

# Radio via mobile phones: the intersecting logics of media technologies in Ghana

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## Abstract

This article argues that the material history of mobile phones as they took shape in Ghana reveals them to be essential parts of radio's infrastructure; one that is social, informal, and transnational. Using the radio tuning feature on mobile phones as an emblematic device, this article unpacks the sociotechnical infrastructure underpinning radio's continued dominance in Ghana, revealing the intersecting logics that help to sustain the media technology landscape in the country.

## Keywords

Africa, China, Ghana, media technologies, mobile phones, radio

## Introduction

In Ghana in early 2016, electric power often went out as the country was experiencing what was known locally as *dumsor* – a power load shedding exercise by the Ghana Electricity Corporation.<sup>1</sup> When this happened, either a diesel-powered generator would come on, reserved power from solar panels would keep some key appliances on, or a handheld torchlight or even a candle would light up in homes across the country. I often tuned a Huawei Ascend Y330 mobile phone into a local radio station, which provided entertainment when reading or watching a screen was not possible. Bought in Ghana, the Huawei Y330 was a midrange phone that had features as capable as another phone I had at the time – a Samsung S6 bought in the United States. While boasting a great camera, fingerprint reader, among other 'state of the art' features, the Samsung cost approximately six times the Huawei when it was first released, and yet could not tune into FM

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signals and required Internet data to listen to radio. The ‘top of the line’ phone ceased to be of importance during the breakdown of infrastructure and the lower quality phone became an indispensable tool.

In Ghana, as elsewhere, mobile phones permeate all aspects of communicative life, but radio is similarly ubiquitous. Both the commercial radio and mobile industries emerged out of the same moment of liberalization in the 1990s and have been intertwined through industry practices and regulation. From the onset, FM radio was associated with the mobile in ways that shaped the culture of outspokenness on the airwaves (Avle, 2011; Coker, 2012). Joy FM, Ghana’s first non-state-owned station, included call-ins from its early days, even when at the time landlines were the most available phone technology, used by bureaucrats at work and upper middle-class families at home (Avle, 2011). Within a relatively short period (about the span of a decade), mobile phones had replaced landlines as the technology for making and receiving calls. This was enabled in part by introducing competition into the phone carrier market and decoupling mobile services from the devices people used, a point that will be elaborated on below. Owning and using a mobile phone thus progressively got more affordable, and radio call-ins over time took on a somewhat more democratic character as a more diverse audience became visible through their on-air interactions (Coker, 2012). Today, most radio programming, including news, across the gamut of station types (community, commercial, etc.) feature a call-in segment, making phone calls an integral aspect of the radio experience for listeners and for those producing the content in the studio.

Generally, automobile and transistor radios, boom boxes, PA systems, and other more traditional radio tuning devices continue to provide access to radio content in Ghana. More recently, however, mobile phones (both smart and ‘dumb’ aka ‘yams’ in Ghana) have become just as important, or perhaps even more so, given their ubiquity and personalized affordances. It is now taken for granted that cell phones have radio tuning capabilities, even for the more expensive phones that are data enabled and have higher quality components. Tuning into radio is as simple as plugging in earphones to function as antennae. This capability is as common as other design features missing in phones used in the global north, for instance, dual (sometimes triple) SIM card slots, live TV tuning, preinstalled Facebook or WhatsApp, and so on. The particulars of why radio tuning is common on phones emerges out of what might be called the intersecting logics of the mobile phone and radio industries. By logics, I mean the heterogeneous processes and events, specifically regulation, industry norms, and the transnational flow of technology design and production, that together helps make radio a mundane yet essential medium in Ghana today.

