11 Drylands connected

Mobile communication and changing power positions in (nomadic) pastoral societies

Mirjam de Bruijn, Qian Zhang, Hama Abu-Kishk, Bilal Butt, Nurit Hashimshony-Yaffe, Troy Sternberg, and Annemiek Pas[1]

ICTs: a power to transform dryland livelihoods

The past decade can be characterized as the digital age for poorly connected parts of the world. Here also, wireless connectivity is becoming a reality, improving communication and information flows. 'Especially mobile phones and wireless internet end isolation and will therefore arguably prove to be the most transformative technology of our time' (Sachs cited in Seid et al. 2016: 614). This optimistic message fits studies that place information and communication technology (ICT) in relation to development (ICT4D). It refers to the forecast that ICTs will open new ways to give people voices, allow democratization in political processes, and provide endless access to information that will allow them to develop better livelihoods (see for instance Unwin 2009; Gumede 2018).

Such positive ideas about the relation of a technology to societal change have already been challenged by various empirical case studies showing that the ways these ICTs interact with society do not *per se* follow such progress itineraries (see for instance Bon and Akkermans 2014; de Bruijn and Brinkman 2018). Interaction between society and technology is complex and does not operate in a single direction. ICTs land in an environment and context that they interact with. Developments can go in multiple directions and may equally reinforce inequality and introduce harm to populations (Gustafsson et al. 2019) as have the opposite effects. Recently in Africa, the notion of control has been put forward as governments increasingly control ICT communication and cut down on the internet or use it to reinforce their power over their citizens (Gumede 2016).

New ICTs as an innovative technology have the power to change society (see Duncombe 2018), but they should be understood in a tradition of cultural and social practices (i.e. existing communication practices) and also in relation to historical and sociopolitical contexts (see de Bruijn 2014; Butt 2016; Debsu et al. 2016; Miller 2018; Hahn 2021a). What then are the effects of such infrastructural developments for (pastoralist) livelihoods in drylands that are often associated with remoteness, poverty, and the challenge of numerous crises (Davis 2016)? As some studies have shown, high-tech infrastructures have indeed affected the ways

pastoralists can make their livelihood (cf. Lind et al. 2020; Waters Bayer and Bayer n.d.). Our study adds to this discussion with an exploration of the possible effects of new ICTs.

In this chapter, we consider ICTs as a resource that can be differently accessed and can be appropriated by various stakeholders. ICTs are a resource—for the states, for (inter)national companies, and for the populations that use them. We focus particularly on ICTs as a resource that facilitates communication and information flows. We try to understand how such technology gives a voice to people living in the drylands. As the case studies will show, new ICTs have taken different forms and—according to the theory of McLuhan (Agel 1996 [1967]), who saw also the form of the ICT as a message ('the medium is the message')—these forms have an influence on the messages that can be conveyed. We focus on the 'working' of mobile telephony, social media, telephone applications (apps), and wireless internet. In our case studies, we touch on several specific communication domains: information flows; its reception and formulation; its giving voice to those who are excluded; women and (dis)connectivity; and the creation of movements.

The development of such technology need not *per se* to be done for the society where it lands. Most telephone developers are based in the West or Asia, and certainly not in drylands. Telecommunication companies are in most cases not national but international business companies. Also, larger NGOs or business developers are based in the global North. They create apps as 'tools' for development. Hence, many innovations are thought out in offices and laboratories in Sweden, China, and England. This raises a question: with what ideas/assumptions are these apps developed? This is discussed especially in relation to the apps that were introduced in Kenya and Mongolia. The case studies situated in Mali and the Negev focus on the introduction of smart and simple phones, with wireless internet, which, as other studies have shown, have been appropriated quickly in nomadic societies (de Bruijn et al. 2016; Seid et al. 2016).

Communication is power, and those who access communication also access power (Castells 2009)—hence changes in this technology of communication will affect power relations in society. The case studies will show how various forms of ICTs in a variety of drylands interact with power relations and change them. 'Technology is a mirror of society' (Lash 1987, as quoted by Abu-Kishk and Mendels 2020). That is, technology is not neutral; it reflects the developer of the technology and his/her/its assumptions and is appropriated by the society where it is used, hence reflecting its political culture. Appropriation is not the same for everybody. Here, we will refer to the digital divide/gap, which reflects power relations in society and the world. The four case studies each show a way of such digital exclusion—which, as Castells (2002) argues, is one of the most abusive forms of exclusion in society and replicates existing socioeconomic gaps.

The four case studies encompass a variety of drylands and the ways their pastoral economies develop, including also their urbanizing trends. These studies show the possibilities in ICTs for the enhancement of livelihoods, but also the limitations in terms of control, non-access, and the digital divide. The case studies also

fill an 'ethnographic gap' in accounts of the relation between political empower-ment and the appropriation of new ICTs (see Dafoe and Lyall 2015; Weidmann 2015). The central question in this chapter is this: how do dryland (ex)pastoral communities, in their various forms from nomadic mobility to urban sedentari-ness interact with new ICTs? We focus on the way the technologies, as a resource for communication and information, enter society and are appropriated (or not) and how they influence local and national (social and political) hierarchies. We also search for the way these empower (former) pastoral societies in the historical and social context of power relations.

Critically evaluating AfriScout: 'The shepherd's eye in the sky' in Kenya

The number of mobile-based apps for delivering information across a wide spatial extent and with finer temporal resolutions has grown rapidly over the last dec-ade. Such apps are embedded in the nexus between development aid groups, tech startups, the state, and rural resource users. These relationships, and their ulti-mate goals, raise important questions about decisions related to the use of ICTs in environmental sustainability, such as what type of knowledge is shared and why, and what assumptions lie behind these decisions? In this short case study, we focus on this question by first describing the technical and political aspects of the app and its deployment in African drylands.

