Emerging Issues Report

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Achieving complex development goals along the digital Silk Road

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About this report

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Abbreviations

AIIB	Asian Infrastructure Investment Bank
B2C	Business to Consumer
BRI	Belt and Road Initiative
BRICS	Brazil, Russia, India, China and South Africa
C2B	Customer to Business
CAC	Cyberspace Administration of China
DFTZ	Digital Free Trade Zones
EO	Earth Observation
eWTP	Electronic World Trade Platform
FDI	Foreign Direct Investment
GPS	Global Positioning System
ICA	Infrastructure Consortium for Africa
ICT	Information and Communications Technology
ICT4D	Information Communications Technology for Development
LGBTQI	Lesbian, Gay, Bisexual, Transgender, Queer (or Questioning), and Intersex
LNOB	Leave No One Behind
M&A	Merger and Acquisition
MCT	Malaysia–Cambodia–Thailand
MDEC	Malaysia Digital Economy Corporation
MDG	Millennium Development Goal
MSME	Micro, Small and Medium-sized Enterprise
OBOR	One Belt One Road
RMB	Renminbi [Chinese currency]
SAIL	South Atlantic Inter Link
SDG	Sustainable Development Goal
SME	Small and Medium-sized Enterprise
TPP	Trans-Pacific Partnership
UNEP	United Nations Environment Programme
WTO	World Trade Organization

1. Overview

Over 2,200 years ago the ancient Silk Road was a network of trade routes that connected China with the west. Back then, this network provided a westward route for Chinese technology and inventions including papermaking and woodblock printing, which allowed printing in large quantities for the first time, and later, “movable type printing”, a technology which went on to revolutionise information sharing in Europe. An early version of the magnetic compass is also believed to have reached Europe via the Silk Road. Moreover, Chinese alchemists inadvertently invented gunpowder while attempting to create an immortality potion and was then traded to the outside world via the ancient Silk Road (Fung et al. 2018). As these ancient Chinese technologies – and others – spread through the ancient Silk Road they had a profound impact on the rest of world. Today the digital Silk Road has similar aspirations.

In 2013, Chinese President Xi Jinping announced aspirations to revive a modern 21st century version of the Silk Road, now known as the Silk Road Economic Belt. A few months later he announced plans for a 21st century “maritime road”, now referred to as the 21st Century Maritime Silk Road. Together these two initiatives are known as One Belt One Road (OBOR) or more commonly, the Belt and Road Initiative (BRI). The Chinese leadership has called the BRI “the project of the century”. The project is expected to cost more than 1 trillion USD, and include over 70 countries in Asia, Africa and Europe, accounting for about half of the world’s population and a fourth of GDP (Kuo & Kommenda 2018). In 2015, the Chinese government published a framework titled “Vision and actions on jointly building Silk Road Economic Belt and 21st Century Maritime Silk Road”, in which it formalised five priority areas for the BRI: (i) policy cooperation; (ii) connectivity of facilities; (iii) unimpeded trade; (iv) financial integration; and (v) people-to-people exchange (People’s Republic of China 2015).

Regarding connectivity, the BRI aims to help countries “improve the connectivity of their infrastructure construction plans and technical standard systems, jointly push forward the construction of international trunk passageways, and form an infrastructure network connecting all sub-regions in Asia, and between Asia, Europe and Africa” (ibid.). It gives priority to “linking up unconnected road stations, removing transport bottlenecks, advancing road safety facilities and traffic management facilities and equipment and improving road network connectivity… and push[ing] forward port infrastructure construction.... Increas[ing] sea routes and number of voyages”, as well as “promoting cooperation in the connectivity of energy infrastructure” (ibid.).

Along with roads, ports, and energy infrastructure projects, the connectivity focus area also stated that China and BRI countries should “jointly advance the construction of cross-border optical cables and other communications trunk line networks, improve international communications connectivity, and create an Information Silk Road. [The BRI] should build bilateral cross-border optical cable networks at a quicker pace, plan transcontinental submarine optical cable projects, and improve spatial (satellite) information passageways to expand information exchanges and cooperation.”

Despite being engrained in the BRI’s vision, the digital infrastructure element of the initiative has been largely overlooked in BRI literature and in the media, which have overwhelmingly focused on roads, ports, and energy infrastructure while undervaluing “the massive digital infrastructures (e.g. fibre-optic cables and data centres) that have been [built] alongside transport and energy projects” (Shen 2018: 2684). Moreover, a deeper look at projects being pushed forward as part of the “digital Silk Road” illustrate that the BRI’s digital aspirations go beyond the construction of information and communications technology (ICT) infrastructure and include exporting digital technologies and the expansion of digital firms. At the time of writing (July 2018), the digital Silk Road had not yet been analysed from a development perspective. This Emerging Issues report adds to the body of literature on the BRI and the digital Silk Road by analysing several aspects of the digital Silk Road using a Sustainable Development Goals (SDG) lens.

This report is divided into four main parts. Section 2 summarises the general literature on ICTs and the SDGs to illustrate both synergies and potential trade-offs between accelerating ICT adoption and achieving complex development goals. It first identifies key SDGs that explicitly call for greater ICT adoption and access to ICT infrastructure, and then covers the literature in five key areas: (i) the relationship between ICTs and economic growth and using ICTs to achieve development outcomes; (ii) the relationship between ICTs and inequality and the "leave no one behind" (LNOB) agenda; (iii) digital barriers and inequality that go beyond the provision of infrastructure; (iv) ICTs and the future of work; and (v) ICTs and environmental sustainability. Although digital technologies could be a force for good and help achieve the SDGs, this trajectory is not automatic, nor is it a given, and in many regards current trends can lead to the contrary. Achieving the SDGs in an increasingly digital world will necessarily mean reversing negative trends and finding ways to deal with some of the challenges emerging from greater ICT adoption. This will require actions above and beyond building infrastructure from a wide range of actors.

Section 3 covers the "digital Silk Road" and analyses it according to the literature on the interactions between ICTs and the SDGs covered in the previous section. It starts by covering some of the policy objectives of the digital Silk Road. It then lightly analyses potential SDG contributions and challenges on some of the main elements of the digital Silk Road including: ICT infrastructure, the growing market share of Chinese device manufacturers, the promotion of "inclusive globalisation" through e-commerce, the exportation of "smart cities" to countries along the BRI, the expansion of China's internet giants, and the Digital Belt and Road Program Science Plan. Overall, Section 3 highlights that although Chinese actors in the BRI often frame their activities as having only positive SDG impacts, they fail to consider the potential challenges arising from a greater adoption of ICTs and digitisation including: the potential of increasing inequalities, the implications for leaving no one behind, energy consumption and e-waste among others.

Section 4 concludes and provides policy recommendations for traditional development actors seeking to engage with the digital Silk Road. It suggests that traditional donors should: (a) use their convening power to bring together a diverse group of stakeholders to work through the complexities of achieving the SDGs as ICTs continue to spread; (b) be honest knowledge brokers for developing country governments about ICTs and their synergies and trade-offs with achieving the SDGs; (c) work on providing offline channels so the unconnected do not fall further behind; and (d) focus on the future of work which largely gets overlooked in the digital Silk Road. However, direct partnerships in digital BRI projects may be risky for traditional development donors due to concerns that may not bode well with their citizens about the digital Silk Road spreading an unfree internet and technologies that could be used to empower governments while disempowering citizens.

2. The relationship between ICTs and the SDGs

2.1 ICTs in the SDGs

The use of technology in the development sector dates back to the sector's origins. US President Harry Truman's inaugural address in 1949 is often cited as the birth of the development sector (Sachs 1992). In his speech Truman suggests that the US "must embark on a bold new program for making the benefits of [its] scientific advances and industrial progress available for the improvement and growth of underdeveloped areas".[1] Although Truman's envisioned approach of inserting technology to "westernise" the rest of the world, or make it more like the US has been widely criticised (ibid.), the use of technology in the hope of achieving complex development goals has been a mainstay in the development sector and has since been continuously adjusted to reflect dominant development theories, paradigms and practice (Heeks 2018).

Thus, it is not surprising that the most widely diffused set of technologies of our time – digital technologies – have been incorporated into both sets of global goals – the Millennium Development Goals (MDGs) and the SDGs – which have largely shaped aid funding and the efforts of development practitioners in the last two decades. MDG 8 called for cooperation with the private sector to make the benefits of new technologies "*especially Information and Communications Technologies*" available to more people (United Nations 2010). Likewise, the current SDGs that underpin development efforts between 2016 and 2030 have included three goals and targets that explicitly call for the spread of ICTs:

> SDG 9.C: "Significantly increase access to information and communications technology and strive to promote universal and affordable access to the Internet in least developed countries by 2020".
> Target 9.C.1: "Proportion of population covered by a mobile network, by technology".
>
> SDG 5.B: "Enhance the use of enabling technology, in particular information and communications technology to promote the empowerment of women".
> Target 5.B.1: "Proportion of individuals who own a mobile telephone, by sex".
>
> SDG 17.8: "Fully operationalize the technology bank and science technology and innovation capacity-building mechanism for least developing countries by 2017 and enhance the use of enabling technology, in particular information and communications technology".
> Target 17.8.1: "Proportion of individuals using the Internet".

We are currently not on track to achieve universal connectivity by 2020 as per SDG 9.C. Although it is common to come across stats stating that over 4 billion people or more than half the global population are online[2], the annual year-on-year growth in internet users declined from 12% between 2015 and 2016 to 7% between 2016 and 2017 (Meeker 2018). Moreover, according to the United Nations' (2018a: 19) report, *Progress towards the Sustainable Development Goals*, "high-speed internet penetration remains very low in developing countries (6% compared to 24% in developed countries) and limited access, capacity, and speed of fixed broadband connections limits the ability of ICTs to be used as a development tool and threatens

[1] https://www.trumanlibrary.org/whistlestop/50yr_archive/inagural20jan1949.htm
[2] http://www.Internetlivestats.com/

to widen existing inequalities”. Moreover, despite goals and targets that explicitly call for making ICTs accessible to all and for the use of ICTs to achieve development impacts, some ICT4D (ICT for Development) scholars have criticised the lack of further integration of ICTs in the SDGs because of their potential to both have impacts across the other SDGs and to amplify disparities in gains across them (ITU 2017; Unwin 2017, among others).

2.2 ICT-enabled growth and development gains

Investments in ICT infrastructure (including mobile and broadband networks) and ICT adoption are often portrayed as having a positive impact on development by spurring economic growth (SDG 8). However, whether investments in ICT infrastructure or ICT adoption cause economic growth on their own is contested. Galperin and Viecens (2017) found that studies widely cited as evidence of a causal relationship – including Qiang et al. (2009) – suffer from limitations to their validity because they are unable to account for possibilities that economic growth may be causing ICT adoption, that they are both caused by a third variable (e.g. good governance), that they may be simultaneously causing one another, or that the correlation may be due to chance. Moreover, some studies found that ICTs were only shown to have a significant impact on economic growth after a significant portion of a country’s population adopted ICTs (Minges 2015). Therefore, “while the evidence indicates that advanced economies are reaping significant benefits from internet investments, the returns for less advanced economies, and in particular for the fight against poverty in these regions, remains uncertain” (Galperin and Viecens 2017: 315). Friederici et al. (2017: 7) found that despite inconclusive evidence, all African country ICT policy documents they reviewed “make explicit claims that increasing connectivity (particularly through the implementation of the ICT policy) leads to economic growth and other types of development impacts. These statements tend to paint a picture of ultimately large impacts and do not refer to evidence.”

One criticism of the way in which ICTs have been included in the SDGs is that they do not adequately capture all potential ways ICTs can impact all SDGs. An ITU (2017) report presents examples and case studies of how ICTs can be leveraged for impacts across the SDGs. However, along with other prominent development reports, including the 2016 World Development Report and the 2016 Human Development Report, it also warned that the impact of ICTs on the SDGs is not always automatic or positive (World Bank 2016; UNDP 2016). While ICTs can help provide access to financial services and affordable clean energy to people for the first time and make cities more livable, it is also true “that technologies can widen disparities between rich and poor, women and men, and disadvantaged communities and everyone else… [and that] the people with the most to gain from ICTs are also those most likely to be locked out of the benefits” (ITU 2017: 9–10). The coexistence of positive and exclusionary relationships between ICTs and development gains is troublesome given SDGs 10 and 4 are centred on reducing inequalities and achieving gender equality respectively (ITU 2017).