Radio tuning capabilities are built into most mobile phone modems such as the Qualcomm LTE that go into all kinds of phones today (Glaser, 2016). However, this feature is turned off in some of the markets in the global north, such as in the United States. Broadcasting groups like the National Association of Broadcasters in the United States have lobbied to get mobile companies to turn these capabilities on. Some carriers, like T-Mobile, have acquiesced to such demands, but with limitations; for instance, only offering on some Android phones (Bowman, 2015; Venta, 2015). On the surface, this appears to simply reflect market preferences, yet such ‘preferences’ emerge out of a mix of social practices, regulatory parameters, and political work by certain actors. That is,

the sociotechnical formations upon which both the designs of the technology and the practices around them rest are mutually constituted (Bijker, 1995). Below, I detail three seemingly disparate sets of events that together help make sense of how radio tuning became a default feature for phones in places like Ghana. I consider internal regulatory and industry dynamics alongside broader shifts in global supply chains, specifically the growth of the Chinese electronics industry and its focus on global south markets. I argue that these phenomena work as crucial turns in the material histories of both mobile phones and radio, the former molding into the infrastructure of the latter.

## **Intersecting logics of radio and mobile phones in Ghana**

### *From mandated sharing to voluntary collaborations*

The current telecoms market in Ghana is organized by a liberalization logic that was first implemented in the 1990s, whereby the state-owned infrastructure was divested into private hands. The records of the National Communication Authority (NCA), which regulates the telecommunications sector, show that since that time, the number of radio authorizations have steadily increased and as of December 2018, there were 398 radio stations operating in the country, about 90% of which are commercial (NCA, 2018). The Greater Accra region alone, with a land size of 71.43 sq. miles and a population of about 2.5 million people, had 51 radio stations in operation in the last quarter of 2018 (compared to 47 in the last quarter of 2016). In contrast, there were 88 TV stations on air in the fourth quarter of 2018 for the whole country in the same period, showing a massive jump from the 15 that were on air nationwide in the second quarter of 2016.

The NCA mandates infrastructure sharing for TV, radio, and mobile operators in the country (Alliance for Affordable Internet (AfAI) and Vieira de Almeida & Associates SdA, RL, 2016; NCA, 2010). Infrastructure sharing, especially tower sharing, is not unusual in telecoms and is a practice found in as diverse markets as the United States and India. However, in Ghana, sharing is mandated in ways that pushed companies across telecommunications and media to work together. The NCA seeks evidence that all reasonable attempts have been made to share infrastructure, particularly towers, and operators are required to give access if asked. This means that for the most part, the NCA wants more than one company per tower and has been steadily increasing that through this rule since 2012. The NCA has argued that infrastructure sharing is the most efficient way to address economic, environmental, and aesthetic concerns about erecting telecoms towers, particularly in urban areas (NCA, 2010). It views tower sharing (for instance, co-locating radio antennas and cell phone receivers on the same tower) as one such efficient outcome of mandated infrastructure sharing. This means that radio and mobile operators, where applicable, already had an operational incentive to work together.

Take, for instance, Vodafone's tower sharing with Citi FM that started when the latter began broadcasting in 2004. The mobile phone company used Citi's tower, erected on its small compound in Accra to expand their network in the densely populated area of Accra that Citi is located in.<sup>2</sup> Over the next 15 plus years, this tower sharing partnership would hold and the two companies would go on to closely collaborate through event sponsorships. Most recently, they have collaborated at events associated with tech development

like hackathons, in which the mobile operator outsources some basic tech work to a growing cadre of tech savvy youth in Accra, while the station benefits from stories for its business and entrepreneurship series.<sup>3</sup> There are plenty of examples online of joint activities by the two firms. Essentially then, by enforcing that a radio station like Citi FM work with a mobile provider like Vodafone, the NCA laid the foundation for bringing two firms in different industries to work together.

### *Decoupling mobile device and service*

Unlike, for instance in the United States, where one gets their phone from a mobile carrier, mobile carriers in Ghana do not tether service to specific devices. All phones come ‘unlocked’, meaning users can insert their own SIM cards from whatever carrier they choose. Early responses to this separation between handsets and service include switching out multiple SIM cards from different networks to maximize call cost reductions that came from making same-network calls. Such ‘smart consumption’ practices (Sey, 2011) were the norm until the costs of cross-network calls went down. However, rather than doing away with multiple SIMs as a result of lower call costs, Ghanaian consumers still typically kept multiple cards to take advantage of various call and data bundles offered by the different network. Over time, the market for devices also changed to provide phones that can hold multiple cards (more on this later) and so the norm of consumers holding multiple phone numbers persists to this day.

