China and Africa: Alternative Telecommunication Policies and Practices

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Abstract
The Beijing Consensus is said to be a win-win for China and Africa. China has become a major force in global telecommunications markets, as a manufacturer, a content provider and in delivering services to its citizens. While the relationship between China and Africa has been explored in many areas, telecommunications has been ignored, despite its strong domestic performance, as well as the presence of Chinese equipment in African networks and in the hands of consumers. China has not exported its domestic model of competing state-owned operators, nor have those operators followed the "going out" strategy. However, manufacturers have benefitted from the Washington Consensus model of oligopolistic markets. In countries with higher risks, they have been aided by Chinese development banks and intergovernmental agreements. In a new policy model, for the Comoros and Ethiopia, Chinese firms have taken on outsourcing of network functions for the state-owned operators. Additionally, manufacturers have found several channels to supply feature-phones and smartphones at low prices, helping to widen access. Absent from African markets are the providers of Internet content and apps. There is very little evidence of spillover effects, with little knowledge being transferred. China has won from hardware sales in Africa, while Africans have won wider access to telecommunications, including states rejecting the Washington Consensus model.

Keywords
Africa, China, Internet, policy, regulation, telecommunications

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1. Introduction

The support of Mao Zedong and the Communist Party of China (CPC) for anti-colonial movements in Africa was, after a long gap, replaced by the Beijing Consensus, a model of development said to offer mutual benefits, in contrast to the Washington Consensus, preferred and promoted by the international financial institutions (IFIs), with its allegedly exploitative neoliberal ideology (Kennedy, 2010; McKinnon, 2010; Williamson, 2012).[1] China has become the largest trade partner and the largest developing country investor in Africa, in addition to providing financial and technical assistance (Busse, Erdogan & Mühlen, 2016). The recent shift in the Chinese economy has seen a steep fall in demand for physical resources, as it moves to higher value-added activities. The responses to the economic and policy changes in China have lacked clear and coherent strategies from African governments, suggesting they are not taking full advantage of the potential opportunities. The business and economic engagements between China and Africa have been and continue to be examined in detail; the extraction of gas, oil and ores to supply Chinese manufacturers, the farms that feed its population (Bräutigam, 2015), and the import of Chinese manufactures into Africa (Alden, Large, & Soares de Oliveira, 2008; Manji & Marks, 2007; Wang & Elliot, 2014). This article addresses an area previously ignored, that of the telecommunications sector, in which China has become a significant presence, in policies, in the provision of infrastructure, in the sale of manufactures and, thus, in the everyday lives of Africans.

Global best practice in telecommunications policy, as advocated and supported by the IFIs, aims for limited, oligopolistic competition by a complex mix of financialisation, liberalisation, privatisation, and regulation (Blackman & Srivastava, 2011; Intven, Oliver & Sepulveda, 2000). Network operators must obtain government licences, either alone or with international or local partners. Manufacturers then sell equipment to the licensed operators and to their customers, with volumes dependent on growth of the market and thus on politico-regulatory decision-making, notably on levels of competition. Consequently, there is intensive corporate political activity (CPA) by manufacturers and operators in the elaboration and adaptation of policies at global, continental, regional, national, provincial and municipal levels (Sutherland, 2014).

Telecommunications has been recognised as an infrastructure enabling and generating economic development and growth (Röller & Waverman, 2001; Waverman, Meschi & Fuss, 2005). Networks widen markets, improve information flows, lower transaction costs and substitute for physical transport. They also provide a platform for economic or Schumpeterian disruption, notably through the "Überisation" of established markets (Nurvala, 2015).

The development of telecommunications in Africa is invariably presented as a pos-

1 This non-interference model is being supplemented by the Asian Infrastructure Investment Bank (AIIB, 2016).

itive story (Etzo & Collender, 2010), though it is largely alien, with governments adopting policies developed by the countries of the Organisation for Economic Co-operation and Development (OECD), usually without much formal adaptation or customisation to national circumstances. The resulting markets are dominated by Arab, European and Indian operator groups, supplied with equipment from manufacturers in China, Europe and North America. Commercial practices have proved so successful, that they have spilled over from competitive and well-governed markets, into countries that do not or could not follow the best practice model, including (i) micro-states and small island developing states (SIDS), with weak institutions and without economies of scale; (ii) conflict and post-conflict states, where good governance was unavoidably absent; and (iii) countries without liberalisation or competition.

China is a major source for Africa, both of network equipment for operators and of phones and smartphones for consumers, with their low unit costs greatly improving affordability. Its network equipment manufacturers have, where there are heightened political risks, been supported by intergovernmental agreements and by loans from development banks. Manufacturers of handsets have engaged on purely commercial terms, proving flexible in their use of formal and informal distribution channels. However, Chinese operators are entirely absent, a difference that cannot be coincidental. Nonetheless, some networks have been constructed and a few subsequently run by other Chinese firms. Countries that would not implement the global best practice reforms have benefitted from the greater flexibility of the Beijing Consensus, and are thus meeting demand for services and boosting their economic growth.

Africa cannot be treated as a single entity, rather it should be disaggregated, to consider countries that are small and large, coastal and landlocked, peaceful and in conflict, democratic and autocratic, rich and poor in resources (Mohan, 2013b). Similarly, China should be divided into the CPC, federal and provincial governments, state-owned and private enterprises, and individual migrant traders (Gonzalez-Vicente, 2011), with private enterprises much less engaged with the "going out" strategy of the government than state-owned enterprises (SOEs) (Gu, Chuanhong, Vaz & Mukwereza, 2016).

Mohan has described the fragmentation amongst academics, amongst the experts on internal processes in China, amongst others who have examined Chinese economic activities in individual African nations, as well as the strongly ideological accounts of China's external relations and largely non-African accounts of Africa (Mohan, 2013a). The challenge he posed was to paint a more complete picture of China-Africa engagements, drawing on a variety of perspectives, disciplines, case studies and data. This article aims to provide one such case study, for the telecommunications sector (Sutherland, 2016). It next examines the general economic engagement of China in Africa, followed by short analyses of telecommunications in China and

then in Africa. This is followed by a review of the various areas of Chinese activity in African telecommunications markets. Finally, conclusions are drawn and issues identified for further research.

2. China in Africa

The commercial and political presence of China in Africa, has been extensively analysed, with growing interest in military activity (e.g., its naval base at Djibouti). The USA has been a severe critic of the allegedly unscrupulous behaviour of the Chinese (Bräutigam, 2011; Power, Mohan & Tan-Mullins, 2012). Concerns about its government and multi-national enterprises (MNEs) may reflect differences from, rather than being better or worse than, the behaviour of the former colonial powers, reflecting centuries of viewing Africa as a target for colonialisation.