2.3.1 Leaving no one behind amidst ICT-enabled (in)equality

Unwin (2017) argues that there has been an over-emphasis on using ICTs for the sole purpose of increasing economic growth or improving development outcomes without enough appreciation for how ICT diffusion can increase inequalities between individuals with differing access to ICTs and levels of digital skills and between owners of capital and employees. Moreover, because digital inequalities may lead to uneven impacts across the SDGs for individuals (ITU 2017), ICTs threaten to increase social, economic and political disadvantage and inequality thus threatening stability and future economic growth and limiting SDG achievement unless this trend is reversed (Unwin 2017).

Although poverty reduction during the MDG era was substantial, the MDGs have been criticised for having average-based targets that incentivised governments and development actors to target the "low-hanging fruit" or those nearest to escaping poverty rather than the poorest or most marginalised (Burns et al. 2013; Stuart and Samman 2017; UNICEF 2015). This translated into wider gaps between the poorest children and other children within countries (UNICEF 2015). Those left behind from MDG gains disproportionately belonged to already marginalised and vulnerable groups including the extreme poor, religious and ethnic minorities, indigenous groups, the LGBTQI community, refugees and migrants (UNDP 2016). Moreover, people experiencing deprivations across economic, social discrimination, and spatial dimensions (e.g. urban slums and remote areas) were especially prone to being left behind (Burns et al. 2013). Lessons learned from the MDGs led to the SDGs adopting the LNOB agenda, a commitment across all SDG targets and indicators that prioritised reaching the poorest, most marginalised and hardest to reach first.

People are gradually turning to digital technologies to do things previously done offline and digital technologies are increasingly the preferred or default medium. Across sectors, actors in developing countries are moving services with SDG and development implications to digital channels. This is allowing well-connected and digitally capable citizens to extract SDG-related gains from digital technologies, but there is growing evidence that those that are not connected or do not have digital skills are being left out from these gains and risk being left further behind (Hernandez & Roberts 2018). One especially concerning trend found in the United Nation's 2018 e-government survey is that governments are increasingly implementing "digital first" strategies that prioritise reaching citizens via digital channels before building offline channels and in some cases offering "digital by default" services that are only online (United Nations 2018b). Although these strategies can cut down on costs, they risk creating a new "low-hanging fruit", those fortunate enough to be digitally connected. Although the digitally connected may include many of the poor, women, people living in remote areas, and other disadvantaged groups, the most poor and marginalised are least likely to be connected and risk being left behind (Hernandez & Roberts 2018).

The ICT and development literature highlights that already better-off groups (urban dwellers, the wealthy, well-educated people, and men) tend to adopt ICTs first and are better positioned to gain from digitisation. Meanwhile, those likely to be left behind by technology are the same disadvantaged groups that have historically been left behind and who would benefit most from their use: the extreme poor, rural and remote communities, indigenous groups and ethnic minorities, women, the uneducated, disabled, etc. with the addition of the elderly as a new group (United Nations 2018b; World Bank 2016). Although SDG 5.B, acknowledges the need to spread ICTs to reach more women, the SDGs do not explicitly call for a spread of ICTs that targets these other groups. Moreover, whereas the general development literature has stressed that those most likely to be left behind often face multiple forms of oppression across economic, social discrimination and spatial dimensions, there has been much less literature on the relationship between multiple forms of oppression and digital inequalities (Hernandez & Roberts 2018).

As more people go online, it is more important than ever for businesses to maintain an online presence to stay competitive. The internet may open new markets for businesses beyond their geographical proximity via e-commerce, provide access to digital and web-based efficiency improving software, and make it easier to subcontract expertise (Sharafat and Lehr 2017;

World Bank 2016). However, digital inequalities are also observed between firms. Businesses in low-income countries are less likely to be online, especially in least developed and landlocked countries. Moreover, UNCTAD (2017) finds that small businesses consistently lag behind in internet usage compared to larger firms and receive less orders online in all countries where data are disaggregated by firm size. Small and medium-sized enterprises (SMEs) disproportionately face barriers to e-commerce including: lack of awareness; lack of access, affordability, and skills; poor availability of international and local payment solutions; lack of access to cost-effective logistics; limited capabilities to manage requests and relationships with international customers; low visibility and lack of reputation; and lack of ability to confirm with legal and fiscal requirements in foreign markets (ibid.).

2.3.2 Addressing barriers beyond infrastructure

Because digital inequalities persist and threaten to leave the disadvantaged further behind, "for ICTs effectively to deliver the SDGs they must be used to empower the poorest, and not just deliver economic growth" (Unwin 2017: 39). This means going beyond the necessary but insufficient act of building digital infrastructure. There is also a need to overcome demand-side barriers, which often deter potential users from going online even when there is sufficient supply (ibid.). Roberts & Hernandez's (2017) "five As of technology access" provide a neat way of categorising the main barriers to access:

1. **Availability** – whether or not connectivity is available in a given context. This is especially relevant to poor and indigenous communities who are more likely to live in areas without mobile coverage. Telecommunications companies have historically prioritised reaching relatively wealthier places with buying power. Poor rural areas with scattered populations have been deemed unprofitable and thus infrastructure has not been built for them or to the same standard. Even when connectivity is available, poorer places are more likely to experience slower and less reliable connections (UNCTAD 2017).
2. **Affordability** includes the price of handsets, data, and maintaining a device. Although prices have generally decreased, data shows that there is an adverse correlation between the income level of a country and the price of connectivity relative to Gross National Income per capita, that the poor are especially less likely to afford connectivity, and that women are more likely than men to be unable to afford connectivity (GSMA 2016; Unwin 2017).
3. **Awareness** refers to being aware not just of the digital technologies themselves and some of its main uses, but also awareness of specific apps, platforms, and websites relevant to one's own experience. A GSMA (2016) study finds "awareness and lack of relevant content" as the main barrier in six of seven Asian countries surveyed.
4. **Ability** – Some potential users can be held back from using digital technology by an inadequate level of skills including both language literacy (being able to read and write) and digital literacy (being able to navigate digital technology). The required ability to be an effective digital citizen is a moving target. UNESCO (2018) suggests that today it should also include the ability to understand visual representation, creatively re-use information, and evaluate the validity of information (e.g. fake news), amongst others. Furthermore, in many places, social norms may predetermine that it is culturally unacceptable or that it is unsafe for women to be online or their access may be mediated by a male gatekeeper hindering their ability to gain access.
5. **Accessibility** is composed of two main sub-components.

a. ***Disability*** – 15% of the global population lives with some form of disability (WHO 2011). Although digital technologies can be an "enabler" for people with some disabilities (e.g. ones that mainly affect their mobility), some disabilities like blindness may hinder use of digital technology if technologies are not designed with disabled users in mind.
b. ***Relevant content*** – much of the internet remains dominated by a few languages. If the internet does not contain content that is both accessible (in language and format) and relevant, people are unlikely to perceive it as useful. At the time of writing, 53% of all websites were in English and 10 languages made up almost 90% of all web content.[3]

The above barriers disproportionately affect the poor and marginalised whom are more likely to be hindered by one or more of these barriers. It is worth noting that digital inequalities are not binary disparities in access between users and non-users, but multifaceted and multidimensional (Ramalingam & Hernandez 2016; United Nations 2018b) (see Table 1). It is beyond the scope of this report to go into the multiple dimensions of digital inequalities in detail but some of them include but are not limited to divides between: geographies, socially stratified groups (e.g. gender, rich and poor, men and women, citizens and migrants, etc.), type of device, literacy, device owners and users that mainly share a device, speed of connection and bandwidth, and content consumers and producers, among others. Thus, tackling digital inequalities goes beyond mere infrastructure and device provision.

Table 1: A selection of digital divides

Divide	Description
Access	It starts with access or the lack thereof: although internet penetration has increased, it continues to be a key barrier as more people globally remain offline rather than online
Affordability	The gap between rich and poor affects affordability of ICTs and serves as an important difference in adoption within countries as much as between them
Age	Older people are generally using ICTs to a lesser extent than younger populations, despite the notion that they could benefit from online social and health services
Bandwidth	International bandwidth and the capacity to transmit and receive information over networks varies greatly between countries and also within them, limiting potential useful endeavours
Content	Relevant content in local language(s) is important to stimulate adoption
Disability	Those with disabilities face additional hurdles to use ICTs if websites are not compliant with web accessibility guidelines
Education	Like social divides, education and literacy rates are fundamental challenges to bridge digital divides
Gender	There is a small but persistent difference in online usage between men and women

[3] https://w3techs.com/technologies/overview/content_language/all

Migration	Migrants may not possess the same levels of digital skills as the population in their new country and if they do, may be subject to content and language divides
Location	Rural and remote areas are often at a disadvantage in terms of speed and quality of services as compared to their urban counterparts
Mobile	Mobile devices provide opportunities to bridge the access gap but can also introduce new forms of divides in terms of technology, speed and usage
Speed	The gap between basic and broadband access is creating a new divide as speed is important to reap the full benefits of a digital society
Useful usage	What people do with their access is a key difference in whether users take full advantage of ICTs, such as e-government services

Note: The above table is intended to be illustrative and not exhaustive

Source: United Nations (2018b)

Similar to how the SDGs call for prioritising the hardest to reach, using ICTs to achieve the SDGs while ensuring they do not increase inequalities and thus hinder our ability to achieve the SDGs requires that digital inclusion efforts prioritise the people hardest to reach first. Reaching the hardest to reach first will be necessary in efforts regarding building digital infrastructure in poor and far-flung geographies, improving digital skills for those least likely to have them, generating content in under-represented languages, and finding ways of getting devices and technology in the hands of the poorest and most powerless (Unwin 2017).

2.4 ICTs and the future of work

SDG 8 calls for “productive employment and decent work for all”. Although the spread of ICTs can create more jobs, this trajectory is not a given and could lead to the opposite or increasing income inequality if policies and technological innovations are poorly designed or introduced without incentives to augment workers rather than displace them (Brynjolfsson & McAfee 2014; Sharafat & Lehr 2017; World Bank 2016). The same efficiency gains offered by ICTs threaten to displace workers and/or exacerbate earning inequalities between workers with in-demand skills and those without them. Up to two thirds of jobs are projected to be susceptible to automation in developing countries and as much as 85% in Ethiopia (World Bank 2016). Whether or not digital technologies will displace workers remains unclear and speculative. These predictions have been contested. Scholars using different methods have predicted that automation does not pose a significant risk to employment levels (Kapoor et al. 2018). However, scholars still warn that even if workplace automation does not decrease overall employment levels, there is still a risk of increasing income inequality (SDG 10) if disparities in education levels (SDG 4) and digital skills (SDG 4.4.1) persist (Acemoglu & Restrepo 2018). Moreover, although digital technologies have generated new forms of employment through “digital work”, these jobs also require internet access and are subject to education and skills biases which mirror offline inequalities (World Bank 2016).

This can be worrisome for the LNOB agenda because the already well off are more likely to possess the levels of education and digital skills needed to extract higher values from the job market whilst the poorer and more marginalised are more likely to lack them (World Bank 2016). Moreover, there are concerns that women and girls are more vulnerable to being left behind without the reversal of social norms and current education and employment trends (Faith 2017).

The relationship between automation, digital skills, and inequality is well captured in the following quote:

> There's never been a better time to be a worker with special skills or the right education, because these people can use technology to create and capture value. However, there's never been a worse time to be a worker with only "ordinary" skills and abilities to offer, because computers, robots, and other digital technologies are acquiring these skills and abilities at an extraordinary rate (Brynjolfsson & McAfee 2014).

