contexts, we recommend policy and programming towards the following objectives:

1. *Supporting migrants' multidirectional mobility between rural and urban areas, and the facilitation of different kinds of remittances – potentially contributing to technology diffusion and greater rural ICT access and use.* Policy actors should engage with communications companies to promote the affordability of ICT access and develop more accessible forms of engagement with services such as mobile money and market information systems.
2. *Targeting the digital inclusion and literacy needs of marginalised groups beyond the mere provision of ICT devices.* Approaches must take into consideration local contexts relating to gender, culture, power relations and macro-socioeconomic conditions, as these have impacts on household livelihoods and physical and virtual (im)mobility.
3. *Initiating or further developing digital literacy discussions in HoA contexts in relation to users' online safety and awareness of the data they generate on digital platforms.* Questions around the 'digital rights' of marginalised mobile populations have yet to be widely considered in many HoA countries. These questions should be integrated into digital literacy-type programming and could have implications for wider online safety, eg in terms of people's engagement with mis/disinformation.
4. *Learning from and using the experiences of returned international labour migrants in the HoA to promote 'safer' mobility through education-based initiatives.* Research has shown that much can be learnt from engaging with current or former migrants about their experiences of ICT use on journeys, and in foreign labour contexts. Insights should be incorporated into educational outreach to potential migrants, raising awareness of the risks (mis/dis-information, abuses, scamming) and developing broader digital literacy skills to navigate complex modern information environments.

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