Firms from the European Union and North America are expected to support democracy, environmental protection, human rights, good governance and transparency, through public and, increasingly mandatory, commitments to the *OECD Guidelines for MNEs* (OECD, 2011). Those from China are considered uninterested, as are MNEs from the Persian Gulf. Yet MNEs based in OECD countries have pandered to kleptocrats, paid bribes, supported nepotism, sold wire-tapping equipment, and disregarded environmental damage. Nonetheless, by engaging with any and every government, China and Chinese MNEs are accused of setting back the, admittedly limited, progress made in governance and human rights (Gu, Humphrey & Messner, 2008; Noman, Botchwey, Stein & Stiglitz, 2012).

Sustained economic growth in China increased demand for gas, oil and metallic ores far beyond its domestic resources, leading to a pursuit of licences and mining rights across Africa, raising volumes traded and unit prices paid (Zafar, 2007). Chinese firms, often SOEs, outbid manufacturers from OECD countries on infrastructure projects, and elsewhere were supported by loans from Chinese development banks, and aided by inter-governmental negotiations, allegedly increasing Chinese bargaining power when acquiring natural resources (Vines, 2007). The Chinese government issued innovative loans secured against natural resources (e.g., oil from Angola and copper from Democratic Republic of the Congo [DRC]), and sometimes paid in infrastructure, the value of which is not easily assessed. These "Angola mode" deals were an alternative to IFI loans with their structural adjustment programmes (SAPs) (Habiyaremye, 2016). The provision of infrastructure allowed China to use its development expertise, deploying teams of architects, engineers and, even, construction workers to build hospitals, railways, roads, and schools, some of the infrastructure later being used to transport oil and ores to Chinese ships. Mineral extraction was supposedly performed in enclaves, with strongly Chinese characteristics: their own workers, rice and, even, cooking oil (Michel & Beuret, 2009). The most outrageous allegation was that gangs of convicts had been transported to Africa to reduce labour costs (Hairong & Sautman, 2012).

Economic reforms brought a sustained boom in manufacturing in China, attracting significant elements of global production facilities, to take advantage of the lower labour costs and access to its domestic market. At the same time, the SAPs, advocated by the IFIs and adopted by governments, opened African markets to imports (Riddell, 1992). The resulting flow of cheap Chinese manufactures undermined already limited African production, diminished exports and created trade deficits, except for those countries with mineral and petroleum exports. Thus, Franks and Ribet (2009) argue that:

> Although African consumers certainly benefit from goods many could previously not afford (especially electrical items), cheap Chinese goods have also contributed to the decline of industrial production and the growing retrenchment of workers. (Franks & Ribet, 2009, pp. 133-134)

To make matters worse, displaced workers typically moved into low productivity activities, such as agriculture and informal employment (McMillan, Rodrik & Verduzco-Gallo, 2014).

Special economic zones (SEZs) were established in Algeria, Egypt, Ethiopia, Mauritius, Nigeria and Zambia to allow Chinese manufacturers access to markets less competitive than China and to transfer activities that could be replaced by more sophisticated manufacturing at home (Bräutigam & Tang, 2014). Information and communication technologies (ICTs) were limited, with Mauritius having some ICT services and the Lusaka SEZ said to have had electronic assembly. However, the SEZs were plagued with delays and generated very limited spill over of knowledge, failing to benefit local economies (Hanusch, 2012; World Bank, 2011).

In the cities of Guangzhou, formerly Canton, and Shenzhen are found large numbers of African traders, many as visitors, though some are now residents, seeking to purchase goods for resale in Africa (Bodomo, 2010; Lyons, Brown & Li, 2013). Textiles, clothing, household fixtures, electrical and electronic goods (notably mobile phones and tablet computers), are shipped to Africa by air and by sea, some passing through third countries to avoid customs duties and import restrictions in their intended markets. Some individual Chinese have taken the opportunity to move to Africa, becoming retailers and displacing local traders.

The evolving economic relationship between China and Africa remains contentious and contested, seen as both exploitative and mutually beneficial, presently being tested by the realignment of the Chinese economy.

3. Telecommunications in China

Set apart from global best practice in telecommunications policy, the sector in China has, nonetheless, seen dramatic transformations. The reforms launched by Deng

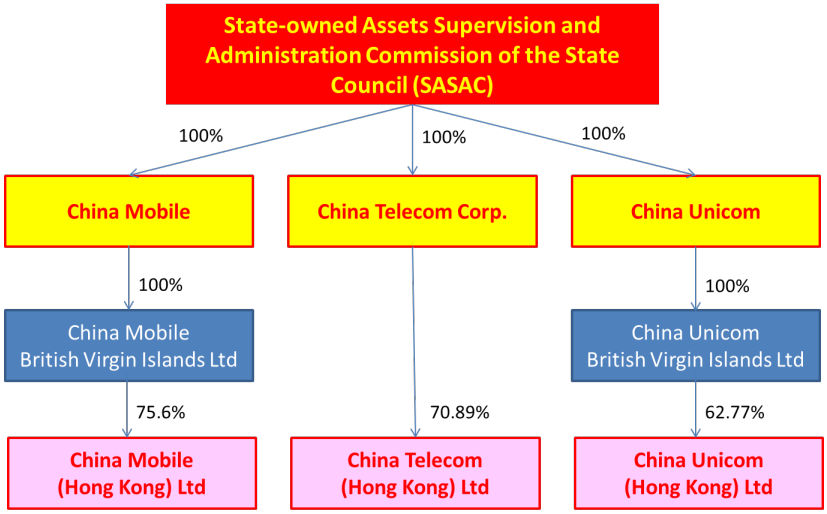
Xiaoping saw the extension of the fixed telephone network, soon outpaced by mobile telephony, initially in cities and later the countryside, achieving near universal availability (Harwit, 2004; 2007; Xia, 2016a; 2016b). This was enabled and driven by the growth of manufacturing in China, of both handsets for customers and network equipment for operators, the result of foreign direct investment (FDI), first in manufacturing and then in research and development (R&D). Network competition was limited to state-owned enterprises (SOEs), in contrast to Russia, where privatisation came first, handing control to oligarchs, from whom it has never been recovered (Stiglitz, 1999). Internet access is behind the "Great Firewall of China",[2] allowing domestic providers of apps, content and services to grow very large, protected from foreign competition by SOEs or state-linked corporations, under the guidance of the CPC/state, seeking to (i) develop economic capability; (ii) shift from importing foreign to exporting indigenous technologies; and (iii) develop a service sector, including content and application providers.