2.5 ICTs and environmental sustainability

There are also concerns about how "sustainable" digital technologies are, due to their environmental footprint and the predominant business model on which the spread of digital devices is based (Unwin 2017). It is still unclear whether ICTs have a net positive or negative impact on sustainability. Although the ICT sector unloads greenhouse emissions from other sectors through efficiency gains, digitising previously analogue services, and reducing the need to travel, among others, this has also coincided with the ICT sector increasing its own energy emissions (Unwin 2017). A phenomenon known as the "Jevons Paradox" suggests that when energy efficiency improves, users tend to demand more of it rather than less because price decreases incentivise innovative uses of energy that were not economically feasible previously thus offsetting gains and potentially even overshadowing them over time (Gossart 2014).

If the IT sector were a country, it would rank third in the world in energy consumption behind China and the US (Greenpeace 2017a). The share of global electricity consumed by ICTs was 4.7% in 2012 and is expected to rise to 14% by 2020 (Van Heddeghem et al. 2014). Andrae & Edler (2015) projected the IT sector's energy usage until 2030 under best, expected, and worst case scenarios. In all scenarios, the share of electricity consumed and greenhouse gases emitted by the ICT sector are expected to increase from 2012 levels. Under the likely scenario, ICTs will account for 21% of energy consumption by 2030. Under the best case scenario, ICT energy efficiency improves and accounts for 8% of energy usage. Under the worst case scenario, ICTs can account for up to 51% of all electricity consumption by 2030 and emit up to 23% of greenhouse gases (ibid.). These scenarios illustrate that there is a need to increase the energy efficiency of the sector as well as ensure that it is powered by renewable energy if the sector is to not derail global environmental sustainability efforts. Moreover, these estimates were made before cryptocurrency (e.g. bitcoin) mining became the heavy energy consumer it is today. Bitcoin mining energy consumption is believed to be growing at 25% a month and on pace to consume as much electricity as the US by as early as 2019 and the rest of the world by 2020 (Jezard 2017).

Although the explosion of data and new data analytic tools can be leveraged to improve SDG outcomes by, for example, monitoring the environment and resource allocation, data centres storing data "in the cloud" and networks transmitting data now consume a greater amount of electricity. Data centres and networks accounted for 15% and 20% of the IT sector's electricity consumption in 2012 respectively and rose to 21% and 29% by 2017 (Greenpeace 2017a). Although device and IT equipment energy efficiency is improving, the rapid expansion of the internet to more users combined with users consuming more data has outpaced these gains. Video streaming – a data-intensive activity – now makes up 60% of all internet traffic and is expected to increase to 80% by 2020 (ibid.). This poses serious challenges for climate change if electricity is not supplied via renewable energy. Despite great strides made by some firms in the IT sector including Facebook, Google and Apple making commitments to 100% renewable energy in the near future, renewable energy still only accounts for a small fraction of energy consumed by data centres and is as low as 5%, 4.2%, and 1% in China, Taiwan, and South Korea respectively (Greenpeace 2017a).

Moreover, universal ICT adoption requires more devices. The current dominant business model of ICT device manufacturers is centred on “planned obsolescence” in which manufacturers attempt to incentivise buyers to continuously buy the latest device while relinquishing their old ones even when they function perfectly well. This has direct environmental implications through the generation of e-waste which is predominately dumped in developing countries often causing environmental damage and toxic exposure to informal workers including women and children (Perkins et al. 2014; Unwin 2017). Moreover, there are concerns about mining activities and labour practices along the ICT device supply chain (Unwin 2017). The extraction of cobalt, one of the essential raw materials in mobile phones, exposes miners to environmental risks and is largely dependent on labourers, including children, working in slave-like conditions (SDGs 8.7 and 16.2) (Amnesty International 2016).

This section has shown that the relationship between ICTs and the SDGs is complex, non-linear, multifaceted and not always positive. Therefore, no single actor can enable ICTs being used in a way that promotes sustainable development. Working through this complexity will require action and coordination between many actors including government, the private sector, civil society, and citizens – including the unconnected and those at risk of being left behind – to come up with solutions that stand the chance of being successful and sustainable (Unwin 2017). ICTs can be used in ways that help to achieve the SDGs. However, as the literature in this section illustrates, failure to put together holistic ICT policies and adopt practices that are conducive to sustainable development may result in the reverse. How we act now regarding ICTs will shape our ability to achieve the SDGs. The many challenges presented in this section have shown that digital infrastructure alone is unlikely to be sufficient for ICTs to have a positive impact on the SDGs. Instead, as Sharafat & Lehr (2017: 30) argue, many factors need to be considered and coordinated including “government policies and actions, infrastructure investment, applications and content, markets and competition, government budgets, and ICT skills and education”. Given the complexity of the interaction between ICTs and the SDGs there is a need to look beyond targets and plans for ICT-specific SDG goals and targets and consider how ICTs can contribute – both positively and negatively – to all the other SDGs and set targets accordingly (Unwin 2017).

3. BRI ambition and intent in investing in digital connectivity and ICTs

The digital Silk Road has been largely overlooked in the BRI literature which has overwhelmingly focused on roads, ports, and energy infrastructure while undervaluing “the massive digital infrastructures (e.g. fiber-optic cables and data centers) that have been [built] alongside transport and energy projects” (Shen 2018: 2684). A deeper look at projects branded as part of the “digital Silk Road” illustrate that China’s digital aspirations go beyond the construction of fibre-optic cables and encompass a wide range of technologies as China races ahead to become a world leader in not just ICT infrastructure but also digital technology more generally.

Although the BRI was first announced in 2013, the digital Silk Road seems to have taken off in 2015 when “Vision and actions on jointly building Silk Road Economic Belt and 21st Century Maritime Road” – often cited as the guiding framework for the initiative – called for the creation of an “information Silk Road” by building “bilateral cross-border optical cable networks at a quicker pace, plan[ning] transcontinental submarine optical cable projects, and improv[ing] (satellite) information passageways to expand information exchanges and cooperation" and "promot[ing] in-depth cooperation with other countries along the Belt and Road in new generation information technology" (People's Republic of China 2015). Subsequently, China's 13th five-year plan published in 2016 called for the development of an "online Silk Road with Arab countries and others and accelerat[ing] the development of the China–ASEAN Information Harbor" and "establish[ing] open international communications facilities, refin[ing] the distribution of international networks, and improv[ing] cross-border land and submarine cable infrastructure" (People's Republic of China 2016: 71). At the 2017 opening ceremony of the Belt and Road Forum for International Cooperation, President Xi Jinping stated that China should "build the [BRI] into a road of innovation" and "innovation driven development" by intensifying cooperation in frontier areas and "turn them into a digital Silk Road of the 21st century". Areas highlighted by the president include the digital economy, artificial intelligence, nanotechnology, quantum computing, cloud computing and smart cities (Shen 2018; Xinhuanet 2017).

A forum dedicated to international cooperation along the digital Silk Road was held in December 2017 during the fourth World Internet Conference in Wuzhen, China. It was attended by high-ranking Chinese and foreign government officials (including President Xi Jinping), and executives from Google, Apple and Facebook despite their services being banned in China (*China Daily* 2017). At the forum, China announced a partnership with seven countries (Egypt, Laos, Saudi Arabia, Serbia, Thailand, Turkey, and United Arab Emirates). Together the eight countries pledge to "expand broadband access and improve quality, promote a digital transformation, encourage e-commerce cooperation, support internet-based entrepreneurship and innovation, promote development of MSMEs (micro, small and medium-sized enterprises), strengthen digital capability building, promote investment in the ICT sector, and promote inter-city cooperation of the digital economy… [and] enhance digital inclusion, encourage policy-making to create a transparent digital economy, promote cooperation in international standardization" (China.org.cn 2017).

3.1 Drivers of the digital Silk Road

The scant literature on the digital Silk Road identifies six major policy objectives: (1) addressing industrial overcapacity, (2) facilitating global expansion for Chinese corporations, (3) supporting the internationalisation of the Chinese renminbi (RMB), (4) constructing China-centred transnational networks, (5) promoting "inclusive globalisation", and (6) promoting internet sovereignty. It is beyond the scope of this literature review to cover all of them in detail. Readers further interested in these drivers should see Shen (2018).

Overcapacity

China's fibre-optic cable market's overcapacity exceeded 50% in 2015 and is in urgent need of external markets. Chinese device manufacturers are also over-capacitated due to insufficient internal market demand. Shen (2018) argues that this led the CEO of ZTE – a Chinese Telecommunications equipment provider – to write in a Chinese communist party magazine asking for the "information Silk Road" to be expedited. Moreover, the BRI is also expected to increase demand for Chinese digital ICT products and services because non-digital infrastructure (e.g. railways, airports and pipelines) will need to be integrated which could further address ICT sector overcapacity (ibid.).

Relieving overcapacity for other sectors through e-commerce

The digital Silk Road also provides an opportunity to facilitate the expansion of e-commerce for other sectors of the Chinese economy like the steel industry, which saw the emergence of over 200 online steel trading platforms between 2013 and 2016 allowing them to conduct business via e-commerce with customers further abroad. One steel-centred e-commerce company, Zhaogang.com, has set up branches across the BRI to help the export of excess capacity. Shen (2018) suggests that this partly explains why digital infrastructure is often built alongside transport and energy projects throughout the BRI.

Enabling the "going out" of domestic firms

In what is known as the "borrowing the boat to reach the sea" strategy, digital infrastructure in BRI countries and digital services (e.g. cloud services) provided by Chinese companies are expected to help Chinese firms reach external markets. Internet companies have been assigned a special role in China's "Internet +" policy which encourages Chinese internet firms to build competitive big data analytic and cloud computing applications and platforms to compliment traditional Chinese industries in international ventures (Shen 2018). Alibaba, for example, has expanded its data centres and Alibaba Cloud services overseas have been widely used by Chinese companies in their operations abroad helping them save on operational costs. Alibaba now seeks to expand its data centres to at least three countries covered by the BRI (India, Indonesia and Malaysia) (ibid.).

Internationalisation of the Chinese renminbi

The more general BRI literature identifies the internationalisation of the Chinese renminbi as a driver for the initiative overall and the establishment of the Asian Infrastructure Investment Bank (AIIB), the Silk Road Fund, and the New Development Bank (Rolland 2017). Until now, the exchange of data throughout the global financial system has been dominated by US-led or controlled institutions. The digital Silk Road could help establish a transnational financial data network that gives China more authority, improves global circulation of the renminbi, and helps China circumvent external surveillance (Shen 2018). In 2015, the Cross-border Interbank Payment System went live which supports clearing and settlements service for international RMB payments and trade. It is seen as both an alternative and parallel to the US-centred SWIFT system (ibid.). One Chinese company, IZP Technologies, created "Globebill" a BRI-specific cross-border payment and settlement digital solution which aims to help "carry out direct liquidation between the Renminbi and other currencies, bypassing the U.S. Dollar as the intermediary" in up to 30 BRI countries and offers dual-currency credit cards in many countries (Shen 2018: 2690–2691).

China-centred digital infrastructure

Fibre-optic cables are susceptible to surveillance by the companies that control them or when they pass through foreign lands. Submarine cables transmit the majority of international data traffic. Today they are mainly geographically concentrated and dominated by "US [and European] Power" (Shen 2018). WikiLeaks uncovered that western spy agencies were tapping these cables for their global surveillance systems. To overcome the need to have their data travel through cables controlled by foreign powers, a Brazil, Russia, India, China and South Africa (BRICS) fibre-optic cable was proposed, but was not implemented due to internal conflict between BRICS countries and “domestic economic challenges”. Shen (2018: 2691) suggests that through the digital Silk Road, China aims to create its own “transnational network infrastructure through submarine, terrestrial, and satellite links, primarily alongside the Belt and Road Initiative countries”.

Moreover, China seeks to expand its BeiDou Navigation Satellite System, a direct alternative to the US-based Global Positioning System (GPS). The government aimed to provide basic BeiDou navigation services to major BRI countries by 2018, and then expand globally by 2020 (Shen 2018; State Council Information Office of the People’s Republic of China 2016). One of the main goals of the BeiDou system is to end military reliance on the US-centred GPS system in China in fear that the US could cut off China or its military from GPS during a dispute. China has already secured agreements with several BRI country governments to use the system in their government and military operations (Shen 2018; Wilson 2017).