In 2018, the global development organization Project Concern International (PCI)[2] introduced a mobile application called AfriScout. The app promised to 'revolutionize the way pastoralists find pasture and water for their animals' and thus alleviate some of the livelihood constraints faced by rural resource-dependent communities. AfriScout is based on a satellite-derived vegetation index (NDVI), with mobile technology that provides spatially and temporally explicit informa-tion on grazing and water areas through 'grazing maps', as well as information on diseases and violent conflict. AfriScout was piloted in Ethiopia, Kenya, and Tanzania (encompassing 511,709 sq km of traditional grazing land). PCI devel-oped their app on the basis that knowledge about African drylands is 'limited in scope, timeliness, and accuracy'[3] and further limited by climate change where existing knowledge is 'little more than guesswork'. They further argue that this knowledge is becoming less reliable because of extreme weather conditions and land-use changes.[4] They have even 'constructed' these landscapes as dangerous and conflict-prone.[5] AfriScout therefore provides a way out of such 'ineffective' and 'old' ways of finding pasture and water, resources critical to the livelihoods of pastoralists in drylands. The app positions itself as better at understanding the resource conditions than current systems and as being in the process 'empowering farmers to make smarter decisions'.[6]

The creation of such apps is also related to a certain idea about drylands: in general, pastoralists are supposedly in need of 'development'. At the same time, the creators of such apps subscribe to the idea that pastoralists in drylands have high levels of connectivity and ability to share information, for the purposes of

accessing water and pastures for the trade of livestock goods for agricultural pro-
duce, and for social-cultural relations such as marriages. The construction of dry-
lands as in need of development is deeply rooted in Kenya's past. Both colonial
and postcolonial governments of Kenya have viewed Kenya's northern and south-
ern drylands as problematic, conflict-prone, and inhabited by unruly pastoral peo-
ple (Mosley and Watson 2016), who need to be controlled (Waweru 2012; Galaty
2016). These views led to different policies linking people closer to bounded terri-
tories (Elmi and Birch 2013), such as the implementation of grazing schemes and
of group ranches, both policies aiming to settle pastoralists in predefined spaces
restricting mobility of people and livestock (Pas 2018).

Currently, the perception of people in Kenya's drylands in need of development
is expressed as 'in need of being connected' to the rest of Kenya. The year 2010
marked an opening to change in the ways Kenya's drylands were envisioned, when
a clear policy shift took place to not only develop the drylands, but economically
modernize them. In the 'Vision 2030 Development Strategy for Northern Kenya
and Other Arid Lands', the drylands are seen mainly in terms of their 'untapped
potential' concerning trade, tourism, and energy and their need for investments
in industry, tourism, and infrastructure for national (and local) economic growth
(Mosley and Watson 2016). The vision also promotes the inclusion of pastoralists
in Kenya's national development as a way to curtail the continuous marginali-
zation of pastoral areas, while making the drylands 'equal to the rest of Kenya'
(Elmi and Birch 2013). High investments in several large-scale infrastructural
projects emphasize this need to connect northern Kenya with Nairobi (Elliott
2016; Kochore 2016; Cormack and Kurewa 2018).

In this context, PCI introduced the AfriScout as a means to improve the live-
stock economy and reduce conflict in the drylands, and, more generally, to de-
velop the dryland regions. AfriScout was launched in Kenya in February 2017,
when USAID together with local pastoralists, government officials, members
of the State Department of Livestock, and NGOs gathered in Kajiado County.[7]
USAID selected Afriscout as an innovation that actually makes a real impact and
transforms lives, as the localized maps in the app are stated to enable accurate
decision-making towards improved migration and pasture management, which
reduces the risk of herd loss.[8] Roughly 2,000 Kenyans were provided with trial
subscriptions by USAID, while other users pay a fee.

However, as in the case of Bedouin women in the Negev (this chapter), there
is a clear digital divide between dryland livelihoods and the rest of Kenya. It is
assumed that people are able to afford the fee or access smartphones through
constant phone-service availability and that they are able to read (in communi-
ties with high levels of illiteracy) the oversimplified maps provided through the
app. Clearly, existing networks of sharing information are underestimated, while
the working of the use of an app is overestimated. Consistently, development in-
tervention is based on the belief that pastoralists passively accept the use of such
digital approaches.[9]

For many scholars studying the relations between technology, sustainability,
and development, mobile apps have often been looked upon with a great degree

of scepticism. An often-used phrase to describe apps is that they are 'solutions looking for problems' (Degnbol et al. 2006). AfriScout proclaims to provide information as quickly as possible, yet an implicit assumption in the app is that people uniformly understand the information displayed and can process and deploy that information in meaningful ways. Based on its implementation in Kenya, we find that AfriScout is problematic in several ways:

First, the natural environment tends to be overly simplified, using indices not easily understood by users. For example, AfriScout uses NDVI as a base layer at resolutions ranging from 250 m to several kilometres[10] and does not reveal what type of vegetation is present. The resolution of the imagery is likely to mask variations in vegetative cover.

Second, the app assumes that users can afford the yearly license fees and expensive data packages, have access to smartphones, and will be within areas that have reliable phone service. The price of data and digital literacy represents a definite barrier to widespread adoption (Machado et al. 2020).

Third, the app suggests that pastoralists and other rural resource-dependent communities do not maintain their own indigenous social communication networks based on kinship and trust (Butt 2015; Pas 2018).

Finally, there are inherent power relations between indigenous communities and development groups that view indigenous people as being in need of development. Placing smartphone apps in the hands of these people often romanticizes people and landscapes and situates them as recipients of technology and advancement. The adoption of these technologies may appear successful at first, without a deeper understanding of the historical and political dynamics of exploitative development interventions (Tinga et al. 2020).

Impact of communication technology on transforming sociopolitical relations and resolving disputes: Mongolia

This case study intends to explore the role of communication technology in resolving disputes and empowering local communities surrounding mines in Mongolia. Since the 2000s the development agenda of Mongolia has been dominated by mining, as the sector attracts 60% of foreign direct investment and makes a major contribution to the country's economy. Mining accounts for a third of the GDP and 89.2% of the state's total exports, but it employs only roughly 5% of the workforce (Diener and Batjav 2019: 781). Mega-investment in mining dominates the national economy; licenses are granted in the capital city, while social and environmental impacts disrupt countryside lives and livelihoods. Nomadic pastoralism, though key to the nation's cultural identity, is less important to the economy. Herding still relies on mobility and frequent movement of herds and campsites. This way of living and its daily practice are being reshaped, however, by the development of infrastructure for mining and related transport (Sternberg and Chatty 2016). Negative impacts are emerging, including resettlement of herders, pasture fragmentation, lack of access to water, and pollution problems. Some short-term benefits have been the creation of jobs related to mining, compensation

for selected herders, and improvement of local roads and access to electricity. The fundamental contradictions between mining and herding practices in perceptions of land, water use, and relations to culture and tradition are difficult to reconcile (Sternberg forthcoming).

As elsewhere, Mongolia embraces ICT, with citizens enamoured of smartphones, social media, and local websites. Today, the number of smartphone users per hundred persons in Mongolia is about 2.3 times higher than the world average, but only 4% of internet service users live in rural areas (Tsolmondelger 2019). By actively adopting new technological tools (primarily mobile phones) and services (e.g. SMS, Twitter), locals join new networks of communications between herding communities, government officials, and development programmes (Hahn 2018). For instance, ICTs play a role in reshaping the patterns of herding movement and, by extension, campsites (Diener and Batjav 2019). However, to date the internet has not been harnessed to bridge the rural/urban and community/company infrastructure divides. These dividers are situated in the complex and rather rapid political and social-economic shifts that this pastoral nation has undergone since 1990 (Sternberg et al. 2015; Sternberg 2018). On the one hand, industrialization, modernization, and urbanization strongly affect and reshape pastoral lives (Kingsley 2017). On the other hand, the society is characterized by a set of polarizations and paradoxes, where open democracy coexists with corruption, high education levels, high unemployment rates, poverty for nearly a third of the population, a modern capital, and a lack of basic economic and information infrastructure in large rural areas.