China is an increasingly powerful player in global production networks (GPNs), in which the activities of MNEs are spread across many countries (Coe, Dicken, & Hess, 2008). In telecommunications it is involved in all stages of the value chain, including research and development; standard setting; design; manufacture; construction and management of networks for operators; and provision in China of a full range of telecommunications and Internet services, and applications.

China joined the World Trade Organisation in 2001 (WTO, 2015), and committed to liberalise its telecommunications markets (DeWoskin, 2001; Zhang, 2001), despite which, SOEs remain overwhelmingly dominant. The expectation had been that liberalisation would open the way for FDI, with foreign operators providing the expertise and finance essential to expand and upgrade networks (Fu & Mou, 2010). Instead, the government created three SOEs from the state provider, instructed them to compete, one with another, while their expansion was funded from their own revenues and by minority flotations on the Hong Kong Stock Exchange (HKSE) (see Figure 1) (Loo, 2004). The choice of the British Virgin Islands (BVI), an opaque, offshore corporate registry, for two holding companies has never been officially explained. While Shen (2012) suggests the structure is because of "tax, legal and regulatory concerns", this makes little sense, since these could easily be modified by the government. BVI can be for tax avoidance and the concealment of transactions, part of an increasing circulation of money between China and the Caribbean. Its use for allegedly corrupt dealings by the Chinese elite has been highlighted by the International Consortium of Investigative Journalists (ICIJ, 2014).

2 Officially known as the Golden Shield.

Figure 1: Ownership of the three Chinese operators[3]



The superficially strange model of competition amongst SOEs is surprisingly effective (Mora & Wiktorowicz, 2003; Xia, 2012). It is subject to opaque political direction by the State-owned Asset Supervision and Administration Commission (SASAC), which acts more as a regulator, ensuring political control, reinforced by a CPC committee inside each firm (Yeo, 2009).[4] This is considered essential to deliver economic growth, which helps to legitimise the government (Yeo, 2013). Liberalisation was begun with eleven Chinese firms selected to become mobile virtual network operators (MVNOs) (Barton, 2014), though they have made little progress in the face of competition from the three dominant and entrenched SOEs (Zallman, 2016).

The selection of 3G technologies was on governmental, not commercial, criteria. Each operator was required to adopt a different 3G network technology (see Table 1), providing test-beds and showcases to support exports by Chinese manufacturers:

> Although adopting multiple standards may not be consumer friendly, may create issues of interoperability and may be less cost effective by increasing the cost for managing the infrastructure, it nevertheless has provided a resolution to sensitive issues concerning China's WTO commitments, and satisfies the TD constituency. (Stewart, Shen, Wang & Graham, 2011, p. 781)[5]

3 The only significant foreign investment is a crossholding between Telefónica de España and China Unicom.

4 For example, Wang Xiaochu, Chairman of China Telecom and Chairman of the Party Committee at China Telecom, has also been an alternate member of Central Party Committee from 2007.

5 More fully TD-SCDMA or Time Division Synchronous Code Division Multiple Access, it is the Chinese version of 3G, a technology that might well have been rejected had the operators made purely commercial decisions.

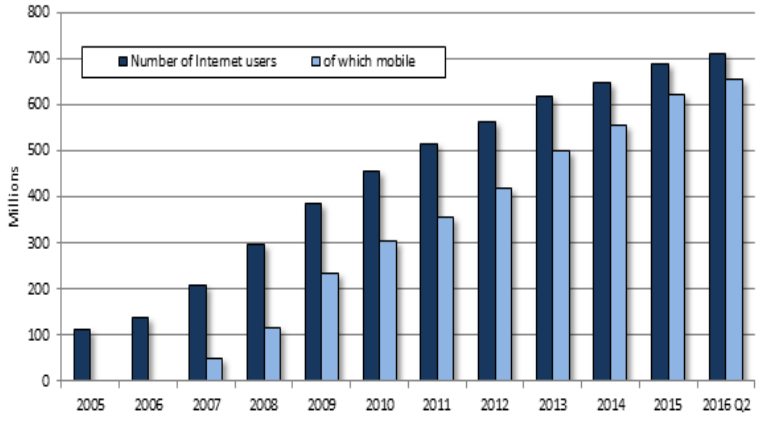
This was repeated with 4G, when the government initially licensed the Chinese version (TD-LTE) and only later the global version (FDD-LTE) that two of the operators had sought, despite 4G being a priority in its 2013 broadband strategy. China Mobile quickly deployed an extensive TD-LTE network, partly because its Chinese technology 3G network had been commercially disadvantageous.

Table 1: Mobile technologies used by Chinese network operators

Generation	China Mobile	China Unicom	China Telecom
3G	TD-SCDMA	UMTS	CDMA2000
4G	TD-LTE	TD-LTE & FDD-LTE	TD-LTE & FDD-LTE

The overall result is impressive, in both geographic and demographic reach (see Figure 2), and progression through technological generations, with over 500 million 4G users at the end of 2016 Q1 (Qiang, Bhavnani, Hanna, Kimura, & Sudan, 2009; Xinhua, 2013; CNNIC, 2016).

Figure 2: Internet users in China



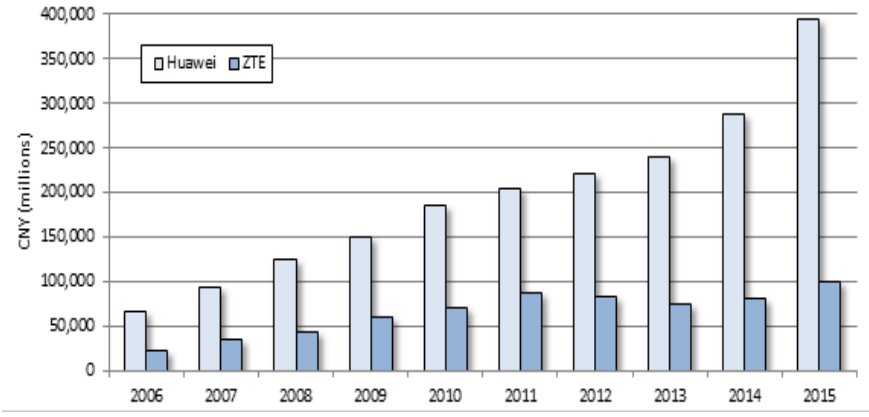
Source: CNNIC (2016)

Unlike the manufacturers, the operators did not follow the "going out" imperative from government, declining the many opportunities for foreign expansion, not least in Africa. The exception is China Mobile, which has two modest investments in China Mobile Pakistan (t/a Zong);[6] and True Group of Thailand.[7] The preference of the CPC/state was that they invest in domestic operations, especially in upgrading to new technologies. Huawei and Zhongxing Telecommunication Equipment

6 In 2007, it acquired 100% from Millicom.
7 In 2014, it acquired 18% for USD880 million.

Corporation (ZTE), the two leading manufacturers, have both "gone out" on a large scale, becoming significant players in the global market (see Figure 3), seen as exemplars of emerging economy multinational enterprises (EE-MNEs) (Sun, 2009). Their overseas expansion has been backed by the government and supported by the China Exim Bank, China CITIC Bank and China Development Bank.