“Inclusive globalisation” and repositioning China in a shifting geopolitical world

Shen (2018) and many others argue that the BRI was formulated at an opportune moment for China. The Trump administration pulled out of the Trans-Pacific Partnership (TPP) and adopted an “America first” rhetoric. Amidst increasing global isolationism from the US, China has vowed to hold up global free trade and economic globalisation and to make it more “invigorated, *inclusive*, and sustainable” (Jinping 2017, emphasis added). In an article in an influential Chinese communist party journal, one Chinese International Relations scholar characterised the history of globalisation into three eras: globalisation 1.0, 2.0, and the current “Globalisation 3.0”. Globalisation 1.0 was underpinned by the ancient Silk Road, 2.0 was led by the western colonial and industrial powers, whilst the BRI is giving way for Globalisation 3.0 “with internet technologies such as big data and smart cities efficiently connecting landlocked and developing countries to the global economy through a more inclusive international trade and investment system” (Wang 2016 in Shen 2018: 2693). Digital technologies are thus viewed as empowering for landlocked states and developing nations and have been regarded as an important tool to be leveraged in China-led inclusive globalisation (ibid.). The electronic world trade platform (eWTP) – see Section 3.4 – was proposed by Alibaba founder Jack Ma on the backdrop that “the benefits of increased trade and globalisation have not reached smaller enterprises and developing countries as much as it has benefited their larger, more established counterparts” (Alibaba Group 2016).

Promoting internet sovereignty and spreading a “not free” internet

China also seeks to expand its idea of “internet sovereignty”, a form of internet governance at odds with the Silicon Valley ideal of the internet as an open forum. At the 2017 World Internet Conference, Wang Huning, a prominent Chinese public official, said “China stands ready to develop new rules and systems of internet governance to serve all parties and counteract current imbalances” (Hornby 2017). Internet sovereignty suggests that the internet should be controlled by the state with each state having the right to regulate its own internet without foreign interference. Through internet sovereignty China defends its current practices of tight restrictions on connectivity with the rest of the world and seeks to help like-minded governments build similar architecture (ibid.). An internet based on these principles is especially attractive to governments seeking to curtail citizens from organising online dissent. It is thus not surprising that China’s selection of partners for the digital Silk Road mainly includes countries where the internet is already quite restricted. Six of the eight partners (including China) score “Not Free” on the

Freedom on the Net index and the two others (Serbia and Laos) are not scored (Freedom House 2017).

China has ranked last on the *Freedom on the Net* index for three years in a row (ibid.). China has been found to shut down mobile services where it feels its central authority is being challenged including places where ethnic minorities and marginalised groups live (e.g. Tibet and the Uighur minority), and citizens criticising the government on foreign websites have received prison sentences of up to 11 years (ibid.). The Chinese government actively censors content regarding government criticism, corruption, conflict, political opposition, satire, social commentary, mobilisation for public causes, blasphemy, LGBTQI issues, and ethnic and religious minorities. This may be troublesome for achieving the SDGs since, as mentioned earlier, ethnic and religious minorities and the LGBTQI community have been found to be at risk of being left behind and such practices may effectively silence their voices (UNDP 2016).

China's system of online censorship has been called "the great firewall". Thousands of foreign websites and services are blocked in the country including most Google services (e.g. search and Gmail), Dropbox, Facebook, live-streaming websites, gossip blogs, and news sites (*The Economist* 2018). Moreover, the Cyberspace Administration of China (CAC) requires all companies operating locally to proactively censor material that "disturbs the economic or social order", "endangers national honour", or may contribute to the "overthrow of the socialist system"; and companies operating in China must comply with government orders to delete user posts and channels (*Financial Times* 2017). A recent Chinese cyber-security law requires that internet companies register users under their real names, store data about Chinese users within China, and comply with data requests from Chinese security agencies (Freedom House 2017). QQ and WeChat users can now be held responsible for any citizen dissent arising from discussions on groups they create even if they did not participate in the discussion (Human Rights Watch 2018). Along with promoting self-censorship in ways that disincentivises citizens from claiming their rights or fighting corruption, internet sovereignty has also meant censoring intellectual and academic content. Springer Nature was forced to pull 1,000 academic articles in China and 300 articles have been blocked from *China Quarterly*, a high impact journal (Human Rights Watch 2018).

There are already signs of these surveillance practices being exported and facilitated abroad by Chinese ICT companies. The Ethiopian government has actively restricted the "right to privacy and freedoms of expression and association, and access to information, among other rights" online (Human Rights Watch 2014: 2). ZSmart, a tool developed by ZTE – a Chinese state-owned enterprise – has been in use in Ethiopia since 2009 and provides the government with information about each user (name, address and ethnicity), detailed call logs, SMS message content, and records phone calls from selected users. Moreover, ZTE's "ZXMT" centralised monitoring system is capable of "intercepting web-based email, email accessed via client software (like Outlook), web browsing, and chat" (Human Rights Watch 2014: 62). It is understood that this system is automatically packaged into ZTE's telecom equipment unless governments opt out. Moreover, content filtering and blocking is believed to be facilitated by Chinese technology and Human Rights Watch also suggests that ZTE provides surveillance technical assistance. The effective usage of these technologies by the Ethiopian government has resulted in Ethiopians feeling that government surveillance on digital channels is omnipresent, self-censoring themselves in fear of being arrested for "anti-government activities". Ethiopian authorities use recorded mobile calls, call logs, and text and email gathered without a warrant as evidence in interrogations and in court. There have also been cases of Chinese technology used to survey citizens in similar ways in Zambia and Zimbabwe (Gagliardone & Geall 2014). However, Human Rights Watch (2014) uncovered that European companies are also guilty of providing Ethiopian surveillance with products, services and expertise.

Moreover, there are increasing fears that Chinese companies may use their infrastructure to aid the Chinese government's intelligence efforts for traditional and economic espionage by including backdoors and vulnerabilities in ICT infrastructure that only they know about (Reed 2013). Huawei has positioned itself as a global leader in 5G technology and is seen as instrumental in implementing a China-led 5G standard. However, some governments have scrutinised the company recently due to its potential ties to the Chinese government and fears that the Chinese cybersecurity law would make ZTE and Huawei operations abroad subject to data sharing with the Communist Party for intelligence-gathering purposes. Consequently, the US and Australia have banned their equipment altogether whilst others such as Japan and the UK have contemplated doing so (Zolfagharifard 2018). Moreover, Huawei and ZTE are often given contracts to run the communications networks they build in countries with state-owned monopoly telecommunications companies (e.g. Ethiopia), giving them a panoptic view of digital activities and meaning all maintenance is done by the companies thus raising further cybersecurity risks (Reed 2013).

3.2 Digital infrastructure

Like many of the other activities carried out in the more general BRI, it can be challenging to define the parameters of the digital Silk Road. This is a very light analysis of the initiative and does not claim to define or cover all its activities. Instead it will mainly cover six key areas that are regularly emphasised when the digital Silk Road is mentioned and their potential implications for the SDGs: (1) digital infrastructure, (2) digital devices, (3) e-commerce, (4) smart cities and surveillance technologies, (5) the expansion of Chinese internet giants, and (6) the Digital Belt and Road Program Science Plan. At the time of writing, the digital Silk Road had not yet been analysed from a development or SDG angle. The SDG links made in this section are made in relation to the more general ICT and SDG literature covered in Section 2 and is by no means conclusive or exhaustive. More work is needed to carry out an in-depth analysis of the interactions, synergies and trade-offs between the digital Silk Road and the SDGs.

Like other infrastructure activities in the BRI, there is no central database that neatly confirms which ICT infrastructure projects in BRI countries are linked to the initiative. At the moment, the best resource seems to be a slightly outdated UNESCAP (2017) study which notes recent, current, and planned terrestrial and submarine fibre-optic infrastructure passing through BRI countries, listed by corridors. However, it is unclear whether all the projects include Chinese involvement or have been branded under the BRI. Nonetheless, the report uncovered 13 major ICT infrastructure projects across six corridors. However, because of its emphasis on main corridors, it did not include African projects. Thus, an updated mapping of BRI-related ICT infrastructure projects – preferably in a living format – is warranted that follows up on projects identified by UNESCAP (2017) to confirm BRI alignment and seeks to include African projects. Another good resource is AidData.org's "Mapping China's Global Development Footprint" map[4] which geocodes Chinese-funded development projects and colour codes them by sector (including communications). However, the map is cluttered with many sectors (and thus colours),

[4] https://www.aiddata.org/china-project-locations-v-1-0-1

and does not currently include a function that allows the isolation of single sectors making it difficult to make sense of investments in a single sector.

Also, like other activities carried out as part of the BRI, this is not the first time Chinese companies have been involved in digital infrastructure construction activities abroad. Telecoms were a “core investment sector” in China’s previous “going out” strategy (Cisse 2012). Huawei’s involvement in African ICT infrastructure projects date back to 1998 when it began its first project in Kenya (Chang et al. 2009). As early as 2007, scholars had pointed out that “China’s concentrated investment in African telecommunication infrastructure has accelerated development to a degree that would be otherwise impossible” at a time when “Western nations [had] displayed particular hesitance to assist Africa’s telecom growth” (SIPA 2007). Chinese telecommunications companies had already supplied around 3 billion USD in ICT equipment to sub-Saharan Africa between 2001 and 2007, mainly in Ethiopia, Ghana and Sudan (World Bank 2009). One notable early ICT infrastructure project was the Ethiopia Millennium Project in which Chinese telecommunications company ZTE was the country’s “sole supplier” and aimed to build a fibre-optic transmission backbone and expand GSM mobile networks for the national monopoly mobile provider, Ethio Telecom (ZTE 2008). Chinese telecommunications companies have since continued to secure contracts to expand and upgrade infrastructure in Ethiopia including a 1.6 billion USD project in 2013 split between ZTE and Huawei (Maasho 2013).

Although Chinese ICT equipment companies had a late start compared to western companies, they now dominate the mobile infrastructure market and controlled over 40% of the market in 2017. Huawei is now the biggest player in mobile infrastructure controlling 28% of the global market and ZTE the fourth biggest with 13% of the market (telecomlead 2018). The profile of Chinese ICT equipment firms is also rapidly improving in the submarine cable market. Huawei Marine launched in 2008 and has since emerged as one of the top suppliers in the world, accounting for the third most amount of systems installed between 2013 and 2017 and has the second most systems planned between 2018 and 2019 (Submarine Telecoms Forum 2017). One notable Huawei submarine fibre-optic project is the recently completed South Atlantic Inter Link (SAIL) cable, a 6,000km-long transatlantic cable linking Africa (Cameroon) with South America (Brazil) which directly connects the two continents for the first time (Huawei Marine 2018). Moreover, Huawei Marine also constructed the 1,300km-long Malaysia–Cambodia–Thailand (MCT) cable which gave Cambodia direct access to a submarine cable for the first time and improved connections in Malaysia and Thailand (Huawei Marine 2017). Huawei’s ascendance in the submarine fibre-optic market is unlikely to slow down in the near future. China is expected to nearly triple its share of global submarine cable projects from 7% between 2012 and 2015 to 20% between 2016 and 2019 with over half of those cables being built beyond the South China Sea (Lee 2017). Moreover, two nascent Chinese companies – Hengton Group Co and ZTT Group – have also begun expanding their operations in the undersea cables market (Ecns.cn 2018).