More importantly, the decoupling of provider and phone device, as well as the competitive nature of selling to a relatively poorer population reduced the likelihood of phone service providers dictating the terms of use for any device. This is important for understanding why radio tuning is common in Ghana and not in, say, the United States. If a carrier has control over what features to enable in placing phone orders from their manufacturing source the way the largest American carriers do, they will seek to maximize features that give them the most revenue. So, for example, given the relative higher price of data services to calls and text in the United States, carriers largely disable anything (like FM tuning capabilities) that can compete with data services (which can provide radio service through streaming). Thus, it becomes impossible to tune directly into the actual waves of any radio station’s frequency from one’s phone. In Ghana, having no control over what features users have on their phones forces service providers to be creative in finding alternate ways of generating profit rather than colluding on particular services. This often ends up with a fair amount of experimentation with promotions and value added services (VAS) through short codes, corporate sponsorships to build brand loyalty, and so on (Avle et al., 2018). These sorts of activities require heavy engagement with media to keep their brands in-front of users and radio, having the most reach in Ghana, is where one hears about new mobile service promotions.

The more relevant outcome of this decoupling of service and device is that it invites or opens up device design and production possibilities to fit other demands of the consumer market than carrier-imposed restrictions. This means phone producers design to the direct demands of users, without an intermediary or ‘middle man’ (other than the retailer, who typically does not dictate the terms of design). The constancy of radio tuning across different generations and styles of mobile phones over the years, points to a

high demand for the feature from customers in the market. Below, I examine the design ecology that supplies phones specifically designed for African markets and the role that this plays in expanding the uses and features of mobile phones such as radio access beyond those favored by global north markets.

### *Transnational flows: from Shenzhen to Accra*

The global ubiquity of mobile phones of all types is in part thanks to two different design and access logics: the (perceived) ‘center’ of Silicon Valley and its high-end target markets and the south of China (specifically Shenzhen) where the bulk of the world’s electronics, including those designed in Silicon Valley, are manufactured. The Shenzhen area, which initially was described as a site for producing fakes (*shanzhai* 山寨), has evolved into a hub of production known for rapid prototyping, niche design, and what might be thought of as ‘manufacturing as a service’ to meet global demand (Lindtner et al., 2015; Wong, 2017; Yang, 2015). Shenzhen’s electronics ecosystem, which relies on open innovation and collaboration, produces electronics in small batches so that quick redesigns based on market response are common. Initially targeting the migrant workers within Shenzhen who could not afford the electronics they were producing for overseas markets, these products now target customers of various economic abilities around the world, including the poorest in low-income countries like Ghana. Across Africa and other parts of the global south, Shenzhen’s phones appeared very much in tune with their target markets, often down to the lowest rung of the economic ladder and to the most niche of phone users. When a particular product does well, Shenzhen produces more. Similarly, if a product does not sell well, production shifts accordingly. In the past decade, a number of producers have started branding and listening even more closely to their customers to keep producing devices with features that are in high demand in Africa, Asia, and the Middle East. My research in Shenzhen and Accra in 2017 and 2018 revealed producers eager to cater to the global south.<sup>4</sup>

The responsiveness of phone makers to customer needs means that Shenzhen both shapes and is shaped by demand from ‘far away’ markets like Accra. Throughout the past decade, almost all phones that have had success in Ghana have maintained a number of features in response to demand: longer battery life, multiple SIM cards, flashlight, and radio tuning. All are required to suit the flexibility of the mobile service provision in the country, and to keep life going when electricity supply fluctuates in order to keep the phone going as long as possible. In the past few years, a few brands have emerged out of the *shanzhai* production system and have started investing in branding to build loyalty and gain more customers.