The Mongolian government, despite its investments in ICTs (Johnson et al. 2005; Hishigsuren 2006; Jackson 2015; ITPTA 2016; Hahn 2020), has failed to succeed in bridging the gap between rural and urban areas (van Doodewaard 2004; Johnson et al. 2005). The Mongolian government holds strong control over the country's telecommunications backbone, through its majority ownership of the Mongolian Telecommunications Company (Tsolmondelger 2019). However, nowadays larger players such as foreign investors have increased rural connectivity through ICT and roads. This is done to serve the larger strategic goals of cross-continent flows of resources, rather than for the specific benefit of locals (Diener and Batjav 2019; Joniak-Lüthi 2020). In addition, NGOs and other social actors have been engaged in using ICT in creative ways to empower vulnerable communities, but largely for project-based conservation (McCarthy et al. 2018) and hazard management purposes (Barnes et al. 2020).

In our case study in a mining area, the interest and access to the internet have not improved the exchange and interaction on mining information, laws, taxes, jobs, expansion plans, and ownership. More seriously, environmental and social impact assessments, taxes paid, company and government responsibilities, and citizen's rights have not benefited from increased ICTs and their potential. This challenge and the social need have captured the attention and energy of a group of local researchers, with support from the University of Oxford. The striking inequity between mining companies (foreign and domestic) and isolated communities leads to a vast information gap that negatively impacts community

development, as communities are not informed/do not know/cannot pursue their rights and legal remedies. Extensive field research (Sternberg et al. 2020) identified a lack of knowledge and access to information as a key problem for herders and town dwellers in understanding and effectively pursuing measures to protect and advance their livelihoods, rights, and customs. The desire of community members to become informed is difficult to meet over large distances, limited educational opportunities, costs of travel to the capital, and the demands of the dominant herding lifestyle. In this context, developing a mobile phone application has the potential to engage and remedy several issues through the innovative use of ICT. The project is still in its pilot phase.

In Mongolia, pastoralists refer to someone who knows everything and makes proper decisions as a *mergen boodie*. *Mergen* means wise, clever, and *boodie* is a little hedgehog. Giving this name to the mobile app conveys content and knowledge for herders about mining. As the app has been developed, NGOs (Steps without Borders, IRIM, Gobi Soils) have been natural participants. Perhaps more surprising, the Ministry of Mining and the Cabinet Secretariat have been supportive of efforts to disseminate information through the app. Their motivation arises from the social challenges mining has brought, the divisions within society, and the government's difficulties in resolving problems. Ministry support for civil society efforts (here by NGOs and universities) to address the issues is easy to provide, as it helps address public and political concerns. The app can present public data in a more accessible form. For herders, the app reduces the barriers between lives lived and new external forces beyond daily comprehension.

The mobile phone app in development presents levels of knowledge and information on mining and site-specific detail. This includes company-reported revenue, tax data, licensing requirements and obligations, and satellite images of operations. As the prototype is tested, local residents are able to comment and contribute to the app through interviews, photographs, and short videos. This approach makes their stories available to a national audience. In addition, the app enables citizens to make mine-related complaints directly to the government. In Mongolian language, with Mongolian faces and content, and with updated news and development issues, the app mirrors the interests and concerns of the rural population.

Essential in the mobile app development is balancing herders' common patterns of ICT engagement: visual, with information on a small screen. Here, NGO involvement and field evaluation are essential. Taking into account education levels in the countryside and the complex nature of mining data, the app can become a connector and conduit between rural citizens and government. Only trial and error show what content interests herders versus what outsiders think is important. For example, the nicely presented complaint-form link on the app will still take time to fill out (perhaps a child will help), and although logged by the government, it may be swallowed by the bureaucracy. Without quick responses, herders may lose interest. The process shares information and initiates thoughts and questions for herders about mining changes seen on TV, viewed in their homelands, and discussed with friends and families.

Because the internet and social media are popular, and cheap mobile phones are easily available over the border with China, phones are not the issue. More challenging for ICT connectivity are transmission antenna and signal strength, lack of wi-fi zones, and the ability to charge phones as pictures and content quickly run down batteries. Solar panels and car batteries are the main power sources for herders, but they vary in reliability. Signals are better on hilltops (even standing on a vehicle can help). These challenges lead people to watch videos together, which is acceptable for entertainment viewing but less rewarding when examining mining data (e.g. taxes paid, contracts, impact assessment claims). Still, apps are well known from TV and this one is particularly relevant to herder livelihoods.

Here, ICT is a marvel that breaks down the 'tyranny of distance' and encourages collective experiences, even if only virtual ones. 'Early adapters' are always necessary: herders who share the app among friends, designers who create an app for rural communities, or ministries open to new forms of public engagement. While a mining-related app is promising, it has its limitations. Will herders in fact return to view it after their original curiosity is satisfied? *Mergen boodie* offer a chance to democratize some information. The real measure of ICT effectiveness will come when herders drive the app engagement and development to suit their own needs, interests, and lifestyles.

ICTs and the reinforcement of exclusion policies: the 'digital divide' among Bedouins in the Negev and the case of Israel under COVID-19[11]

The 'digital divide' as presented in this case study is a mirror of the status of Bedouins in Israel, and especially of women within Bedouin society. As we focus on young women (students), we demonstrate in miniature the complexity of the relationship between the Bedouin population and the state of Israel, through the lens of ICT ownership and use.

The Bedouin population in the Negev currently numbers 270,000, constituting about 3.5% of Israel's population and close to 30% of the Negev population (Abu-Kaf et al. 2019). Since the 1950s, the Israeli government has implemented a policy of establishing new settlements and transferring the Bedouins into permanent residences, delimiting this essentially nomadic population to living within the boundaries of towns and villages. This ongoing process has led to towns planned by the state, 'unrecognized villages' with 25–40% of all the Bedouin in the Negev. The former nomads are now engaged only in minor practices of semi-pastoralism, with a limited semi-nomadic livelihood present.[12] The literature distinguishes four generations of Bedouin women, and these generations demonstrate different abilities to cope with instability and crisis. Older Bedouin women have lost their traditional status, but they remain a source of power and personal security; second-generation women facing transition difficulties operate behind the scenes; third-generation women are the most integrated in the world outside the traditional tribes, but they are in the midst of an unfinished transition process—these women are positioned between their mothers' generation and their daughters' generation

and therefore nicknamed 'the split generation' (Alhuzail 2018); the fourth generation women are undergoing a substantial change that has not yet been completed. It is this fourth generation that is the subject of this study (Meir 1997; Alhuzail 2014).