As mentioned earlier, ICT infrastructure has historically been built in places with buying-power deemed profitable by ICT companies meaning many rural, remote and poor areas have been left behind or experience less reliable connectivity. Most countries in Central Asia in particular have found it difficult to invest in or attract investment in digital infrastructure due to challenging geographical typology (e.g. deserts, mountainous terrain, and some countries being landlocked) combined with small populations scattered over large often rural and remote areas. Moreover, these countries also suffer from low international bandwidth, especially when measured in terms of speed per internet user (Kunavut et al. 2018). Digital infrastructure built as part of the digital

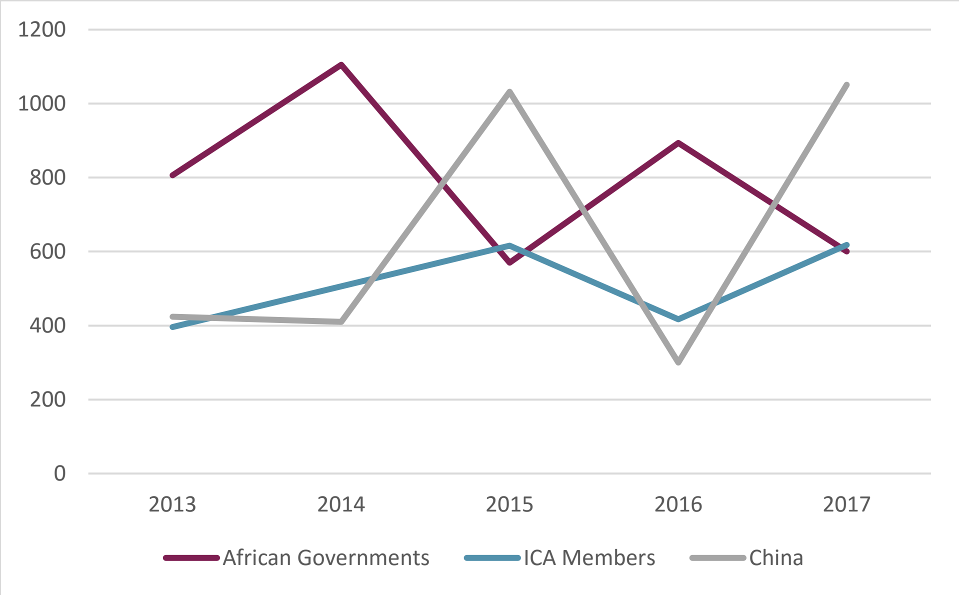
Silk Road could thus help overcome this barrier and contribute to SDG 9.C by improving the availability and affordability of broadband networks and services for these countries and other BRI countries (ibid.).

Submarine cables account for 90% of global internet traffic. Currently, digital networks spread from submarine cables in the sea that are connected to overland cables which thin out the further they get from the submarine cable, especially when traversing countries that have limited fibre-optic interconnections and international gateways. Digital connectivity has been identified as a potential route to integration into globalisation for landlocked developing countries. For these countries, internet access is hindered by insufficient bandwidth and accessing international links which requires connecting to neighbouring countries and can be costly due to high transit costs (Kunavut et al. 2018). Landlocked countries often rely on a few outdated terrestrial connections to neighbouring countries with access to regional and global cable systems. Consequently, landlocked countries tend to have more expensive and slower internet connections. These costs have been identified as a barrier to e-commerce and the use of the internet by SMEs in the region (ibid.).

The growth of global Chinese telecommunications companies may be especially beneficial for developing countries. Huawei has historically offered ICT equipment 5–15% cheaper than equipment providers from western countries without compromising quality while ZTE has offered equipment up to 30–40% cheaper (Chang et al. 2009; Cisse 2012). Moreover, in line with China’s non-interference policy, Huawei and ZTE have been known to take risks in countries and environments that Western suppliers often shy away from (Cisse 2012). The relative low cost of Huawei and ZTE equipment has raised suspicions amongst foreign companies and governments regarding unfair subsidies provided by the Chinese government that provide the companies with an unfair advantage in global markets (*Financial Times* 2014).

Nonetheless, Chinese ICT infrastructure is helping connect Africa. Chinese funding for ICT infrastructure routinely rivals and often surpasses all members of the Infrastructure Consortium for Africa (ICA) countries combined – which include all the G8 countries plus South Korea – making Chinese ICT companies the most significant foreign players in African digital infrastructure (see Figure 1) (ICA 2017). “China has made inroads into the emerging telecommunications market in Africa through a mixture of loans, which are part of aid packages, and export credits, which are used to foster Chinese investment by offering resources to Chinese companies willing to invest in African markets” (Gagliardone & Geall 2014: 3). Chinese ICT infrastructure funding typically comes in the form of loans financed by the Export–Import Bank of China and the China Development Bank, which require equipment to be purchased from Chinese telecommunications companies (Cisse 2012).

Figure 1: Total African ICT infrastructure financing by source, 2013–2017



Source: Adapted from ICA (2017: 85) and https://www.icafrica.org/en/topics-programmes/ict/ict-financing-trends/

However, whether this access will be universal as the SDG target calls for remains to be seen. Although China's 13th five-year plan promises 98% internet coverage in China, similar promises have not been made for BRI countries (People's Republic of China 2016). Given that the project is driven by China and Chinese company interests – as shown in Section 3.1 – it may be likely that digital Silk Road projects prioritise building infrastructure in areas that are of geopolitical significance or help them best achieve their objectives rather than reach the most underserved areas. Scholars have argued that this has historically been the case with Chinese ICT suppliers operating in Africa as they have been heavily supported by the government through diplomatic and financial support (Cisse 2012). Although this may mean areas that were previously seen as unprofitable by western ICT equipment companies may be prioritised, already unconnected areas in BRI countries without strategic significance may be left further behind (LNOB goal) if others do not step up to build the infrastructure.

Fortunately, Huawei, the biggest Chinese ICT infrastructure supplier, has made clear efforts to align itself with the SDGs as well as the BRI. The company asserts that "[their] corporate mission is to bring digital to every person, home and organization for a fully connected, intelligent world, [they] believe that ICT is a critical contributor and enabler of [the] UN's SDGs, helping to quicken their reach and achievement".[5] The company publishes an annual ICT SDG Benchmark report that seeks to examine the degree to which ICTs enable the SDGs in 49 countries. In these reports, Huawei argues that ICTs have the highest potential to positively impact six SDGs based on the strength of correlations between ICT adoption and improvement in the relevant goal: SDG 4 (quality education); SDG 3 (good health and wellbeing); SDG 9 (industry, innovation and infrastructure); SDG 5 (gender equality); SDG 11 (sustainable cities and communities); and SDG 7 (affordable and clean energy) (Huawei 2018).

[5] https://www.huawei.com/en/about-huawei/sustainability/sdg

However, the Huawei (2018) report is blind to the potential challenges ICTs pose to achieving the SDGs covered in Section 2 of this report. In the opening sentences of the executive summary, Huawei (2018: 5) asserts that "Information Communication Technology (ICT) is a force for good. By providing access to information, it makes people more effective and businesses more efficient. Access to ICT can help society build a more equitable, sustainable world". However, as the ICT and SDG literature shows, although ICTs can help achieve positive impacts, the relationship between the two is complex, not certain and may run counter to the SDGs if appropriate actions are not taken (Unwin 2017). The Huawei (2018) report also suggests that ICT development is strongly correlated "with faster and more efficient progress on the SDGs", making "ICT a leading indicator for sustainable development". Their ICT score depends on three factors: "access", "digital skills", and "use", all of which Huawei points out are strongly correlated to the SDGs on their own. Similar to logical leaps that suggest that *correlation* between economic growth and ICT adoption is causal highlighted by Galperin & Viecens (2017), the Huawei (2018: 6) report claims that "SDG 3 (Good Health and Well-being) and SDG 4 (Quality Education) showed the highest level of correlation with ICT, suggesting that this is where digital technology has the highest potential to accelerate country performance and that this is especially true for Pioneer and Up-and-Comer countries, where small investments in ICT are coupled with significant SDG gains". The report also highlights correlations between its ICT SDG Benchmark with the triple bottom line – GDP, the Human Development Index and Environmental Performance Index. However, as the literature exploring the relationship between economic growth and ICT adoption shows, that two indices are correlated does not tell us the presence or direction of causality (Galperin & Viecens 2017). The report is full of Preston curves suggesting that a small increase in ICT adoption leads to significant development gains. However, the inability to prove causality from Preston curves has long been acknowledged (Bloom & Canning 2007). There is a risk that these claims just fuel the false pretence on which the African ICT policies analysed by Friederici et al. *(*2017) are based in which ICTs are largely promoted as an end in themselves without evidence.

One thing the Huawei (2018) report does well is highlight that an uneven spread of digital technologies could lead to exacerbating inequalities between women and men, developing and developed countries, and between those without and with digital skills. However, Huawei does not seem to acknowledge the potential for ICTs to move us away from achieving the SDGs rather than toward them. In fact the report (Huawei 2018) may be guilty of promoting digitisation prematurely when it urges the public sector to digitise its processes and fully embrace e-government services suggesting that this would not only "improve the quality and effectiveness of public services, but they would also free up significant resources to invest in healthcare, education and other major areas key to societal well-being". However, as mentioned in Section 2.3.1, the United Nations' (2018) latest e-government survey warned that if governments prematurely turn to "digital first" and "digital by default" strategies whilst people remain offline, this can contribute to the offline populations falling further behind (LNOB goal). Instead of a sincere report about achieving the SDGs, the text reads more like a marketing/public relations attempt to SDG-wash their activities. In its next report, the company should include ways in which it will work with others to mitigate the potential challenges posed by ICTs.

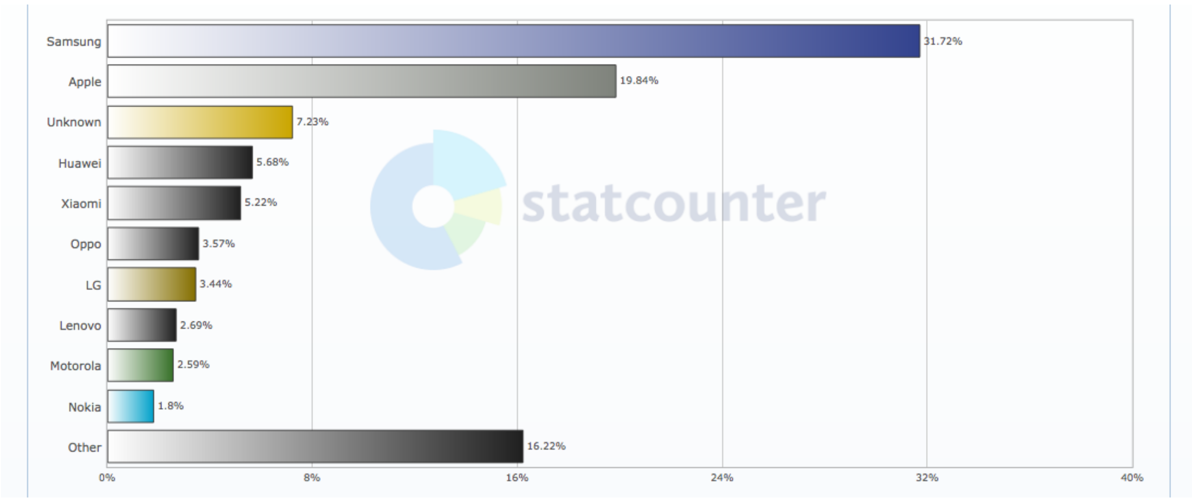
Furthermore, Huawei (2018) pushes forward the need to build more data centres without any mention of their energy consumption implications or the need for them to run on green energy. The only mention of energy efficiency is about how utilising cloud services offers environmental benefits in the form of increased energy efficiency and improved processes. However, as Unwin (2017) and Greenpeace (2017a) argue, although the ICT sector helps unload emissions from other sectors across the economy, this has also meant that the ICT sector is now consuming more electricity and emitting more greenhouse gases and it is still unclear whether the ICT sector will have a net positive or negative impact on the environment. The Huawei (2018: 31) report passively mentions that mobile phones are “creating enormous problems and opportunities as well. We face a staggering 50 million tons of e-waste every year”, but these sentences were written in a short box written by staff from the United Nations Environment Programme (UNEP) and the point is not raised again. Ironically, waste generated per capita was one of the indicators it used to measure the ICT score correlation with SDG 11 (sustainable cities and communities) and renewable energy consumption as a percentage of total energy consumption was used for SDG 7, but Huawei did not seem ready to acknowledge that it too may be a source of waste and energy consumption. As mentioned earlier, networks – Huawei’s core business – was highlighted as the biggest electricity-consuming sub-component of the IT sector and the share of energy consumed by networks has grown in recent years thanks to an explosion of data (Greenpeace 2017a). Moreover, the other major energy-consuming activities of the IT sector (data centres, devices and manufacturing) are also all areas in which Huawei operates. For digital infrastructure in the BRI to contribute to a more sustainable environment rather than detract to it, Huawei needs to more openly link its efforts to improve SDG outcomes to the ICT equipment sector’s ecological footprint. The authors of the journal article projecting future ICT sector emissions, Andrae & Edler (2015), were Huawei employees – albeit from their Swedish subsidiary – thus it must be on the company’s radar. Furthermore, the company publishes an annual sustainability report and the latest edition illustrates the steps it is taking to make its operations greener and more sustainable and includes a page dedicated to “green operations” (Huawei 2017). However, a more honest and holistic SDG report is warranted from the world’s biggest ICT equipment company.