X-Tigi, for instance, was one of the companies that made ‘powerbank/army/soldier phones’, named because of their bulky and retro form factor that accommodated extra batteries, during *dumsor* in Ghana. At the time (in 2016), the company had no visible brand presence in Ghana and online searches for the label did not generate any results in English. By spring 2017, X-Tigi had a brand-new website on which it described itself as an ‘international multicultural company which designs, develops, and markets globally a growing range of mobile devices’, one that creates products for their ‘X-fans’: ‘We incorporate their feedback into our product range . . . [and] in the past ten years, with

more than 30 million handsets sold in Africa . . . we set Africa as our key market in our industry strategy' (x-tigi.com, 2019). X-Tigi positioned Africa as a central market in its bid for global expansion, having discovered a neglected segment whose consumer demands are not unlike the migrant populations in Shenzhen that *shanzhai* designers initially made products for (Lindtner et al., 2015). The website claims that 'the Africa market will always be its significant business journey in the global expansion' [sic] and in line with that, features black models and news updates from Africa prominently on the website. As is common practice, X-Tigi is listed as a Hong Kong company but leverages the well oiled *shanzhai* system and indeed the production culture of "fakes" and "reverse engineering" that has "metastitized" throughout Shenzhen (Wong, 2017).

Tecno Mobile also changed its focus to Africa in 2008 and dramatically ramped up marketing to make their blue and white logo highly visible and recognizable across African cities, from Accra to Addis Ababa.<sup>5</sup> Tecno in particular has been adept at turning insights from its African customers into features at a pace and prices that the likes of Apple and Samsung are unable to keep up with, even if they wanted to.<sup>6</sup> When it released its then flagship smartphone, Camon C8 in 2016, the company highlighted the camera's specific ability to take quality shots of dark-skinned subjects in low lighting (Avle and Lindtner, 2016). It may not appear as a major point of functionality but anyone with dark skin who has attempted to take a photo at night or in low light settings with a smartphone such as the iPhone will comment on how tricky that used to be. Tecno focused on enhancing their phone cameras to resolve that very particular challenge based on market research on university campuses in sub-Saharan Africa, including Ghana. Operations routinely pair local talent with Chinese staff to continually feed market insights into the design and production process.

Other Chinese brands like Huawei maintain a similar presence and the mobile phone market now belongs to Chinese and Korean brands, where a decade ago, they belonged to European and American ones. By taking the low-income consumer as focus and leveraging a production style that evolved over the years since China's opening up in the 1980s, mobile phone design and features have become tightly coupled with the social milieu that they are sold in, with radio tuning a stable one throughout various iterations that have included but since lost things like TV tuning. The X-Tigi (and other similar) soldier phone changed form and functionality to meet a short-term crisis in Ghana, notably in a period when sleek smart phones were on the rise, and was rewarded with an expanded customer base (Quartey, 2015).

## Discussion

Radio continues to be a dominant medium and social institution in Ghana, as elsewhere in Africa (Avle, 2011; Chiumbu and Ligaga, 2013; Coker, 2012; Mare, 2013; Mudhai, 2011; Willems, 2013). The heavy concentration of radio, particularly in urban areas, and the culture of public listening have made radio a part of the everyday soundscape of Ghana. Mobile phones have achieved ubiquity in Ghana and are now indispensable for keeping connected to radio, as much as they are for interpersonal talk and online connectivity. A social understanding of radio's infrastructure (Star and Bowker, 2006) includes the ways that people access and engage with radio in an environment in which radio is considered a part of the broader public culture.

As infrastructures become visible upon breakdown (Star, 1999; Star and Bowker, 2006), so too the things that provide stop-gap support in those moments of breakdown. Electricity blackouts in Ghana made radio visible as a social infrastructure upon which daily routine relies on. Scenes of people gathering around battery powered radio in rural Ghana where electricity is more scarce were replayed in urban settings, this time with people plugging headphones into their mobile phones to listen to their favorite station. To minimize the disruption of blackouts, Ghanaians turned to a trusted routine of radio listening made accessible by a device meant primarily for other uses. In this way, mobile phones became important devices upon which radio, in all its mundaneness, remain crucial to the everyday in Ghana.