Israel is one of the world leaders in the percentage of its population with internet access—78% of Israeli households (Schejter and Lee 2007; Abu-Kaf et al. 2019)—but Bedouin villages have only 34% of their households connected to the internet. Against this background, the pandemic situation sharpened the existing inequalities in society, one of which is the position of Bedouin women. At the core is the long-standing dispute between the state of Israel and the Bedouins over land rights. The state's refusal of recognition is part of the daily life of their inhabitants, who do not enjoy full-service provision: they are not connected to the electricity grid, water and sewerage systems, and telephone lines and internet services that should be fully provided by the State. The low level of services in villages and the lack of infrastructure reflect the core issue of the dispute over land rights.

Based on mapping the ownership of ICTs among young Bedouin women, who were in various stages of their academic studies at the onset of the COVID-19 pandemic, the case study shows Bedouin women (fourth generation at times of crisis) suffering from a double digital divide. Following the COVID-19 pandemic and alongside the seclusion at home and the social distancing guidelines, higher education campuses were closed and the faculty moved to online distance learning. The case study examines the implications of these measures for female Bedouin students and examines their end-user equipment, how they connected to the internet, and the nature of their internet use.[13]

The data collected show that the majority of female Bedouin students' own smartphones (78%), and a majority testified that it was a major tool in daily life, with a prominent use for learning purposes (92.1%). However, there were two negative findings: the diverse means of connection and the low quality of cellular reception. This also explains why, despite the high rate of smartphone ownership allowing for easy connection to social networks, we found only 42.9% used social networks for a high sharing of social issues among themselves. The most common apps used were WhatsApp and email applications, and less usage was found for all others. Most respondents pointed out that using social networks was accompanied by concerns over the sense of being controlled and supervised by the family and the collective. This remains valid and threatening among young Bedouin women in higher education institutions when they use social networks. The interviews revealed that the distance-learning experience was particularly affected by the ability to connect to the internet and the technical difficulties that accompanied this.

Feelings of helplessness, anger, and anxiety emerge from the interviews. The sense of drowning that interviewees described exemplifies the magnitude of the anxiety and the sense of failure. As emerges from the interviews and the data collected, distance learning inevitably entailed technical and substantive difficulties that hampered their learning ability and provoked thoughts of dropping out of

formal education. The technical barrier, which is beyond their control, burdens the already difficult distance-learning experience, impairs their ability to continuously participate in their studies, and therefore may affect both their social place and the process of social change that is in progress.

The situation of young Bedouin women, who suffer from a double 'digital divide', reflects the digital gap that exists between Negev and the rest of Israel. The vast majority of female Bedouin students (who participated in the study) face a three-level digital gap (Abu-Kishk and Mendels 2020):

The access gap: only one-third of the respondents have a wired internet connection in their home; the rest rely on a cellular connection. However, about two-thirds of the respondents reported that there was partial or no cellular reception in their place of residence. Thus, the significant barrier for them was the lack of access to infrastructure that allows connection to the internet and the lack of ownership of end-user devices that allow connection and use.

The skills and uses gap: this refers to the inequality in the ability to utilize ICT while exercising critical judgment. The findings show that young Bedouin women's use is concentrated on WhatsApp, emails, and text messages, and they do not use additional channels. The use of the internet for them is limited to academic needs and information retrieval. The data indicate the skills gap and the weakness of female Bedouin students in the diverse uses of a digital environment, including the use of complex sources of information and the software, required particularly in modern society (Eshet-Alkalai 2004; Ganayem 2018; Lev-On et al. 2020).

As we also introduced in this study, ICTs are influenced by the social, political, and economic environment and the discourse that surrounds it. These factors are reflected in how female Bedouin students use the internet in a way that is subject to the patterns of behaviour set for them by their society. It is also reflected in their concerns about the use of the internet and social networks and their use of social networks as a private space. It is evident that these young women suffer both from the weakness of the status of Bedouin society in relation to Israeli society in general, and from their own internal weakness within Bedouin society.

The participation gap: this third gap stems from the previous two and relates to the difference in the experience of those who enjoy full access to advanced internet services compared with those who lack it (van Deursen and Helsper 2015). From the interviews, it can be seen that the negative experience of the female students during the COVID-19 pandemic affected their participation in distance learning. The students, who had relied until then on the services of the academic institution (library, computer classrooms) to meet academic requirements, found themselves with the imposition of the lockdown and social-gathering restrictions without an available solution. This case study demonstrates an occurrence at a specific time and in a specific place, but more than that it indicates a broad phenomenon.

Lack of access, along with difficulties in the intelligent and diverse use of media, can lead to the exclusion of groups and individuals from key social discourse

arenas and to the limitation of their ability to accumulate resources and develop abilities (van Dijk 2005). This is also the case where a state of crisis is adding to an already existent exclusion. In this case, the poor general infrastructure, including only partial deployment of cellular antennas, resulted in difficulties in reception and in connecting to the network (Abu-Kaf et al. 2019) became a part of effective government control over the Bedouin population. The challenges posed by the COVID-19 pandemic highlight the unique status of young Bedouin women and their dependence on the existing infrastructure in their place of residence, thus challenging their place in the process of social change.

Nomads unite: mobile telephony in Sahelian crisis communication

This case study recounts a specific episode in Fulbe semi-nomadic life in central Mali that developed also with the changes in the communication landscape. Here, we sketch how the mobile phone has become a real resource in the changes in livelihood that have come along with the conflict that has divided Mali since 2012.

The story is based on a long ethnographic engagement with the Hayre, a specific group of pastoral semi-nomads in a specific region in Central Mali.[14] There are several large aspects involved in the interaction between Fulani semi-nomads, society, technology, and the conflict, and these aspects are related to historical and geographical differences. In the Hayre, Fulani society has a strict hierarchical ordering. With the arrival of the colonial state bureaucracy, the political and religious elites of these Fulani became gatekeepers/intermediaries in nomad–state relations. The nomads had a (politically) marginal position in the postcolonial state, and the protection of their elites resulted in many cases of extractive policies by state agents with regard to the main wealth of the nomads: their cattle.