Moreover, although Huawei (2018) makes a strong case for expanding digital infrastructure and also acknowledges that access is not sufficient on its own but that digital skills and effective use are also necessary, it is unclear what steps it will take to tackle the multidimensional digital inequalities and barriers covered in Section 2. As Unwin (2017) argues, along with universal provision of digital connectivity, for ICTs to empower marginalised groups, they need to be aware about these technologies and how they could be leveraged in ways to extract value across the SDGs, have appropriate skill levels to leverage ICTs, be able to afford digital technologies and have content that is relevant to experience in the languages that they speak and in formats that they can access. This does not mean, however, that Chinese actors should go at this alone. As mentioned in Section 2, many factors need to be considered and coordinated including “government policies and actions, infrastructure investment, applications and content, markets and competition, government budgets, and ICT skills and education”, (Sharafat & Lehr 2017: 30). Taking into account the complexity of the interaction between ICTs and the SDGs, governments, businesses, civil society, citizens and development actors will need to look beyond targets and plans for ICT-specific SDG goals and targets identified in the beginning of this section and consider how ICTs can contribute – both positively and negatively – to all the other SDGs and set targets accordingly if ICTs are to have a net positive impact on the achievement of the SDGs (Unwin 2017). Given their big and ever-increasing role in digital infrastructure, Chinese ICT equipment suppliers must be brought into any partnership seeking to ensure ICTs enable SDG achievement.

3.3 Expanding markets for Chinese mobile device makers

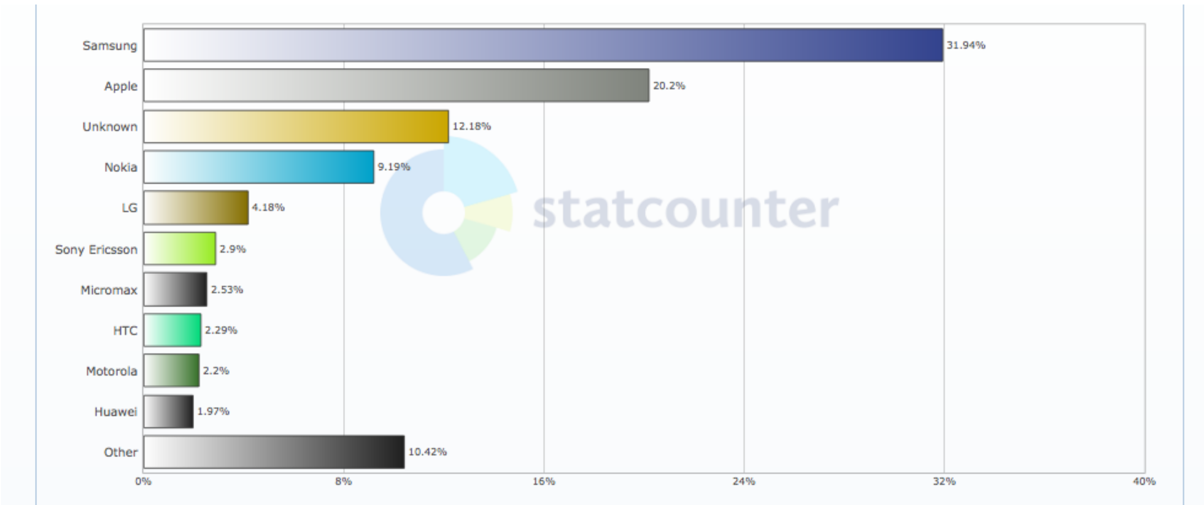
ICT infrastructure is not very useful without devices to connect to it. The profile of Chinese device manufacturers has also been on the rise. Huawei, Xiaomi, Oppo, and Lenovo now occupy the third, fourth, fifth and seventh spots in global mobile device market share (see Figure 2). All four companies have reached there in only a short amount of time. Huawei appeared in the top 10 for the first time in 2015 and three other companies still did not appear (see Figure 3).

Figure 2: Mobile vendor market share worldwide, August 2017–August 2018



Source: http://gs.statcounter.com/vendor-market-share/mobile/worldwide/#monthly-201708-201808-bar under Creative Commons Attribution-share Alike 3.0 Unported License

Figure 3: Mobile vendor market share worldwide, 2015

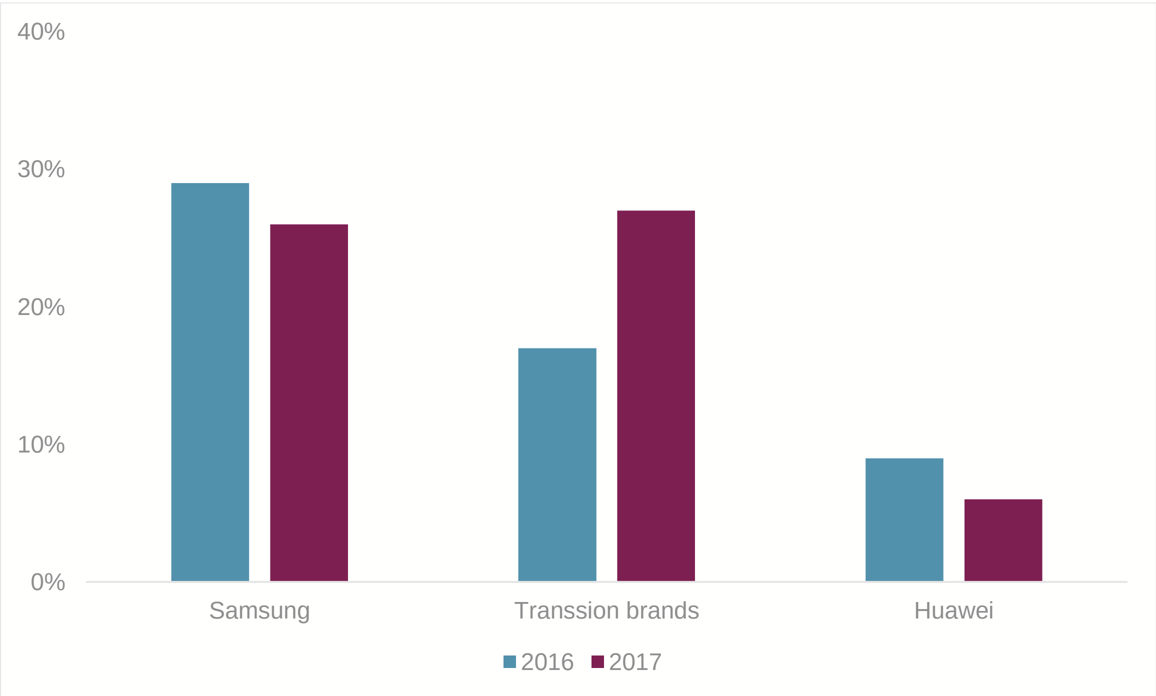


Source: http://gs.statcounter.com/vendor-market-share/mobile/worldwide/#yearly-2015-2015-bar under Creative Commons Attribution-share Alike 3.0 Unported License

Chinese smartphone manufacturer Transsion owns several brands including Tecno, Infinix, and Itel amongst others and has appropriated a large share of the market in Africa. The company first opened a factory in Ethiopia in 2011 and has since focused on tailoring its products to African consumers by “working closely with research and development centers in Nigeria and Kenya, and providing affordable and region-specific phones (ranging from 10 to 400 USD) to cities and rural Africa" (Dahir 2018). Some of its phones include features that cater to the needs of local people including multiple SIM slots, long battery life, FM radio, anti-oil fingerprint (to withstand bad weather), camera exposures calibrated to darker skin tones, and that run in local languages such as Amharic and Swahili. Thus, it seems Transsion is contributing to SDG 9.B by "supporting domestic technology development, research and innovation in developing countries".

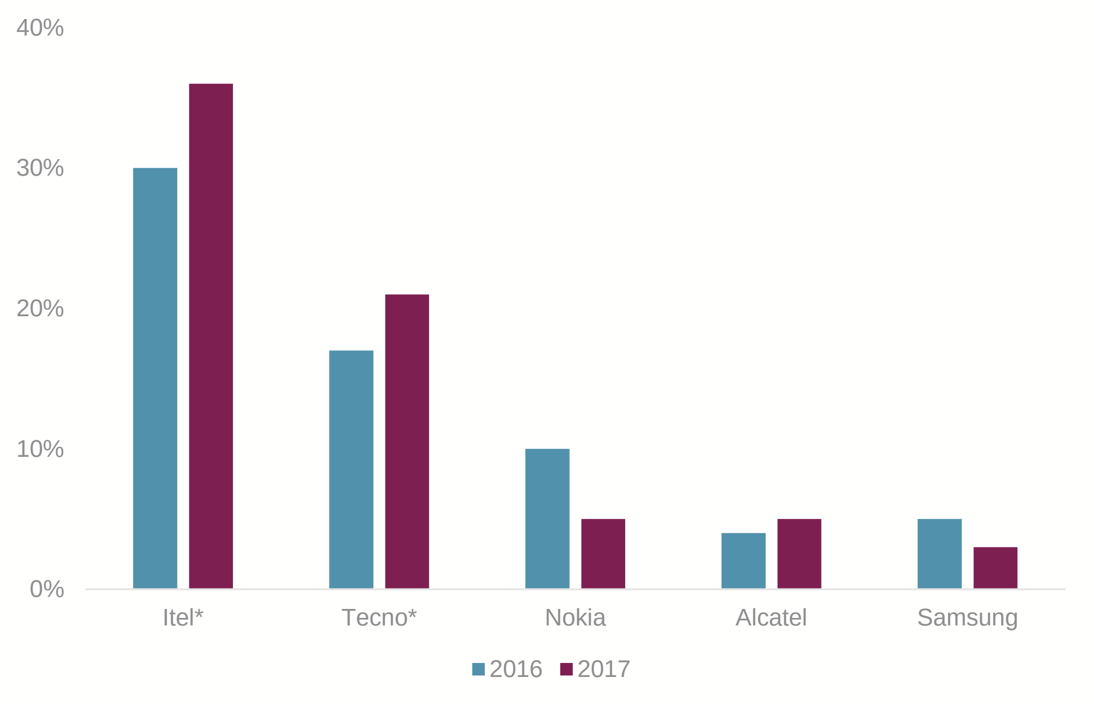
Transsion Holdings surpassed Samsung in African market share in 2017 when all its brands are combined (see Figure 4). Moreover, Transsion brands itel and Tecno dominate the African feature phone market (see Figure 5) (Dahir 2018). Thanks in large part to Transsion, the share of smartphones sold in Africa declined from 2016 to 2017 while feature phones increased to 61% up from 55% in 2016 (Sadeque 2018). Although Transsion's feature phones may be digitally including people for the first time, the digital inequalities literature warns that although an increase in feature phone ownership may decrease the absolute divide between those with and without devices, digital divides are multidimensional and there is a risk that relative divides increase between feature phone owners, smartphone owners, and people who may have access to multiple digital devices (e.g. smartphone and a PC). This may have implications for SDG 10 on reducing inequalities. Although feature phone functionality has increased substantially, they are limited in the apps and functions they support and are much slower and less powerful than smartphones. Differing functionalities and capabilities between feature phones and smartphones as well as differing user ability to use a smartphone effectively is leading to "smartphone divide" "based on a user's ability to access and use [and benefit from] an array of different services" (Lee & Park 2015: 81). Thus, if a large proportion of new mobile owners in BRI countries only use feature phones and do not eventually upgrade to smartphones or do so only much later in the future, this trend could risk leaving feature phone users behind relative to smartphone users (LNOB goal).