Infrastructure ‘never stands apart from the people who design, maintain, and use it’ (Star and Bowker, 2006: 152), and looking at where radio tuning on mobile phones stands situates Ghana’s radio infrastructure within the transnational production of electronics. By building on social practices in Ghanaian society around radio, companies in the south of China capitalized on an ecosystem built from providing contract work for global north firms and transformed it into a flexible and responsive industry for keeping life going, in moments both mundane and exceptional for local migrants and subsequently to markets in the global south. During the *dumsor* crisis in 2015 and 2016, the ‘power bank/soldier/army phone’ appeared from China as a stop-gap technology to accommodate other aspects of contemporary life in Ghana. These phones came with extra batteries that not only powered phones longer but also had extra USB ports to charge other small electronics (perhaps other phones), featured LED lights to act as flashlights, had slots for multiple SIM cards to accommodate social norms, and more relevant to this article, maintained the functionality to tune into FM radio (Quartey, 2015). Despite their bulky form factor, and seemingly retro design, these phones became popular and gave little known *shanzhai* brands, such as X-Tigi, a foothold in the market that was already seeing the likes of Tecno making inroads into the larger African market.

The global circulation of ‘Made in China’ phones in some ways opened up possibilities beyond the world of the perpetually digitally connected (smart) phone that underlies much of the research on mobile phone uses (Farman, 2017; Houston and Jackson, 2016; Jackson and Kang, 2014; Lindtner et al., 2015; Yang, 2015). Despite claims of interest in the so-called ‘bottom of the pyramid’ (Prahalad, 2006), much of the developments in smart phone technology and associated services from Silicon Valley assume a universally connected user who has access to certain infrastructure (like uninterrupted electricity, affordable Internet, etc.). However, the majority of the world in the global south does not fit what has been named the ‘WEIRD (Western, educated, industrialized, rich, and democratic) populations’ that most behavioral science and tech industry research rests (Henrich et al., 2010). The inability to respond quickly and flexibly to global south consumers is in part responsible for the decline of companies like Nokia, Motorola, and Ericson that once dominated the phone market in the first decade of mobile phone expansion around the global south. Of course, other reasons such as high costs of production might very well have been crucial to the shift away from European and American brands, but the expansion of the Chinese technology ecosystem beyond contract relationships into original production for ‘the rest’/majority world plays a key role in these developments.

These informal shifts in design and production practice were accompanied by more structured, formal policies at the transnational level. Within Ghana, formal rules laid out by the NCA formed part of the heterogeneous processes that gave way to the current media technology landscape in Ghana. Its mandated rules that required entities that needed towers to share them, essentially set the scene for other collaborations. Radio, television, and mobile providers need not extend their tower sharing beyond what the NCA requires, but over time, these relationships evolved into long-term partnerships for some of these companies. Its infrastructural requirements codified collaboration and set the stage for media and telecommunications firms to co-habit.

Outside of crises such as power outages, however, mobile phones (and radio for that matter) easily fade into the background and become mundane and taken-for-granted. This is in part due to their ubiquitous presence and the ease with which they fit into the everyday (Ling, 2012). No one entity owns or directs Ghana's radio infrastructure, it is transnational and multisited (Horst, 2013; Star, 1999), relying on mobile phones to embed the radio culture more deeply by providing constant radio access, even in moments of breakdown and crisis. The material histories of media technologies are thus heterogeneous and intertwined with their institutional and social histories.

Altogether, these seemingly disparate aspects of the media and telecommunications industry in Ghana show the interrelated logics of regulation, sociocultural norms, media practices, and transnational markets in a media technological landscape. There are political dimensions that deserve attention beyond the scope of this article. For instance, what does it mean when radio's infrastructure is made up of mobile phone design and practices within contemporary geopolitics where Chinese technology and influence appear to be constantly shifting? Future work might also consider the work of the human infrastructures (Dye et al., 2018) that keep these logics intertwined both within Ghana and transnationally; for instance, the mobile phone traders, phone company workers in Ghana and in China, as well as telecoms regulatory enforcers, radio producers and even radio serial callers/listeners (Nunoo, 2015) who enliven talk radio in Ghana.