Figure 3: Revenues of Huawei and ZTE

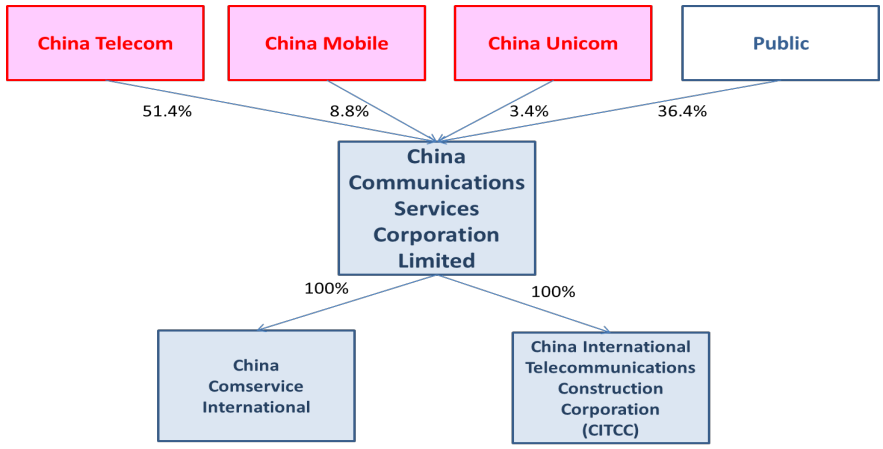


Source: Huawei Annual Reports (2006-2015), ZTE Annual Reports (2006-2015)

The Directorate General of Telecommunications (DGT) had a unit for the project management, design and construction of networks. This had originally been spun off in 1999 as part of China Telecom, from which China Netcom, the northern part, was later spun off. In 2006, China Telecom, which held the southern part, spun off China Communications Services Corporation Limited (CCS), listing it on the HKSE (see Figure 4). Then in 2011, CCS acquired the northern part, which had been separated from China Netcom as China International Telecommunications Construction Company, for CNY505 million (CITCC, 2013).[8] CCS has been the principal builder of mobile networks in China, with CITCC supporting the manufacturers by building networks overseas.

8 China Netcom was later acquired by China Unicom.

Figure 4: China Communications Services Corporation Ltd



Source: CCS (n.d.)

The market for handsets is more complex and more competitive, with the government having initially licensed selected manufacturers, while others operated as *shan zhai* or mountain fortress bandits, producing cheaper and more disruptive devices (Zhou, Tong & Li, 2011; Lee & Hung, 2014; Chubb, 2015; Dong & Flowers, 2016). These firms evaded controls, initially in "mosquito" factories, assembling phones that were stylish, gimmicky, or imitated the latest models of the major domestic and foreign manufacturers, but at much lower prices, based on chip sets that had the core functions of a phone, developed by MediaTek (MTK) and Spreadtrum (Tse, Ma & Huang, 2010).[9] They opened new markets, for poorer citizens, especially those in smaller cities and the countryside, but were also taken by those "going out" to developing countries. The lifting of the licensing requirement in October 2007 legitimised the *shan zhai* manufacturers, which had proved nimbler than the licensed firms. The most remarkable story has been the rise of Xiaomi, founded in 2009 and a global player within five years, but seems to already be failing to make the transition to more expensive devices, unlike Oppo and Vivo (Shih, Lin & Luarn, 2014; IDC, 2016).

The Great Firewall blocks access to foreign Internet services (Ensafi, Winter, Mueen & Crandall, 2015; Li & Reimers, 2015; Minzner, 2015; Stevenson, 2007; Yuen, 2015), behind which there grew up providers of a range of applications and content, some of which are now amongst the largest Internet companies (e.g., Alibaba, Tencent and Weibo).[10] The suppliers grew rapidly by replicating business models devised in developed economies (e.g., search and social networking), in effect import-substitution

9 Among the features added were ultraviolet lights to test the authenticity of banknotes and dual-SIM card slots to avoid the limitations of a single network.

10 e.g., Tencent's first product was a copy of ICQ, a US-based instant messaging service, otherwise banned in China.

industrialisation (ISI). One domestic requirement has been for very tight controls, sometimes styled "censorship 2.0", involving both automatic and human interventions (King, Pan & Roberts, 2014). Thus while Baidu, the dominant Chinese search engine, embraced censorship and collaboration with government, Google retreated to Hong Kong, SAR, to avoid compliance and in order to protect its global brand (Lu, Hu, Liang, Lin & Peng, 2013), while Facebook has been developing censorship capabilities to enter the market (Frier, 2016).

The Chinese government has run a campaign against corruption, including prosecuting some formerly very senior figures (Chow, 2015). Chang Xiaobing, resigned as Chairman of China Telecom, because of investigations into his former role at China Unicom (BBC, 2015). Li Hua, former chairman of the Sichuan branch of China Mobile, was convicted of accepting more than USD2.5 million in bribes (Barboza, 2011). Zhang Chunjiang, who had held posts in a provincial administration, China Netcom and China Mobile, was sentenced to death following his conviction for bribery, with his personal assets confiscated and political rights stripped (SCMP, 2011). He had taken CNY7.46 million in bribes from a telecommunications company and an advertising company. Additionally, there have been a few overseas prosecutions for bribery, for example, ZTE managers were convicted in Algeria and Lucent was found by US authorities to have bribed officials from an unspecified Chinese operator.[11]

Today, China is a leading global supplier of network equipment and handsets, and an exemplar of the widespread adoption of telecommunications and the Internet, albeit strictly censored. However, its model is not replicable, because of the enormous domestic economies of scale, the decades of planning, and the carefully acquired skills in manufacturing, design, research and standardisation. Nor is it easily understood, because of the opaque processes of competition amongst SOEs, corporate political activity (Gao, 2008), compliance with censorship and the movement of officials between party, government and operators.