Figure 4: Transsion smartphones overtook Samsung in Africa in 2017



Source: Based on IDC Worldwide data. https://www.theatlas.com/charts/Hy39g0lwz

Figure 5: Transsion brands dominate Africa's feature mobile phone market



Source: Based on IDC Worldwide data. https://www.theatlas.com/charts/Hk8pyCxwG

There are sustainability concerns surrounding Chinese device manufacturers. In 2017, Huawei was found to be the only top three device manufacturer to not report on its supply chain or its emissions and "has yet to set any goal to transition its supply chain to renewable energy" (Greenpeace 2017b: 13). The emerging Chinese smartphone manufacturers Oppo, Vivo and Xiaomi were also found to lack transparency meaning the carbon emissions of their supply chains remain hidden from public view. All four manufacturers ranked poorly on Greenpeace's (2017b) Green Electronics company report card which scores companies in three main areas: dirty energy consumption, resource intensity, and harmful chemicals contained in products. Transsion's brands were not included in the assessment. Greenpeace (2017b) finds that although they tend to score better on average, several western manufacturers are also guilty of not taking adequate measures to protect the planet's ecosystem. Device manufacturers as a whole should work together to set green energy targets and increase their transparency. Greenpeace (2017a) showed that device manufacturers emit a significant 34% of the IT sector's emissions.

As mentioned in Section 2, mobile phone e-waste often ends up dumped in developing countries where harmful chemicals can negatively affect the health of waste pickers and mobile recyclers (Perkins et al. 2014). Although the threshold is not known, Huawei has set restrictions on acceptable levels of some of these harmful chemicals but still lags behind Apple and Google, which have eliminated these chemicals altogether (Greenpeace 2017b). Oppo, Vivo and Xiaomi scored poorly regarding chemicals. If Chinese device manufacturers – and others – do not remove these chemicals and reduce e-waste, their activities may detract from our ability to achieve SDG 3 (Health and Well-being). Solving these issues will likely become more important as more people gain access to phones and Chinese device manufacturers continue to increase their market share.

Moreover, Amnesty International (2016) has called out Huawei, ZTE, Lenovo, and western ICT companies for not taking adequate actions to ensure that the cobalt used to make the lithium ion batteries in their products do not depend on children working in hazardous conditions, forced labour, or human rights violations. SDG 8.7 calls for “immediate and effective measures to eradicate forced labour... and elimination of the worst forms of child labour”. Thus a failure to get these Chinese companies and others in the device manufacturing industry onboard may hinder our ability to achieve SDG 8 on decent work for all.

3.4 The expansion of Chinese internet companies on the BRI

Although the BRI was first announced in 2013 and Huawei and ZTE had been involved in international ICT infrastructure projects abroad for decades, the Chinese government did not incentivise or promote the global expansion of Chinese internet companies more generally until 2015 (Lee 2017). That year, the Chinese government urged its internet companies to get involved in building a “digital Silk Road, a Silk Road in cyberspace” to “expand e-commerce, industrial networks, and internet banking abroad” (Huanxin 2015). Chinese internet companies have quickly embraced the initiative and have expanded their influence. Shen (2018) suggests that Chinese companies have responded by aligning their international efforts to the BRI in order to get government blessing, funding, and diplomatic and political support.

The technology, media and telecommunications sector has outperformed all other sectors in attracting Chinese foreign direct investment (FDI) in 2016 and 2017 in volume with 340 disclosed merger and acquisition (M&A) deals worth 71.2 billion USD (Ernst & Young 2018).[6] Alibaba has been buying majority shares of e-commerce companies across the BRI countries including but not limited to PT.Tokopedia in Indonesia, Trendyol in Turkey, Lazada in Singapore (which also serves Malaysia, Indonesia, the Philippines, Thailand and Vietnam), and Daraz.pk in Pakistan, which also operates in Bangladesh, Myanmar, Sri Lanka and Nepal (Chou 2018; Ernst & Young 2018; Russell 2018; Xinhua 2017). Moreover, the Alibaba Group’s main domestic competitor, Tencent, which owns WeChat and JD.com, has also been busy acquiring stakes in firms across the BRI countries.

Alibaba and Tencent have been investing in a diverse set of areas including electric vehicles, bike-sharing services, e-commerce, electronic payment systems (fintech), social media, messaging apps, online gaming, music streaming services, ride-sharing apps, and more. Between 2008 and 2017, Alibaba and Tencent combined for over 65 billion USD in investments in foreign firms with much of the value invested from 2015. This has occurred in parallel to a general decrease of 30% in overall Chinese M&A as the government has become wary of some of the acquisitions that it believes do not align with China’s strategic interests, showing that China’ s technology sector is seen as an essential player in the BRI and China’s geopolitical and geoeconomic interests (Lucas 2017). The Asia and Pacific region accounts for over 80% and 70% of Alibaba’s and Tencent’s foreign M&A activity respectively. These M&As seem to be strongly aligned with the BRI as a majority of them have occurred in the Asia and Pacific region – often under a BRI banner (Sender 2018).

Alibaba and Tencent have been investing in the region amidst a lack of local venture capital and angel investment funds, which entrepreneurs can tap into. Thus, these investments may be well aligned with SDG 8.3, which calls for encouraging the growth of SMEs through access to finance.

[6] This figure includes data for Hong Kong, Macau and Taiwan.

However, there are growing concerns that the two companies have become too powerful in Asia and that because they are often the only two funders, that refusing their money could put entrepreneurs in a tricky position (ibid.). Moreover, there is growing concern that consumer data in Chinese acquired firms may not be safe given the Chinese cybersecurity law mandating Chinese companies to comply and assist with state intelligence-gathering missions (Mozur 2018). There are also environmental concerns about the operations of the big Chinese internet companies. Greenpeace (2017b) showed that two thirds of the electricity supply for the big three Chinese IT companies (Alibaba, Baidu and Tencent) currently comes from coal with all three companies scoring an "F" in energy transparency and commitment to renewable energy.

3.5 Promoting "inclusive globalisation" through e-commerce

In late 2016, Chinese e-commerce giant Alibaba's founder, Jack Ma introduced his idea of an electronic world trade platform (eWTP) and aligned it with the BRI. Ma said this initiative will "pay special attention to the OBOR [One Belt One Road] strategy and execution, [he] thinks with eWTP, we can make OBOR, more lovely" (Ma 2017). Ma envisions that the eWTP will work complementarily to the World Trade Organization (WTO). Whilst the WTO is mainly the realm of states, multinationals and big business, the eWTP is meant to be a business-driven platform (with government support) for SMEs and aims to help them "overcome complex regulations, processes and barriers that hinder their participation in global commerce" (Alibaba Group 2016). To achieve this, the eWTP also aims to support the creation of eHubs, or "Digital Free Trade Zones" (DFTZ).

Whereas traditional duty-free zones act as physical areas where goods can be imported, further processed, and re-exported without paying duties and have mostly been used by big businesses, the DFTZs will offer services tailored to SMEs to help them access international markets in a similar fashion and provide them with quick clearance and access to improved internet-enabled logistics (Alibaba Group 2016; Yean 2018). The first DFTZ was launched in Malaysia in November 2017 by Alibaba and the Malaysia Digital Economy Corporation (MDEC) with the aim to "connect Malaysia's SMEs globally through Alibaba-inspired electronic world trade platforms that are being established to support greater exchange between BRI countries" (Rastogi 2018; Yean 2018: 1). The Malaysian DFTZ has three main components: (i) an e-fulfilment hub serving as a centralised aviation, air cargo, and logistics facility seeking to speed up both the process for SMEs to secure export clearance on customs and cargo as well as Cargo Terminal Operations; (ii) a satellite hub in Kuala Lumpur offering a range of facilities including digitally connected physical showrooms and training centres; and (iii) an e-services platform which offers integrated e-services to businesses including cross-border trade advisory, end-to-end business support for cross-border e-commerce, and market access to exporters and importers (MITI 2018; Rastogi 2018). SMEs in the DFTZ will also gain access to Alibaba's OneTouch e-services platform, and be able sell to China via Alibaba and its subsidiary marketplaces (Rastogi 2018). Alibaba Group's, Ant Financial has signed agreements with two Malaysian financial service providers to offer its mobile digital wallet (Alipay) to SMEs. Furthermore, Alibaba Cloud is also establishing a data centre in Malaysia (Yean 2018).

Because the initiative is relatively new, there is not much literature on its rationale. Jack Ma gave a speech at Alibaba's office launch in Kuala Lumpur, Malaysia that serves as a good reference point. In it, he frames the eWTP as a "WWW" (Win-Win-Win) and about a new era of globalisation. In his speech he elaborates:

> The first win should be given to your customers… the second win is for the partners and the third win is for yourself…. The difference between our model and the American model or traditional globalised model is we come here looking for partners. We come here to enable partners. We want the partners to be local king here, because we know only when partners succeed, we can be successful so we come here to work with Malaysian young people... so that they can go out globally with us. By supporting young Malaysian people, Malaysian young people will support Alibaba going global… I am a 100% believer of globalisation... but globalisation needs to be improved. In the past 30 years, the globalisation of global trade was controlled by 60,000 big companies. If we can support 16 million small businesses around the world so they can do business, I think that is called inclusive globalisation. That is the future. That is the hope of sustainable economy. In the future it will not be called e-commerce, it will be called e-business. Eighty per cent of small business[es] will be online and 80% of small business will be global. If they do not think global there will be no future for them if you only sell your products in your town you will never survive (Ma 2018b).

However, it is unclear how inclusive the eWTP and DFTZs will actually be. Yean (2018) suggests incentives to increase imports through e-commerce may negatively impact domestic producers and that not all SMEs are well placed to equally benefit from e-commerce platforms since it requires export strategies and understanding regulatory regimes and documentation for both Malaysia and importing countries. Moreover, nearly 90% of businesses in Malaysia are SMEs but only 28% of SMEs have an online presence and only 15% already export (Yean 2018). As mentioned in Section 2, this is a trend that is replicated across countries. Small businesses are less likely than larger ones to be online or receive orders over the internet (UNCTAD 2017). Only time will tell whether the DFTZ will help narrow this gap in Malaysia and in other places that adopt them. If successful, the initiative can have positive implications on SDG 8.3 which calls for "Promoting development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalisation and growth of micro-, small- and medium-sized enterprises, including through access to financial services", as well as SDG 9.3 which calls for "Increasing the access of small-scale industrial and other enterprises… and their integration into value chains and markets".

However, early adoption of the Malaysian DFTZ seems to mirror digital inequalities between SMEs rather than overcome them. As of March 2018, 2,072 Malaysian SMEs were registered on the platform. Three states (out of 13) accounted for 69% of SMEs participating (Yean 2018). Moreover, registration has not necessarily led to usage. "Malaysian SMEs that were already listed on Alibaba before the establishment of the DFTZ… appear [to] not have necessarily been using the platform for exports, but for prestige [especially] Gold members. SMEs in general lack understanding of ecommerce, and lack competent personnel to conduct ecommerce activities and market goods and services" (Yean 2018: 5). Digital capacity disparities between firms may lead many SMEs to be passive exporters on the platform waiting for buyers to discover them. Taking full advantage of the initiative will require SMEs to be capable of researching their competitors' products and pricing strategies and respond by repositioning products and finding buyers rather than waiting to be found (ibid.). Moreover, although the DFTZ expedites the process of obtaining documentation, SMEs will have to obtain these documents on their own and SMEs are likely to have varying levels of knowledge and ability to comply with foreign rules and regulations (ibid.). It is also unclear if SMEs' engagement will sustain after government financial assistance ends especially if benefits do not materialise as envisioned. If actions are not taken to reverse these trends, Ma’s vision of a future where small businesses fail if they do not go online and go global may lead to offline and remote SMEs falling further behind.