## **Conclusion**

Overall, mobile phones have been key to extending radio access in Ghana. Their intersecting logics reveal social and technological entanglements that support the culture of radio that dominates Ghana's media technology landscape. As prior work on infrastructure has shown (Star, 1999; Star and Bowker, 2006; Star and Ruhleder, 1996), infrastructures are relational and that of radio and mobile phones in Ghana are no different. By unpacking their intersecting logics, this article has shown how mobile phones form a part of radio's sociotechnical infrastructure and are shaped by regulation and transregional production logics that have hitherto not been considered together.

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## Notes

1. *Dumsor* (pronounced ‘doom-soh’), from the Akan language, literally means ‘off-on’.
2. From informal conversations with former Vodafone staff and Citi FM management in 2019.
3. See <https://citifmonline.com/2017/03/28/vodafone-cash-hfc-bank-support-citi-fms-easter-orphan-project/> and <https://www.modernghana.com/entertainment/41694/citi-fms-exciting-heritage-caravan-set-to-hit-the-road.html> for some other examples of the two collaborating. Accessed 20 April 2017.
4. The fieldwork in 2018 was conducted with Silvia Lindtner, University of Michigan, in Accra and Shenzhen. Together, we interviewed, among others both Chinese and Ghanaian staff of mobile phone companies like Tecno and observed how these businesses were conducted.
5. See also published press interview with Tecno vice-president here. Accessed 25 April 2016.
6. It should be noted that Samsung now also manufactures phones at lower price points with additional features for the global south. Many of these phones are unavailable for purchase in the north.

## References

- Alliance for Affordable Internet (AfAI) and Vieira de Almeida & Associates SdA, RL (2016) Legal framework for infrastructure sharing in Ghana. Available at: <https://1e8q3q16vyc81g8l3h3md6q5f5e-wpengine.netdna-ssl.com/wp-content/uploads/2016/07/Ghana-Coalition-Session-III-Legal-Framework-for-Infrastructure-Sharing-Ghana.pdf>
- Avle S (2011) Global flows, media and developing democracies: the Ghanaian case. *Journal of African Media Studies* 3(1): 7–23.
- Avle S and Lindtner S (2016) Design(ing) ‘here’ and ‘there’: tech entrepreneurs, global markets, and reflexivity in design processes. In: *Proceedings of the 2016 CHI conference on human factors in computing systems*, San Jose, CA, 7–12 May, pp. 2233–2245. New York: ACM.
- Avle S, Quartey E and Hutchful D (2018) Research on mobile phone data in the global south. In: Welles BF and Gonzalez-Baillon S (eds) *The Oxford Handbook of Networked Communication*. Oxford: Oxford University Press, pp. 488–512.
- Bijker WE (1995) *Of Bicycles, Bakelites, and Bulbs: Toward a Theory of Sociotechnical Change*. Cambridge, MA: MIT Press.
- Bowman E (2015) The hidden FM radio inside your pocket, and why you can’t use it. *All Tech Considered: Tech, Culture and Connection*. Available at: <https://www.npr.org/sections/alltechconsidered/2015/04/16/400178385/the-hidden-fm-radio-inside-your-pocket-and-why-you-cant-use-it> (accessed 25 July 2019).
- Chiumbu SH and Ligaga D (2013) ‘Communities of strangerhoods?’ Internet, mobile phones and the changing nature of radio cultures in South Africa. *Telematics and Informatics* 30: 242–251.
- Coker W (2012) Mobile communication and the culture of self-expression: the case of SMSing to radio in Ghana. *Journal of Media and Communication Studies* 4: 123–133.