4. Telecommunications in Africa

In the years following their independence, African countries neither changed direct state provision nor encouraged expansion of their fixed networks, with post-colonial governments maintaining moribund institutions and policies (Noam, 1999). Starting only about 15 years ago, there came the unexpected rise of mobile services, with the acceptance of major policy changes: introducing competition, private capital and-cellular wireless technologies. The crucial retail innovation was the prepaid offer, turning niche markets for elites of a few thousand into mass markets for millions.[12] This is now being extended from voice and text messages to mobile Internet access,

11 *SEC v. Lucent Technologies Inc.*, Civ. Act. No. 1:07-cv-02301 (D.D.C.) (RBW) (filed December 21, 2007) and in re Lucent Technologies Inc. (November 14, 2007).

12 While the unit prices might have been high, spending was easily controlled.

supplemented by limited offers of fixed broadband. There was also a surge of investment in undersea cables, both purely commercial and with governmental involvement (Song, 2015).

Analyses of telecommunications have generally been framed in terms of "divides" compared to the OECD countries. Each discipline created its own interpretation of this divide, whether the availability of networks or their use, through to the reaping of the social and economic benefits, and political participation (Fuchs & Horak, 2008; James, 2016, pp. 89-93; Pick & Sarkar, 2015, pp. 275-310). Complex spatial patterns were identified, with variations between countries, and between cities and the countryside (Chéneau-Loquay, 2007). One divide that affects future economic growth is the use of ICTs in higher education (Pehrson, 2010; Rye, 2008). It is sometimes inverted into a, perhaps overly optimistic, "digital opportunity", raising difficult questions as to who might grasp this and the conditions they would require to succeed. The poorer performing countries and operators have been ignored or glossed over, playing down the challenges of overcoming weak governance, providing high quality services, any service at all in remote areas, or affordable services for the urban poor.

The growth of the revenues of mobile operators has been slowing, reflecting declining expansion in subscriber numbers, increasing competitive pressures and regulatory actions (GSMA, 2015). In Sub-Saharan Africa the recent compound annual growth rate (CAGR) has been 7%, with the broadly defined mobile ecosystem generating 5.7% of GDP, forecast to rise to 8.2%, due to increased use of mobile broadband. In 2014, capital investment was USD9 billion and the sector employed 4.4 million, with operators collecting USD15 billion in taxes for governments, in addition to the payment of licence and regulatory fees, plus one-off spectrum auction fees.

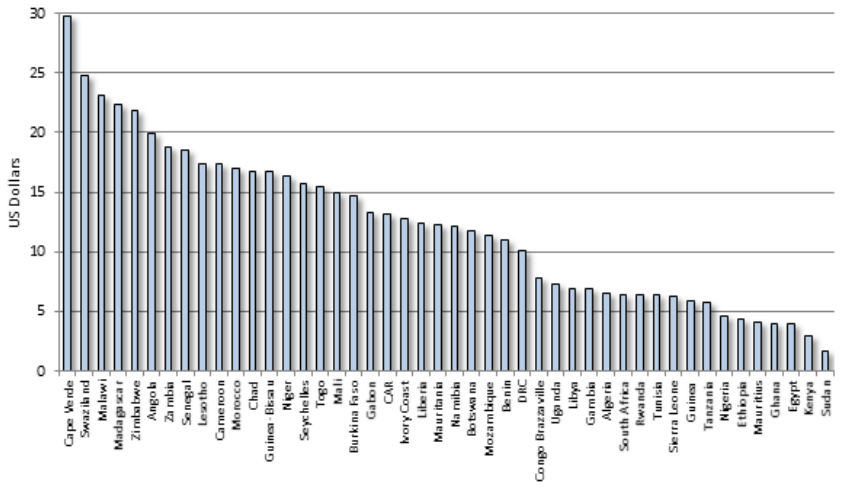
Gillwald (2013) asserted that "mobile is closing the voice and the data gap in Africa", in effect that it was catching up with the OECD countries. Yet Informa (2010) used a factor of 1.24 to reduce reported mobile subscriptions in Africa to real and distinct individuals, further lowered by the mobile operators using a factor of 2.0 (GSMA, 2012). The number of active SIM-cards held by an individual varies between and within countries, allowing them to switch networks to make cheaper on-net calls, because of distortions in tariffs and wholesale rates; overcome poor coverage by operators; and avoid congestion, because there are too many customers on a network (Sutherland, 2009). These market problems have been ignored or inadequately addressed by governments and regulatory authorities.

Although the policy and regulatory approaches were largely derived from the European Union (Stork & Gillwald, 2014), governments failed to collect the data and to use the competition analyses, impact assessments and public consultations that the EU considers essential, whereas, regulatory authorities have engaged in an almost

obsessive registration of SIM-cards. This is despite obvious limitations of inadequate information systems, weak cyber security, unreliable national identity documents and transcription errors, leading to inaccurate databases, without evidence of their use in criminal prosecutions (Donovan & Martin, 2014).

Figure 5 shows the range of prices, far greater than any underlying cost differences, with many countries lacking sufficient competition to drive prices down or regulations that might substitute for or complement that competition. Consequently, for many people mobile services remain unaffordable, while for others they are only intermittently within reach (Duncan, 2013; Powell, 2014). Unfortunately, regulatory authorities do not measure affordability, leaving that to researchers.

Figure 5: Cheapest prepaid offers for OECD "40 call basket"



Source: RIA (2013)

The second claim by Gillwald (2013), about the closing data gap or "digital divide", is more difficult to assess. The majority of Africans still have no access to the Internet and those that do are constrained from using bandwidth-intensive services, such as Netflix, Skype and YouTube, as the result of usage-sensitive tariff structures.[13] There are currently bitter arguments about the merits of zero-rated tariffs and "free" Wi-Fi. Any services paid for by advertising or customer data present severe problems, given the weakness of consumer protection and privacy laws and of enforcement agencies. There has been only limited, but growing, deployment of fibre to the home (FTTH), with most consumers relying on mobile services, raising questions about availability,

13 e.g., download caps and per-megabyte charges.

affordability and network quality, and of the lack of agreed metrics to measure progress, in particular in determining the depth and richness of the experience of the use of mobile services.