The transition from analogue to digital communication came late in the region, especially in the rural areas. The capital city, Douentza (then around 9,000 inhabitants) received electricity only in 2000. The first poles for wireless technology appeared in the city shortly afterwards. People from the rural lands would already go to the towns to make telephone calls, but only a decade later the nomadic camps also had direct access to wireless communication. Around 2009 connectivity improved as more wireless communication masts were erected (Keita et al. 2015). The (semi) nomadic pastoralists of this region began to use their new connectivity to relate to others who had left the region (Keja, Amadou and de Bruijn 2020), and this created increased connections with, for instance, more urbanized fellows. The ideas of those who had left, and who were now more connected with the world and ideas outside of their own original society, began to trickle down into the pastoral community (Keita et al. 2015).[15]

In 2012, an ethnic conflict merged into a war between the Malian state and a liberation movement that was later complicated with the incursion of jihadi movements (Lecocq et al. 2013). Leaving aside the origins of this war, we will describe the way ICTs have been appropriated by a variety of stakeholders and

have become a weapon in the war, and also for the semi-nomadic pastoralists who, in their society, belong to the politically marginalized. The rebel groups from the north occupied central Mali, quickly being overrun by jihadi groups (MUJAO), followed by the arrival of the French, who 'reconquered' the region in the beginning of 2013. However, central Mali did not regain full state control, nor any military control, which turning the area into a non-governed zone. During the jihadi 'occupation', the jihadi soldiers offered their phone numbers for security calls; so, whenever there was a problem, a phone call could mobilize protection. After they left, insecurity returned to the region.

In the specific case, we are referring to here, a fellow Fulani nomad, who was also chief of a group of nomads close to the border of Burkina Faso, began a 'crusade' to unite the Fulani semi-nomads, in order to establish security in their region. He went from leader to leader, either travelling or by using his mobile phone, to inform them about the situation. His efforts to unite the Fulbe succeeded. A meeting was organized where over 1,000 Fulani from the region met (Sangaré 2016, 2019; Sijsma and de Bruijn 2019).[16] Without mobile phones, this could not have been realized.

The nomads had hoped to get support to securitize their region. That did not happen. The leaders of the nomads also visited embassies of the European Union and NGO offices in Bamako, but actions did not follow. They decided then to organize their own self-defence groups. The young men started to join the jihadi groups. Today only the cities (Douentza, Boni) are controlled by the Malian military; the bush is rather volatile and largely controlled by Fulani militias, who in some cases are associated with jihadi groups. Videos from the region that circulate through mobile phones show large groups of young men with motorcycles who prepare for attacks; other videos show what happens after attacks of military camps, displaying the trophies, from cars to heavy weapons. As Fulani are a majority population in the region, they are also the majority in these groups.

Over time, mobile phone transformed into smartphones, which would carry especially Facebook and WhatsApp as channels of communication. Modibo Cissé conducted research on the ways propaganda from these groups affected the (semi) nomadic groups (Cissé 2019). A very important moment was the appearance of the sermons of Hamadoun Koufa, a Fulani Muslim singer, from the Inner Delta of the Niger. Today, he is an ally of 'AlQuaida dans le Magreb', a unit led by a Tuareg group who were part of the incursions in 2012. What is clear is that the Fulani nomads also receive these sermons and preaching in their phones. Hamma Koufa directs his attention to Fulani and, for instance, speaks about the marginalization of the Fulani in the Malian state.

In this case, we have seen the mobile phone appropriation by semi-nomadic Fulani who have joined a violent conflict that was based on historical realities, a narrative that was politicized via social media channels. We could refer to this as discursive warfare. The question remains: how do social media and mobile (smart)phones, play a part in a media war that has real effects on the ground?

Discussion and conclusions

The four case studies have represented different dryland dynamics, related to urban transformation, state control, people's livelihoods, and to connectivity histories. We began this chapter with the question how the introduction of new ICTs, and their relation with society, affected the (pastoral) societies in the drylands. It is clear that connectivity in its different forms is a resource, but not only for the inhabitants of the drylands. Important to note is that connectivity is a resource in terms of tax money for the state, income for international companies, and for the NGOs for whom it also means the continuation of their interventions. In the concluding remarks, we will focus on how connectivity is or can be a resource for the population of the drylands, but how its optimal penetration is still a problem.

For all drylands, distance is a concern. The distance between the rural and urban centres also represents a difference in access to State and other services and a distance between social groups; furthermore, the drylands as vast rural areas are not well served with connectivity infrastructure. New ICTs, especially mobile phones, have been able to reduce certain aspects of this distance. Today it is easy and affordable to connect to other regions and people. However, does this new connectivity indeed overcome the distance? For instance, has it led to more access to education, to the market, and to national politics? The app introduced in Kenya has as its main objective to improve connectivity with the market and to supply information in order to produce better. As the case study showed, there are still too many issues hindering its success. In the Negev, we have seen how young women, despite better connectivity, are still excluded simply because the technology is not good enough and is manipulated by those in power. In Mongolia, the attempt to connect through apps was received with enthusiasm and does indeed overcome distance, allowing access to more information; but the cost of using the technology underlying the app is expensive, and despite the bottom-up approach, it is still uncertain whether it will become a lasting success. In central Mali, the presence of new connectivity has led to further marginalization from the centre of recognized power, and there has been a move towards a powerful periphery. Hence, ICTs may turn out not to be powers that bridge the gap between the periphery and the centre, while at the same time they open the possibility for shifts in power relations.

Each of the case studies deals with specific ICTs and their appropriation in society. In the case of the nomads in Mali, the appropriation of mobile phones into their communication ecology was rather smooth. We can say that in this case the mobile phone enhanced mobility, mobilization, and finally organization into a rebellion against the State. Such changes also remind us of the processes of fission and fusion that are characteristic of nomadic society. In the case of the introduction of the apps, another process is at work. The Afriscout app in Kenya is developed by outsiders who have specific ideas about the needs of the pastoralists in drylands: the recipients are low-tech, marginal, and need to be developed. However, dryland communities have gone through multiple changes, similar to the case of communities elsewhere, and we should not get fixated on

the image of a low-tech society (Hahn 2021a, 2021b; Waters Bayer and Bayer n.d.). Blinded by this image, the app developers overlook existing knowledge, skills, and ways of doing. Finally, the question is this: who will be benefitting from such technology—especially also when it has to be paid for? Costs are also hampering the acceptance of the 'development' app in Mongolia, despite its participatory development, and the early enthusiasm of the pastoral communities involved.