- Dye M, Nemer D, Mangiameli J, et al. (2018) The human infrastructure of El Paquete, Cuba's offline internet. *Interactions* 26: 58–62.
- Farman J (2017) Repair and software: updates, obsolescence, and mobile culture's operating systems. *Continent* 6: 20–24.
- Glaser A (2016) Your phone has an FM chip. So why can't you listen to the radio? *Wired*. Available at: <https://www.wired.com/2016/07/phones-fm-chips-radio-smartphone/> (accessed 25 April 2017).
- Henrich J, Heine SJ and Norenzayan A (2010) The weirdest people in the world? *Behavioral and Brain Sciences* 33: 61–83.
- Horst HA (2013) The infrastructures of mobile media: towards a future research agenda. *Mobile Media & Communication* 1: 147–152.
- Houston L and Jackson SJ (2016) Caring for the next billion mobile handsets: opening proprietary closures through the work of repair. In: *Proceedings of the eighth international conference on information and communication technologies and development*, Ann Arbor, MI, 3–6 June, p. 10. New York: ACM.
- Jackson SJ and Kang L (2014) Breakdown, obsolescence and reuse: HCI and the art of repair. In: *Proceedings of the SIGCHI conference on human factors in computing systems*, Toronto, Canada, April 2014, pp. 449–458. New York: ACM.
- Lindtner S, Greenspan A and Li D (2015) Designed in Shenzhen: Shanzhai manufacturing and maker entrepreneurs. In: *Proceedings of the fifth decennial Aarhus conference on critical alternatives*, Aarhus, Denmark, August 2015, pp. 85–96. Aarhus: Aarhus University Press.
- Ling RS (2012) *Taken for Grantedness the Embedding of Mobile Communication into Society*. Cambridge, MA: MIT Press.
- Mare A (2013) New media, pirate radio and the creative appropriation of technology in Zimbabwe: case of Radio Voice of the People. *Journal of African Cultural Studies* 25: 30–41.
- Mudhai OF (2011) Survival of radio culture in a converged networked new media environment. In: Wasserman H (ed.) *Popular Media, Democracy and Development in Africa*. Abingdon: Routledge, pp. 253–268.
- National Communication Authority (NCA) (2010) Guidelines for the deployment of communications towers. In: Ghana Government (ed.) *Accra, Ghana: Government of Ghana*. Available at: <https://www.nca.org.gh/assets/Uploads/Communications-Towers-Guidelines3.pdf> (accessed 22 December 2019).
- National Communication Authority (NCA) (2018) *Authorised VHF-FM Radio Stations as at Fourth Quarter of 2018*. Available at: <https://www.nca.org.gh/industry-data-2/authorisations-2/fm-authorisation-2/> (accessed 22 December 2019).
- Nunoo FE (2015) *The 'serial callers' of Ghana: how 'serial callers' influence public debate on talk radio and the implications for Ghana's public sphere*. Master's Thesis, University of Witwatersrand, Johannesburg, South Africa.
- Prahalad CK (2006) *The Fortune at the Bottom of the Pyramid*. Bengaluru, India: Pearson Education.
- Quartey E (2015) The mystery of the power bank phone taking over Accra. *The Flint/Medium*. Available at: <https://medium.com/the-flint/the-mystery-of-the-power-bank-phone-taking-over-accra-344adbb56919> (accessed 16 April 2017).
- Sey A (2011) New media practices in Ghana. *International Journal of Communication* 5: 380–405.
- Star SL (1999) The ethnography of infrastructure. *American Behavioral Scientist* 43: 377–391.

- Star SL and Bowker GC (2006) How to infrastructure. In: Lievrouw LA and Livingstone SM (eds) *Handbook of New Media: Social Shaping and Social Consequences of ICTs*. Thousand Oaks, CA: Sage, pp. 230–245.
- Star SL and Ruhleder K (1996) Steps toward an ecology of infrastructure: design and access for large information spaces. *Information Systems Research* 7: 111–134.
- Venta L (2015) T-mobile to activate FM chip/NextRadio. *Radio Insight*. Available at: <https://radioinsight.com/headlines/94107/t-mobile-to-activate-fm-chipnextradio/> (accessed 25 July 2019).
- Willems W (2013) Participation „Äi In what? Radio, convergence and the corporate logic of audience input through new media in Zambia. *Telematics and Informatics* 30: 223–231.
- Wong WWY (2017) Speculative authorship in the city of fakes. *Current Anthropology* 58: S103–S112.
- x-tigi.com (2019) *About X-TIGI*. Available at: [http://www.x-tigi.com/index.php/about\\_c\\_2.html](http://www.x-tigi.com/index.php/about_c_2.html) (accessed 02 January 2020)
- Yang F (2015) *Faked in China: Nation Branding, Counterfeit Culture, and Globalization*. Bloomington, IN: Indiana University Press.