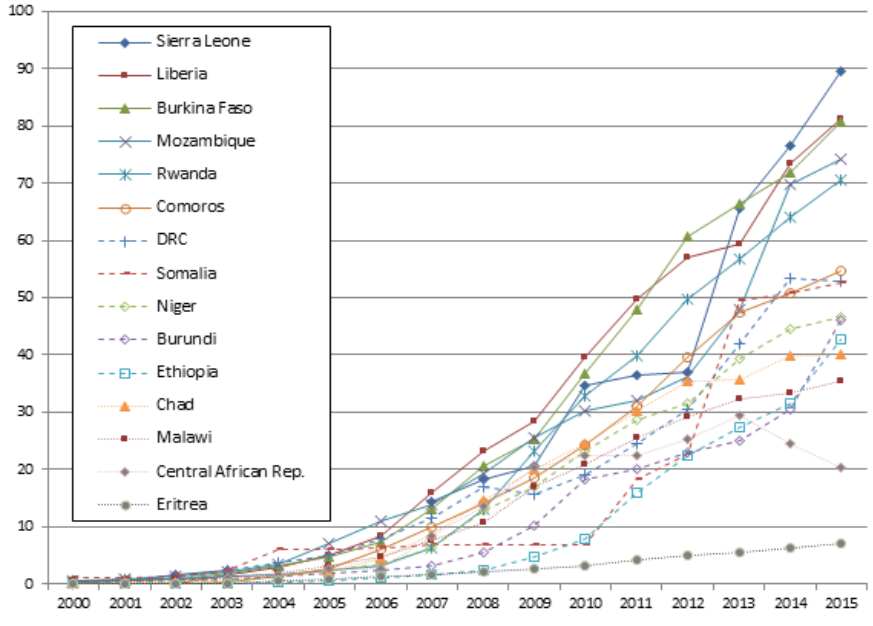
Given the need for substantial further investment in infrastructure, the ability of operators to maintain and upgrade networks, which is essential to carry growing data traffic, revenues are a central concern (Williams, 2008). If retail prices are too high, then use will be discouraged and revenues will be insufficient, similarly, if too low, they will require unaffordable investments in infrastructure. A global pattern of customers switching from paying services to apps offering free voice and SMS threatens operator revenues, diminishing their incentives to invest in networks (Jayakar & Park, 2014; Peng, 2016; Xu & Chen, 2016).

While ministers talk about competition and are supported by operators, mobile markets are oligopolies with little prospect of further market entry, and significant risks of consolidation.[14] Competition is constrained by first-mover advantages and by global allocations of spectrum, which permit only a very few operators, and the subsequent national assignments of spectrum to operators, which has been conducted with little transparency, with lobbyists fighting over each successive licence and spectrum band. Ownership is dominated by a handful of major multi-national groups (Curwen & Whalley, 2011; Sutherland, 2007): Bharti Airtel (India); Etisalat (UAE); MTN (South Africa); Orange (France); and Vodafone Group (UK).

Not all African countries have been willing to adopt the best practice policies pressed on them by the IFIs, with a few preferring to retain a monopoly state provider, while others lacked the ability or did not have the "good governance" necessary for implementation and thus investment. Some were too small to achieve economies of scale for multiple operators. Nonetheless, Figure 6 shows the use of mobile telephones in the poorest performing African states, where there is solid growth, with the sole exception of Eritrea, where the government seems intent on depriving its citizens of access to telecommunications. In part, these successes are due to the diffusion of successful business models and commercial practices, with smaller and weaker operators copying nearby countries, aided by manufacturers and software houses offering the necessary technical support and vendor finance.

14 As seen with the disappearance of Yu Mobile (Essar) in Kenya.

Figure 6: Mobile teledensities in poorer performing countries in Africa



Source: UN (2015)

Civil conflicts and their aftermath present challenges to good governance, supposedly a requirement for well-ordered markets, so that investors ought to have been hesitant, an obstacle which seems to have been overcome. Micro-states lack economies of scale in both markets and institutions, the former undermining profitability and the latter limiting the ability to implement the policies and regulations, yet these too have growing mobile markets.

Mobile banking has been an area of mixed successes, with mobile operators bringing banking and financial services to some of the "unbanked" and obtaining a slice of the very substantial remittance business, but with some governments having been reticent (Buku & Meredith, 2013; Dunn, 2015; Hughes & Lonie, 2007; Jun & Palacios, 2016; Suárez, 2016). Initiated in Somalia, it was quickly overtaken by M-Pesa in Kenya, a service from the state-owned Safaricom working as a "fast follower". However, in countries where the banks are well established, there has been resistance from banking regulators, supported by banking lobbyists.

Through mobile networks and prepaid services, using a model of limited competition amongst commercial operators, Africa has shown substantial growth. This has spread

into almost all countries with variations of the global best practice model, even where the prerequisite of good governance appears to be absent, as operators copy business models and commercial practices. Capital and technology are overwhelmingly foreign,[15] though with some development of apps for smartphones and tablet computers in innovation centres with venture capital in Kenya and South Africa (Kelly, 2014).

5. Chinese telecommunications in Africa

At the Forum on China-Africa Cooperation (FOCAC), Chinese then-President Jiang Zemin noted that (Zemin, 2000): "The gap between the North and the South is being widened not only economically, but also in science and technology. Hence, there has emerged a disturbing 'digital divide'." Chinese efforts to address this have included loans by development banks; sale of network equipment, handsets, smartphones and tablet computers; network construction and management; and exchange of voice telephony and international mobile roaming traffic. There is little, if any, presence of network operators, and only limited presence of service providers, such as Tencent and Weibo, with some virtual private network (VPN) services provided by PCCW.

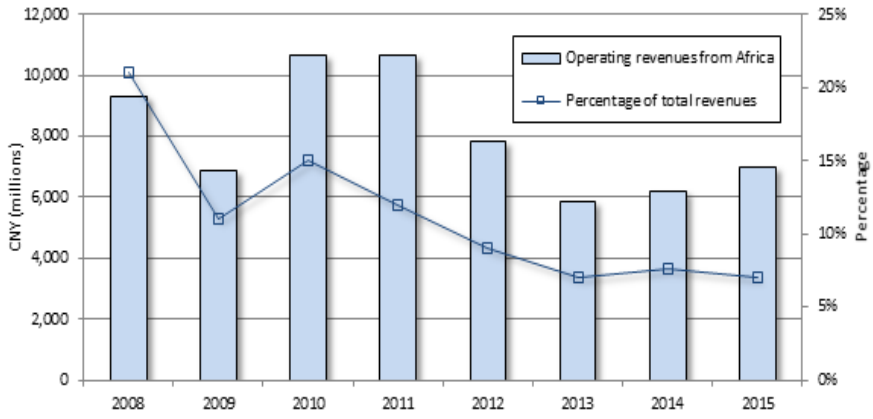
In OECD countries, mobile operators are a principal distribution channel for handsets for the larger manufacturers, which bundle them with services, together with large chains of electronics or specialist stores. In Africa, where the majority of customers are pre-paid, they mostly buy cheaper, entry-level or second-hand devices, with operators offering own-brand Chinese handsets at low prices.[16] Electronic equipment, including phones, is available through semi-formal channels, along with the other manufactures brought from China by traders. Governments have become concerned by no-brand and "counterfeit" handsets, which challenge the profit margins of the major brands and tax revenues, but increase consumer welfare through the cheaper adoption of mobile telecommunications (ITU, 2010; ITU-T, 2012; ITU-D, 2014).