Central to an understanding of the 'working' of ICTs is the way they can be accessed. The example of the young Bedouin women in the Negev is a case in point. Although in principle they should be able to access the online systems freely, in practice they cannot. This case illustrates how the digital divide reflects the Israeli government regime. The access, skills, and participation gaps are part of a politics of marginalization. The strong Israeli state clearly has its own appropriation and control of digital communication technology. It can be interpreted as an extension of the deeper conflict, and hence a weapon in that war. Here, political conflict is translated into denial of access to internet services for those who are not in power. The technology then becomes a way to exclude people even more. This raises an important question: if we consider ICTs as a resource, for whom is it a resource? Who controls the access and the development of these technologies after all? Also, in the case of geo-app development, there is an important access question to be raised. In Kenya—and in Mali, for instance, where similar apps are introduced— pastoralist economies are diverse. There are extremely rich pastoralists who can afford to keep their animals in place (ranching) or those who live with their cattle/ animals for a family living. The rich may profit much more from such geo-apps than their poorer neighbours do, and hence apps can increase existing inequalities and give more power to the few 'modernizing' pastoralists in the drylands.

(New) ICTs are certainly a resource, and they offer multiple possibilities with their communication and information functions. The benefits of communication over long distances, the simple function of voice calls, do make the pastoralists from the drylands more aware of their situation, and this may open the possibility to give them more voices in decision-making about the drylands—even if the politics of the State are against it. However, those who represent the drylands in these voices will still be those who have access to the ICTs, and who define power relations.

Notes

1 The authorship follows alphabetical order from the third author. Annemiek Pas and Bilal Butt did the Kenya case, Troy Sternberg and Qian Zhang did the Mongolia case, Nurit Hashimshony-Yaffe and Hama Abu-Kishk did the Israel case, and Mirjam de Bruijn did the Mali case.
2 PCI, based in the USA, is dedicated to preventing disease, improving community health, and positive community development.
3 https://www.pciglobal.org/AFRISCOUT/ [Accessed 3 November 2020].
4 Accessed 2 December 2020.
5 http://stisolutions4sdgs.globalinnovationexchange.org/innovations/afriscout [Accessed 2 December 2020].

6 http://stisolutions4sdgs.globalinnovationexchange.org/innovations/afriscout [Accessed 2 December 2020].

7 https://divportfolio.org/resources/seeking-greener-pastures-will-kenya-s-rural-pastoralists-pay-for-digital-satellite-powered-maps [Accessed 2 December 2020].

8 https://globalcommunities.org/pci-archives/afriscout-app-debuts-in-washington-dc/ [Accessed 4 April 2022].

9 Perhaps the app would have been appreciated somewhat differently if it had followed a participatory development process similar to that of the app described in the Mongolia case (this chapter).

10 SAPARM: Finding green pastures thanks to satellite data. Available online at: https://www.eurisy.eu/stories/saparm-finding-green-pastures-thanks-to-satellite-data_174/?__GP_URL__=saparm-finding-green-pastures-thanks-to-satellite-data_174 [Accessed 29 January 2021].

11 Negev (a desert region in the south of Israel) is the Hebrew term for Arabic *Naqab*, the term used by the Bedouins.

12 Unrecognized villages are those not built by the state and are therefore illegal settlements. For more details see http://www.dukium.org/wp-content/uploads/2014/06/DINSC_JAN_2017_HEB-print.pdfAnd:https://www.dukium.org/the-arab-bedouin-community-in-the-negev-nagab-a-short-background/

13 The study contained two stages and applied a mixed methods approach. Mixed methods are used to present a complex picture of reality (Greene 2007; Shorten and Smith 2017). The first stage included two background interviews and semi-structured interviews with female Bedouin students. The interviews provided us with the preliminary information and served as means to construct an online questionnaire, with 140 respondents. The online questionnaire was distributed in November–December 2020 through education institutions, in WhatsApp groups of women Bedouin students and using the snowball technique (Morgan 2008). All the details are anonymous.

14 I undertook research in the region from 1989, for MA and PhD theses, and later as a post-doc. Later I headed various research programmes in the region. I also published, together with Han van Dijk, an ethnography of the Fulani in this region (de Bruijn and van Dijk 1995).

15 Blog post: https://mirjamdebruijn.wordpress.com/2015/10/12/quest-for-citizenship-of-the-fulbe-seminomads-in-central-mali/comment-page-1/#comment-1344

16 See a video report with a researcher in Mali in which the conflict and the meeting are discussed: https://voice4thought.org/watch-online-hopeless-biographies-of-radicalization/

References

Abu-Kaf, G., Schejter, A. and Jafar, M.A. (2019). The Bedouin divide. *Telecommunications Policy* 43(7): 101810.

Abu-Kishk, H. and Mendels, J. (2020). *Attempting to connect: Digital divide and distance learning among Bedouin students during the COVID-19 Crisis.* [Hebrew]. Israel: Sapir Academic College and MOFET Institute.

Agel, J. (ed.) (1996 [1967]). *The medium is the massage: Marshall MacLuhan and Quentin Fiore.* London: Penguin.

Alhuzail, N.A. (2014). 'The blessing' in the lives of three generations of Bedouin women. *Affilia - Journal of Women and Social Work* 29(1): 30–42.

Alhuzail, N.A. (2018). A place of many names: How three generations of Bedouin women express the meaning of home. *Journal of Housing and the Built Environment* 33(2): 247–262.

Barnes, A.N., Baasandavga, U., Davaasuren, A., Gonchigoo, B. and Gray, G.C. (2020). Knowledge and practices surrounding zoonotic disease among Mongolian herding households. *Pastoralism* 10(1): 1–14.

Bon, A. and Akkermans, H. (2014). *Rethinking technology, ICTs and development: Why it is time to consider ICT4D 3.0*. Amsterdam: VU Amsterdam WR4A.

Butt, B. (2015). Herding by mobile phone: Technology, social networks and the 'transformation' of pastoral herding in East Africa. *Human Ecology* 43(1): 1–14. https://doi.org/10.1007/s10745-014-9710-4.

Butt, B. (2016). Conservation, neoliberalism, and human rights in Kenya's arid lands. *Humanity: An International Journal of Human Rights, Humanitarianism, and Development* 7(1): 91–110.

Castells, M. (2002). *The internet galaxy: Reflections on the internet, business, and society*. Oxford: Oxford University Press on Demand.

Castells, M. (2009). *Communication power*. Oxford: OUP.

Cissé, M.G. (2019). Hamadoun Koufa: Spearhead of radicalism in Central Mali. In de Bruijn, M. (ed.) *Biographies of radicalisation: Hidden messages of social change*. Berlin: De Gruyter Oldenbourg.

Cormack, Z. and Kurewa, A. (2018). The changing value of land in northern Kenya: The case of Lake Turkana Wind Power. *Critical African Studies* 10(1): 89–107.

Dafoe, A. and Lyall, J. (2015). From cell phones to conflict? Reflections on the emerging ICT—political conflict research agenda. *Journal of Peace Research* 52(3): 401–413.

Davis, D.K. (2016). *The arid lands: History, power, knowledge. History for a sustainable future*. Cambridge, MA: The MIT Press.

De Bruijn, M. (2014). Connecting in mobile communities. *Media, Culture & Society* 36(3): 319–335. https://doi.org/10.1177/0163443714521088.

De Bruijn, M., Amadou, A., Lewa Doksala, E. and Sangaré, B. (2016). Mobile pastoralists in Central and West Africa: Between conflict, mobile telephony and (im)mobility: -EN- -FR- Les pasteurs nomades en Afrique centrale et de l'Ouest : entre conflits, téléphonie mobile et (im)mobilité -ES- Los pastores nómadas en África Central y Occidental: entre conflicto, telefonía móvil e (in)movilidad. *Revue Scientifique et Technique de l'OIE* 35(2): 649–657. https://doi.org/10.20506/rst.35.2.2546.

De Bruijn, M. and Brinkman, I. (2018). Mobile phone communication in the mobile margins of Africa: The 'communication revolution' evaluated from below. In Mutsvairo, B. (ed.) *The Palgrave handbook of media and communication research in Africa*. pp. 225–241. Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-70443-2_13.

De Bruijn, M.E. and van Dijk, J.W.M. (1995). *Arid ways : Cultural understandings of insecurity in Fulbe society, Central Mali*. CERES 1. Wageningen: Thela Publisher Amsterdam. https://openaccess.leidenuniv.nl/handle/1887/9333.

Debsu, D.N., Little, P.D. Tiki, W., Guagliardo, S.A.J. and Kitron, U. (2016). Mobile phones for mobile people: The role of information and communication technology (ICT) among livestock traders and Borana pastoralists of southern Ethiopia. *Nomadic Peoples* 20(1): 35–61. https://doi.org/10.3197/np.2016.200104.

Degnbol, P., Gislason, H., Hanna, S., Jentoft, S., Nielsen, J.R., Sverdrup-Jensen, S. and Wilson, D.C. (2006). Painting the floor with a hammer: Technical fixes in fisheries management. *Marine Policy* 30(5): 534–543.

Diener, A.C. and Batjav, B. (2019). Axial development in Mongolia: Intended and unintended effects of new roads. *Mobilities* 14(6): 778–794.

Duncombe, R. (2018). *Digital technologies for agricultural and rural development in the Global South*. CABI.

Elliott, H. (2016). Planning, property and plots at the gateway to Kenya's 'new frontier'. *Journal of Eastern African Studies* 10(3): 511–529. doi:10.1080/17531055.2016.1266196.

Elmi, M. and Birch, I. (2013). Creating policy space for pastoralism in Kenya: Future agricultures consortium. Future Agricultures Working Paper 068. Brighton, UK. 1–28.

Eshet-Alkalai, Y. (2004). Digital literacy: A conceptual framework for survival skills in the digital era. *Journal of Educational Multimedia and Hypermedia* 13(1): 93–106.

Galaty, J.G. (2016). Boundary-making and pastoral conflict along the Kenyan–Ethiopian borderlands. *African Studies Review* 59(1): 97–122. doi:10.1017/asr.2016.1.

Ganayem, A.N. (2018). Internet within the Arab society in Israel [Hebrew]. https://www.isoc.org.il/wp-content/uploads/2018/12/isoc-il-asma-ganaim.pdf.

Greene, J.C. (2007). *Mixed methods in social inquiry* (Vol. 9). Edison, NJ: John Wiley & Sons.

Gumede, W. (2016). Rise in censorship of the internet and social media in Africa. *Journal of African Media Studies* 8(3): 413–421. https://doi.org/10.1386/jams.8.3.413_7.

Gumede, W. (2018). How new technologies boost democracy and development in Africa. *Journal of African Media Studies* 10(1): 135–144. https://doi.org/10.1386/jams.10.1.135_7.

Gustafsson, J., Ngomba, T.J. and Nielsen, P.E. (2019). New media and processes of social change in contemporary Africa. *Journal of African Media Studies* 11(2): 125–141. https://doi.org/10.1386/jams.11.2.125_2.

Hahn, A. (2018). Mongolia's 2015 referendum via text messaging: Engaging rural and nomadic citizens in public screen deliberation. *International Journal of Communication* 12: 4379–4400.

Hahn, A. (2020). Nomadic digital ethnography and engagement. *Nomadic Peoples* 24(2): 299–311.

Hahn, A. (2021a). ICT development for mobile communities. In Hahn, A.H. (ed.) *Media culture in nomadic communities*, pp. i, 23–54. Amsterdam: Amsterdam University Press.

Hahn, A. (2021b). *Media culture in nomadic communities*. Amsterdam: Amsterdam University Press. https://doi.org/10.5117/9789463723022.

Hishigsuren, G. (2006). Information and communication technology and microfinance: Options for Mongolia (No. 42). ADBI Discussion Paper.

ITPTA. (2016). 2016 White Paper: ICT Development of Mongolia. ITPTA. https://cita.gov.mn/wp-content/uploads/2015/06/KHARILTSAA_KHOLBOO_TAILAN_ENGLISH.pdf.

Jackson, S. L. (2015). Dusty roads and disconnections: Perceptions of dust from unpaved mining roads in Mongolia's South Gobi Province. *Geoforum* 66(November): 94–105. https://doi.org/10.1016/j.geoforum.2015.09.010.

Johnson, C.A., Ariunaa, L. and Britz, J.J. (2005). Constructing the pillars of a knowledge society: The challenge of providing access to ICTs in rural Mongolia. *Libri* 55(4). https://doi.org/10.1515/LIBR.2005.216.

Joniak-Lüthi, A. (2020). A road, a disappearing river and fragile connectivity in Sino-Inner Asian borderlands. *Political Geography* 78(April): 102122.

Keita, N., Magassa, S., Sangaré, B., and Ag Rhissa, Y. (2015). *Téléphonie et mobilité au Mali*. Mankon: Langaa Research and Publishing Common Initiative Group.

Keja, R., Amadou, A. and de Bruijn, M. (2020). (Dis)connectivity and the invisibility of mobile Fulani in West Africa. In Bjarnesen, J. and Turner, S. (eds) *Invisibility in African displacements*. Africa Now, pp. 199–215. London: ZED Books.

Kingsley, P. (2017). Nomads no more: Why Mongolian herders are moving to the city. *The Guardian*. theguardian.com/world/2017/jan/05/mongolian-herders-moving-to-city-climate-change.

Kochore, H. (2016). The road to Kenya? Visions, expectations and anxieties around new infrastructure development in northern Kenya. *Journal of Eastern African Studies* 10(3): 494–510. doi:10.1080/17531055.2016.1266198.