The design and manufacture of network equipment is capital intensive, with formal purchasing procedures, in which well-financed operator groups buy and install competitively priced equipment, frequently from Huawei and ZTE (see Figure 7). The manufacturers also tender for and often win supply contracts funded by the IFIs.

15 An exception is Nigeria, where domestic entrepreneurs operate two networks.

16 For example, MTN South Africa offered a "Steppa" 3.5-inch Android smartphone with a Snapdragon processor for ZAR499, with three months free social networking (ITWeb, 2014).

Figure 7: ZTE revenues in Africa



Source: ZTE Annual Reports (2008-2015)

Where an operator lacks the necessary organisational capacity, the equipment can be installed by CITCC and, if necessary, operated by it:

> Having carried out the "going global" strategy of the CPC Central Committee, CITCC has witnessed a stair-like expansion of business from economic assistance projects, subcontracting projects to contracting projects in overseas communication engineering construction market. Its general contracting construction projects such as national backbone cable networks in Ethiopia and Nigeria have been well received by the governments and owners. Acting as the first general contractor of overseas large communication projects among Chinese communication construction enterprise, CITCC has built up a good professional enterprise image in international market. (CITCC, 2014)

The ruling Ethiopian People's Revolutionary Democratic Front (EPRDF) rejected liberalisation and privatisation, insisting on a state controlled monopoly, resulting in a break with the IFIs and forcing Ethiopia Telecoms Company (ETC) to look elsewhere for finance (Workneh, 2014; 2016). ETC signed major contracts with Huawei, ZTE and CITCC, worth USD2.4 billion in 2006, for a 2G network, later extended to 3G and 4G, and expanded coverage (Cheru, 2016). This was supported by Chinese development banks, without any investment by the Ethiopian government, all the costs being recovered from customers, with the government also extracting significant profits (Davidson, 2012). ETC was rebranded as Ethio-Telecom and placed under the management of Orange from 2010 to 2012, but this contract was not renewed. The result has been the façade of an Ethiopian SOE, behind

which were three Chinese SOEs doing much of the work. Despite comparatively low teledensity (see Figure 6), the government justifies the maintenance of state ownership by extracting an estimated USD3.5 billion generated, to pay for other infrastructure. Between 2010 and 2012, reports emerged that indicate the Ethiopian state's utilisation of technologies both to exercise targeted electronic blackouts and to carry out widespread online surveillance [anti-terrorism laws]. The facility to monitor and track dissidents has proved controversial, with the government acquiring software from European firms to supplement the facilities offered by Huawei and ZTE (HRW, 2014).

The Union of the Comoros rejected repeated calls from the IFIs for the privatisation of Comores Telecom (Comtel), formerly the *Société Nationale des Postes et Télécommunications* (SNPT). Instead, Comtel upgraded its mobile network and inter-island links with support from China. The IFIs continued to press for privatisation, as part of its Heavily Indebted Poor Countries (HIPC) programme, which was rejected by the Comoran Parliament, though with the concession of a possible second mobile licence from the Autorité Nationale de Régulation des TIC (ANRTIC).[17] From a short list of Mauritius Telecom and Telecom Malagasy (Telma) of Madagascar, it chose the latter, then, bizarrely, sought regulatory support from Madagascar (Telegeography, 2015; 2016).

Given the development of Chinese mobile standards and the strong presence of Chinese manufacturers, these networks might have been expected to be deployed in Africa. Yet, most of the 4G networks are using global FDD technology, with TD-LTE having been taken up mostly by fixed wireless ISPs, seeking to replace their WiMAX networks that had proved a commercial and technological dead-end (see Table 2). Some mobile operators offer both FDD and TD-LTE.

Table 2: TD-LTE networks in Africa

Country	Operator	Launch
South Africa	Telkom	April 2013
Uganda	MTN	April 2013
Nigeria	Spectranet	August 2013
Nigeria	Swift Networks	November 2013
Ghana	NITA	February 2014
Ivory Coast	YooMee Africa	April 2014
Madagascar	Blueline	April 2014
Angola	Net One	August 2014
Ghana	Blu Telecoms	October 2014
Uganda	Vodafone	February 2015
Gambia	Netpage	March 2015

17 The candidates were Mauritius Telecom and Telecom Malagasy (Telma) of Madagascar.

Nigeria	MTN Hynet	July 2015
Nigeria	Cyberspace	August 2015
Tanzania	Smart	August 2015
Cameroon	MTN	December 2015
Tanzania	TTCL	December 2015
Ghana	Busy	January 2016
Nigeria	Bitflux	August 2016

Source: GSA (n.d.), GTI (n.d.), Telegeography (n.d.)

Given the heavy Chinese involvement in infrastructure projects, it is unsurprising that many have added fibre optic cables to other networks (see Table 3). These contribute to national and regional backbone networks and are often interconnected with undersea cables, an activity where Chinese firms are not yet active. Chinese manufacturers have also been involved in selling digital broadcast equipment to support the digital switchover (Jiang, Li, Rønning & Tjønneland, 2016).

Table 3: Chinese support for backhaul networks

Countries	Network	Comments	Links to undersea cables
Angola	ADONES (Angola Domestic Network System)	Ericsson constructed undersea coastal cable 1,600 km, with 8 landing stations, operational since 2008. Angola Cables and Alcatel Shanghai Bell and ZTE building land-based fibre network.	ACE, SAT-3, WACS
Cameroon-Chad	Oil pipeline by China National Petroleum Company	Includes 12 optic fibres for Central African Backbone (CAB)	ACE, SAT-3, WACS
Democratic Republic of the Congo [DRC]	National fibre optic transmission network	USD36m from China Exim Bank in 2008 for CITIC to connect Kinshasa to and Moanda (undersea cable landing station) and USD223m from China Exim Bank for 3,250 km of fibre optic network by CITCC	SAT-3, WACS
Ethiopia	Upgrade to ETC/EthioTelecom network	Includes 10,000 km backbone network supplied by ZTE and CITCC	TEAMS, EaSSY, SEACOM, SEA-ME-WE-3 via Djibouti
Ghana	Sinopec	Fibre optic cables laid alongside pipeline from Atuabo to Accra	ACE, SAT-3, WACS
Ivory Coast	National fibre optic transmission network	USD210m for 6,700 km network by CITCC	ACE, SAT-3, WACS