Lecocq, B., Mann, G., Whitehouse, B., Badi, D., Pelckmans, L., Belalimat, N., Hall, B. and Lacher, W. (2013). One hippopotamus and eight blind analysts: A multivocal analysis of the 2012 political crisis in the divided Republic of Mali. *Review of African Political Economy* 40(137): 343–357.

Lev-On, A., Steinfeld, N., Abu-Kishk, H. and Naim, S.P. (2020). The long-term effects of digital literacy programs for disadvantaged populations: Analyzing participants' perceptions. *Journal of Information, Communication and Ethics in Society* 19(1). https://doi.org/10.1108/JICES-02-2020-0019.

Lind, J., Okenwa, D. and Scoones, I. (2020). *Global investment in dryland eastern Africa has accentuated inequalities and social difference.* LSE Research online. http://eprints.lse.ac.uk/id/eprint/107161

Machado, E.A., Purcell, H., Simons, A.M. and Swinehart, S. (2020). The quest for greener pastures: Evaluating the livelihoods impacts of providing vegetation condition maps to pastoralists in eastern Africa. *Ecological Economics* 175: 106708.

McCarthy, C., Shinjo, H., Hoshino, B. and Enkhjargal, E. (2018). Assessing local indigenous knowledge and information sources on biodiversity, conservation and protected area management at Khuvsgol Lake National Park, Mongolia. *Land* 7(4): 117.

Meir, A. (1997). *As nomadism ends: The Israeli Bedouin of the Negev.* Philadelphia, PA: Westview Press.

Miller, D. (2018). Digital anthropology. In Stein, F., Candea, M., Lazar, S., Diemberger, H., Robbins, J., Stasch, R. and Sanchez, A. (eds) *Cambridge encyclopedia of anthropology.* https://doi.org/10.29164/18digital.

Morgan, D. L. (2008). Snowball sampling. In Given, L.M. (ed.) *The SAGE encyclopedia of qualitative research methods*, Vol. 1–2, pp. 815–816. Newbury Park, CA: SAGE Publications.

Mosley, J. and Watson, E.E. (2016). Frontier transformations: Development visions, spaces and processes in Northern Kenya and southern Ethiopia. *Journal of Eastern African Studies* 10: 452–475.

Pas, A., (2018). Governing grazing and mobility in the Samburu lowlands, Kenya. *Land* 7(2): 41.

Sangaré, B. (2016). *Le centre du Mali, épicentre du Djihadisme?* Bruxelles: GRIP.

Sangaré, B. (2019). 12. Central Mali: Toward a Fulani question? In de Bruijn, M. (ed.) *Biographies of radicalization*, pp. 174–193. Berlin: De Gruyter Oldenbourg.

Schejter, A. and Lee, S. (2007). The evolution of cable regulatory policies and their impact: A comparison of South Korea and Israel. *Journal of Media Economics* 20(1): 1–28.

Seid, M.A., Yoseph, L.W., Befekadu, U.W., Muhammed, A. and Fikre, T.Z (2016). Communication for the development of pastoralism: -EN- -FR- La communication au service du développement du pastoralisme -ES- Comunicación al servicio del desarrollo del pastoreo. *Revue Scientifique et Technique de l'OIE* 35(2): 639–648. https://doi.org/10.20506/rst.35.2.2545.

Shorten, A. and Smith, J. (2017). Mixed methods research: Expanding the evidence base. *Evidence Based Nursing* 20(3):74–75. https://doi.org/10.1136/eb-2017-102699.

Sijsma, S. and de Bruijn, M. (2019). *Hopeless, biographies of radicalization.* Documentary, Voice4thought,https://voice4thought.org/watch-online-hopeless-biographies-of-radicalization/.

Sijsma, S. and de Bruijn, M. (2019). *Hopeless/sans espoir, un documentaire de la recherche CTD.* https://www.voice4thought.org/watch-online-hopeless-biographies-of-radicalization/.

Sternberg, T. (2018). Investigating the presumed causal links between drought and Dzud in Mongolia. *Natural Hazards* 92(S1): 27–43.

Sternberg, T., Ahearn, A., and McConnell, F. (2020). From conflict to a Community Development Agreement: A south Gobi solution. *Community Development Journal* 55(3): 533–538. https://doi.org/10.1093/cdj/bsz018.

Sternberg, T. and Chatty, D. (2016). Marginality, climate and resources in pastoral rangelands: Oman and Mongolia. *Rangelands* 38(3): 145–151.

Sternberg, T., Rueff, H. and Middleton, N. (2015). Contraction of the Gobi Desert, 2000–2012. *Remote Sensing* 7(2): 1346–1358.

Tinga, T.M., Murphy, P.D. and Sessou, E. S. (2020). ICTs, environmental activism and community mobilization in Senegal, Kenya and South Africa. In Díaz-Pont, J., Maeseele, P., Egan Sjölander, A., Mishra, M. and Foxwell-Norton, K. (eds) *The local and the digital in environmental communication*, pp. 129–149. London: Palgrave Macmillan. https://doi.org/10.1007/978-3-030-37330-6_7.

Tsolmondelger, O. (2019). Research report on ICT infrastructure co-deployment with transport and energy infrastructures in Mongolia (draft). UN ESCAP. https://www.unescap.org/sites/default/files/Research%20Report%20on%20ICT%20infrastructure%20Codeployment%20%20with%20Transport%20and%20Energy%20Infrastructures%20in%20Mongolia.pdf [Accessed 6 October 2020].

Unwin, T. (2009). *ICT4D: Information and communication technology for development.* Cambridge: Cambridge University Press.

van Deursen, A.J.A.M. and Helsper, E.J. (2015). The third-level digital divide: Who benefits most from being online?, *Communication and information technologies annual.* (Studies in Media and Communications, Vol. 10), Bingley: Emerald Group Publishing Limited, pp. 29–52. https://doi.org/10.1108/S2050-206020150000010002.

Van Dijk, J.A.G.M. (2005). *The deepening divide: Inequality in the information society.* New York: Sage Publications.

Van Doodewaard, M. (2004). Mongolia: Who bridges the digital divide. *IIAS Newsletter* 33: 12–12.

Waters Bayer, A. and Bayer, W. (n.d.). Pastoralists in the 21st century: 'Lo-tech' meets 'hi-tech'.

Waweru, P. (2012). *Continuity and change in Samburu pastoralism: Under colonial rule, c. 1909–1963*, p. 292. Saarbrücken: LAP, Lambert Academic Publishing.

Weidmann, N.B. (2015). Communication, technology, and political conflict: Introduction to the special issue. *Journal of Peace Research* 52(3): 263–268. https://doi.org/10.1177/0022343314559081.