Kenya	National Optic Fiber Backbone Infrastructure (NOFBI)	KES6,040m loan from China Exim Bank, supplied by Huawei	TEAMS, EaSSY, SEACOM
Lesotho	National fibre backbone	USD20m loan from China	-
Kenya, Uganda, Burundi and South Sudan	East Africa Railway by China Road and Bridge Corporation (CRBC)	Optic fibre laid beside track	TEAMS, EaSSY, SEACOM
Malawi	Electricity Supply Corp. (ESCOM)	National fibre optic network, connecting with Mozambique and Zambia	-
Namibia	Nampower	Fibres installed, but not yet in use	-
Niger-Mali-Algeria	Links Bamako with Algeria and Niger	Exim Bank USD45m for 942 km fibre optic network	Several in Mediterranean
Tanzania	National Information and Communication Technology Broadband Backbone (NICTBB)	China Exim Bank loan USD170m, for construction by CITCC	EaSSy and SEACOM
Uganda	e-government backbone	ZTE supported by USD 160M Chinese government loan	-
Zambia	ZESCO	Fibre optic network alongside electricity distribution network	-
Zambia-Tanzania	Tazara Railway	Fibre optic network alongside railway network	EaSSy and SEACOM
Zimbabwe	Link to EaSSY landing station	Exim Bank	EaSSY

Source: AllAfrica.com (n.d.); Aid Data (n.d.); oAfrica.com (2013)

The pattern of Chinese involvement in African telecommunications is complex and sometimes opaque. Where there are commercial operators, whether large or small, its manufacturers supply equipment at competitive prices, even in countries where there is a conflict or its aftermath, with the risks partially offset by the home government. Where there is only a state-owned monopoly, Chinese vendors will build a network and, if required, manage it as an outsourcer, helping to implement generic commercial practices to boost customer numbers and revenues. Handsets are sold to operators, with and without brands, and to consumers through a range of channels, including branded, unbranded and counterfeit. Fibres are added to other network infrastructure, being used for national and regional backhaul. The approaches taken have been extremely flexible, seemingly unconstrained by the absence of good governance, enabling the growth of mobile telephony where it was least expected. Non-Chinese rival manufacturers rely on governments to be persuaded to open their markets and for operators to take advantage of the resulting licensing, after which they can sell equipment, giving them less scope than Chinese vendors, with their home country specific advantage of greater flexibility.

6. Conclusion

In China the fused CPC/state remains a strong, if not always controlling, influence on telecommunication markets, owning the three principal operators, supporting manufacturers of network equipment, if not the handset manufacturers, and promoting indigenous standards, aided by officials moving between or straddling Party, state and SOEs. Manufacturers have followed the CPC/state invocation to "go out", scoring considerable successes, not least in Africa where it is helping to close its voice and data divides. At home operators and service providers have supported a strict system of domestic censorship, some of which has been made available for export. The CPC/state has delivered considerable successes in domestic services and "national champion" manufacturers, which helps maintain its legitimacy, using a policy model that is novel and which diverges significantly from global best practice.

African countries have never had any telecoms manufacturing capacity, have little or no research and development, and most governments, following the advice of the international financial institutions, privatised their state-owned operators, which in any event lacked economies of scale and the financial and commercial expertise to deploy new services.[18] Nonetheless, governments control policy and its implementation, even if it is largely copied from elsewhere, allowing operators to negotiate with presidents and ministers, often excluding consumers. The adoption of the GSM platform, complete with legislation, policies, business models and technologies, enabled only limited competition, primarily due to spectrum restrictions, but allowed incremental investments in networks with short payback periods, facilitating entry even in difficult circumstances (e.g., close to war zones). It also allowed a pre-paid service that was to permit mobile communications access to hundreds of millions of customers, who could control their spending. Adaptation occurred less in policy and legislation, than in implementation and use, influenced by lobbying, bribery, nepotism and state capture, with significant principal-agent and information asymmetry problems. Even flawed liberalisation allowed the entry of operators and the expansion of transnational groups, mostly from outside Africa, pursuing economies of scale and customer numbers. This enabled the widespread adoption of mobile services without drawing on the limited supply of government funding, while boosting economic growth and generating significant tax revenues.[19] These are not regulatory states, since the mechanisms for accountability are weak or absent, with governments finding their legitimacy in other ways, and markets operating with limited oversight.

China, having successfully transferred GSM technology from Europe, was able to match or undercut other manufacturers in price and quality to supply network

18 The exceptions are only partial privatisations in Kenya and South Africa, plus North African countries, which retained some degree of ownership.

19 The operators complain bitterly about the "high" level of tax (Deloitte, 2014), though it is passed immediately to consumers.

equipment and handsets in Africa. While it has developed its own 3G and 4G technologies, sales of these in Africa have been limited, with multinational operator groups preferring other standards. Backed by the CPC/state and development banks, Chinese manufacturers have sold equipment not only to operators in states with good governance and relatively competitive markets, but also to those in micro-states and in states in varying degrees of civil strife and conflict, where there is limited hope of good (sometimes any) governance. The Chinese government offset part of the risk for manufacturers, through its development banks. Unless governments wilfully resisted, Chinese firms have found ways to boost the adoption of mobile telephony in order to sell equipment.

Technology transfer to Africa has been limited to a few training centres for operators. Unlike China, it lacked the skilled workforce needed for factories and, especially, for research and development. Consequently, the spill over effects have been limited, though they are growing with the rise of innovation systems around mobile apps.

Outsourcing has emerged as a policy alternative to liberalisation, privatisation and regulation, allowing the retention of at least the façade of state provision, though it is probably closer to a concession. This challenges global best practice in telecommunications policy as advocated by the IFIs, by not seeking to create well-regulated commercial markets and by disregarding good governance, instead pursuing latent demand by whatever means are available. Thus, remarkably, China offers two alternatives to global best practice: (i) commercial, engineering and management outsourcing; and (ii) competing state-owned operators. This points to the inflexibility of the IMF and World Bank, raising questions about their failure to explore alternatives, and which of the three options will perform best in the longer term, as technologies and markets evolve. Absent from these options is a genuinely radical or socialist alternative.

Further research is needed to explain the reluctance of Chinese network operators and content providers to enter African markets, as is an exploration of the physical distribution system for mobile phones from China. There are also questions about cultural differences between Chinese and African firms, managers and employees in the sector. It is essential to map and to analyse ICT ecosystems in Africa and the role of Africa in global production networks. The investments by manufacturers and operators need to be examined to determine the extent of foreign direct investments and to understand the flows of money for equipment and networks over the lifetime of contracts and loans. The limited African ownership in the multinational operators groups needs to be explored and explained. There is a pressing need to explore the Chinese contribution to the security services, their provision of systems for the interception of traffic and collection of metadata, of censorship, and of any spying they

might perform on African firms and governments for China.[20] The supply of military telecommunications systems would also be interesting, if sufficient data could be collected.

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