Ma also envisions a future in which there will be no “made in China” or “America”, but everything will be “made in the internet” and there will be no more B2C (Business to Consumer), but instead C2B (Customer to Business) because everything will be tailor-made (Ma 2018b). In Ma’s vision, international trade will no longer be shipped via large containers but instead:

> It will go through packages... 8 years ago China had only less than 80,000 packages delivered on the street. This year China will create more than 50 billion. So this number alone, China alone is bigger than the rest of the world combined. That is because of internet. That is because of e-commerce. That is because of C2B (Ma 2018b).

However, a similar scale of packaging growth across the BRI will necessarily come with environmental implications if packaging is not fully recyclable and recycled. The Chinese government is currently struggling to deal with the tonnes of wastage that the e-commerce boom is creating in its cities. “The combined length of packing tape used by China in 2015 could circle the equator 425 times” and only an estimated 20% of Chinese packaging is recycled (Luo 2017). Moreover, the packaging often contains hazardous chemicals that could pose risks to human health (ibid.). If other countries are to replicate China’s e-commerce boom, more sustainable practices will be needed as the proliferation of packaging is likely to have implications for SDG 12.5 on reducing “waste generation through prevention, reduction, recycling and reuse” and SDG 12.4 on “achieving the environmentally sound management of chemicals and all wastes throughout their life cycle… in order to minimize their adverse impacts on human health and the environment”. Moreover, Ma’s idea of a prosperous future for SMEs tends to imply that more consumerism and waste generation will fuel economic growth and stands in contrast to SDG 8.4 calling for a decoupling of economic growth from environmental degradation.

3.6 Smart cities

Silk Road (*China Daily* 2017). According to HSBC (2018), “China’s Belt and Road Initiative (BRI) is paving the way for a new iteration of cities throughout Asia. Dubbed ‘smart cities’, new urban areas are being constructed which utilise advanced information and communication technologies (ICT), the internet of things, and other high-tech strategies to integrate municipal services, monitor traffic and pollution, facilitate ecological waste management, streamline public facilities such as hospitals, limit energy usage, and, ultimately, make cities more efficient, clean, and safe.”

China is now home to half of the over 1,000 smart city pilots with around 100 new smart cities planned between 2016 to 2020 (Deloitte 2018). It is thus no surprise that China is exporting smart city technologies. Notable BRI smart city projects according to HSBC (2018) include the New Manila Bay City of Pearl, the biggest BRI project in the Philippines; and the “China Smart Creation (CSC) Smart Eco-Valley in Betong”, a joint venture between 10 Chinese companies and two Malaysian developers including “hotels, universities, ‘smart’ factories, and state-of-the-art housing and will receive its technology directly from China”.

At its core, a smart city is the physical digital integration of a cities system and its citizens. Smart cities generally seek to digitally interconnect and integrate services within a city to provide more efficient services by better anticipating demand and decreasing waste and pollution. In other words, smart cities aim to improve the functioning of a city to make it more sustainable, efficient, and livable (Suzuki 2017). As a greater percentage of the global population move into cities, making cities smarter may become a necessity for sustainable development. Smart cities could positively contribute to several SDGs including but not limited to: SDG 3 (good health and wellbeing); SDG 6 (clean water and sanitation); SDG 11 (sustainable cities and communities); and SDG 13 (climate action).

Although there is general agreement that smart cities must include systems, people and information, there is no widely accepted view of what a smart city should look like in practice. At one end of the spectrum governments and technology companies may infuse predefined technocratic systems into the city without consulting citizens about what is important to them. At the other end there are bottom-up community-led approaches where citizens are directly involved in deciding what data is collected and for what purposes and sometimes involved in the data collection itself. Suzuki (2017) argues that what makes a city smart varies from context to context depending on what citizens of the city see as important and valuable. Until now "smart cities have been mainly designed as centralized top-down projects led by corporations, which put municipalities under pressure to deploy their projects and in which citizens appear at best as consumers". This also seems to be the case with Chinese smart cities. Chandrasekar et al. (2016: 9) found that "China follows the traditional 'top down' approach with each city having its own smart leadership group with formal leadership structures… [and] [o]ne of the main challenges is engaging with community stakeholders".

Suzuki (2017) emphasises that although smart cities do provide potential to improve development outcomes, smart cities should be made "for people" and that technology should only be an enabler. Specifically, she recommends that people seeking to implement smart city solutions ask themselves "Smart cities to whom?" Because the decisions made by smart city platforms are based on data, these will only be as good as the data that goes into them and can potentially be biased. Better-connected citizens may generate more data than unconnected citizens. Given that women, children, disabled people, minorities, and the elderly are disproportionately less likely to be as connected, this may lead to cities that underserve their needs or do not take into account their "rights, needs, expectations, and inclusion". According to Chandrasekar et al. (2016: 9) this seems to currently be the case in China where "City governments need to overcome the risk of marginalising services only to affluent sections of the community who own smartphones. As a vast segment of the community will not have access to smartphones and other mobile technologies, provision should be made for a multi-channel strategy." This can be troublesome since unconnected groups already tend to be underserved. If smart cities disproportionately serve the interests of elites and the better off, this may potentially hinder achievement of SDG 10 on reducing inequality and create new forms of discrimination and poverty, limiting our ability to achieve SDG 5 on "gender equality and empowering women and girls" as well as the overarching goal of LNOB. Thus, we must ensure that smart cities built as part of the BRI include the voices of the unconnected and that being smart does not equate to over-relying on technology that the poor and marginalised do not have access to.

Suzuki (2017) warns that collecting the wrong data and using the wrong technologies may result in problematic smart cities. The western media and activists have grown weary of surveillance technology, which is increasingly linked to the BRI. "Smart cities" in China are often replete with CCTV cameras which, with the aid of facial recognition software, artificial intelligence, and biometric national IDs can keep tabs on Chinese citizens (Mozur 2018). Huawei, for example, brands the bundling of smart city and surveillance technology as “safe city solutions”.[7] In Shenzhen, there are reports that this surveillance apparatus is being used to issue fines for jaywalking and publicly naming and shaming jaywalkers on large screens on public crossings and a government website (Baynes 2018). Moreover, the government plans to introduce a mandatory social credit rating system by 2020 – already under pilot for millions of people – in which surveillance data, social media data, and data from elsewhere will be combined to rate citizens with potential impacts on their abilities to have their children go to a good school, get a good job, stay at a good hotel, take the train, and even slowing down the internet speed of the “bad citizen”. On the other hand, “good citizens” may get energy bill discounts, better interest rates, and get their profiles boosted on dating apps (Ma 2018a). The potential implications of this system on the SDGs (especially SDG 10 on reducing inequalities) and the overarching goal of leaving no one behind need to be looked into.

There are already signs that some elements of safe city technology are being exported through the BRI. A Chinese company signed a deal with the Zimbabwean government to implement a mass facial recognition project and “help the government build a smart financial service network as well as introduce intelligent security applications at airports, railway stations and bus stations” (*Global Times* 2018). Moreover, the company seeks to use the BRI as an opportunity to improve its software algorithm’s ability to recognise darker skin tones, which has been a challenge for facial recognition software to date. The data generated by this surveillance system, which was made without citizen consent and is mainly based on pictures of people’s faces and bodies, will be sent to China as part of the deal and will likely give the Chinese company involved an edge when scaling out to other African countries (Hawkins 2018). *Global Times* (2018), a Chinese newspaper focusing on international relations issues from the government’s perspective, suggests that “this Chinese AI Industry project in Africa could contribute to the economic development and technology sharing in countries along the Belt and Road Initiative and realize the win-win goal of economic benefits”.

Whereas the Chinese and Zimbabwean government may present this as a system that can help tackle “social security issues, including robberies and shootings”, others feel the technology will be mainly used to control people’s freedoms and further crack down on dissenting voices in a country with a long history of government repressing freedom of expression including with the use of other surveillance technologies (Hawkins 2018). This issue is not unique to Chinese companies. One of three surveillance technology exports by European companies between 2014 and 2016 was found to be exported to countries where the internet is “not free” (Gjerding & Skou Andersen 2017). Rather than simply cracking down on Chinese companies exporting surveillance technologies under the BRI, overcoming the issue of what happens with surveillance technology once it is exported will require international collaboration. Although the SDGs are grounded in human rights, ambiguity in the language of the SDGs make them inadequate to criticise increased surveillance and the potential for it to be used in ways that limit civil liberties and undermine human rights. Privacy International (2017) research shows “that the fears of the growing scope of ID, including when tied to biometric technologies such as facial recognition, can give governments the potential for unprecedented control and monitoring over populations” and thus risks human rights violations and becoming disempowering for citizens. This could prove to be one of the SDGs’ biggest shortcomings if Chinese – and Western – surveillance companies

[7] https://e.huawei.com/ae/solutions/industries/public-safety/safe-city/safe-city

are able to provide equipment to governments with negative intentions that they actively use to suppress rights of groups already at risk of being left behind.

3.7 The Digital Belt and Road Program Science Plan

The Digital Belt and Road Program Science Plan is a science diplomacy initiative between Chinese scientists and experts from 19 countries and seven international organisations that is directly linked to the SDGs and the Paris Agreement. It seeks to "share expertise, knowledge, technologies and data to demonstrate the significance of Earth Observation Science and Technology and Big Earth Data applications for large-scale sustainable development projects" (Digital Belt and Road 2017: 1). The programme calls for leveraging of big Earth data[8] in the design, development and implementation of a diverse range of projects including infrastructure, environmental protection, disaster risk reduction, water resource management, urban development, food security, coastal zone management, and cultural heritage site management and conservation. The initiative seeks to improve Earth Observation (EO) data availability, quality, and capabilities through the provision of EO infrastructure and technologies and data capacity building to help countries mitigate threats to shared ecosystems. Its three main objectives are addressing knowledge gaps in earth system processes related to the SDGs in BRI countries, promoting big Earth data-based advanced science and decision support services, and "to enhance capacity building and technology transfer towards a system of partnerships and research networks". Data streams for the project will include communication, remote sensing, and navigation satellites, and oceanic and ground-based observations.

Dissemination of SDG-relevant outcomes from the initiative is planned to be via "SDG Highlight Reports". If implemented well, the initiative could be transformational for BRI countries, which cover 38.5% of the Earth's land area and are home to a diverse range of fragile environments and their knock-on effects including rising sea levels, overfishing, pollution, access to fresh water, food security, and exposure to natural hazards among others (Chin & He 2016; Huadong 2018). The initiative builds on its successful application in cases in China and other developing countries, for example the use of aerial imagery following the 2008 Wenchuan earthquake to uncover 700 people trapped in a village. The initiative claims to have potential impacts across seven of the 17 SDGs namely: SDGs 2, 6, 9, 11, 13, 14 and 15. However, the initiative is relatively small – only 32 million USD (Huadong 2018) – and was not within the scope of this report so is not covered in detail.

4. Conclusion and policy implications for traditional donors

In conclusion, the digital Silk Road is more than ICT infrastructure. Road, port and energy infrastructure get most of the attention in the more general BRI literature and ICT infrastructure has been largely ignored. The digital Silk Road has several policy objectives including: dealing with overcapacity of Chinese fibre-optic cable and ICT device manufacturers, relieving overcapacity of other firms through e-commerce, facilitating the "going out" of Chinese firms in general, internationalising the Chinese renminbi, obtaining independence from US-based infrastructure by building global ICT networks that are "China-centred", repositioning China in a shifting geopolitical world as a leader of "inclusive globalisation" and spreading the idea of

[8] Big data associated with the Earth sciences including but not limited to Earth observation.

“internet sovereignty” (Hornby 2017; Shen 2018). Chinese ICT equipment manufacturers are increasingly gaining market power and are prioritising regions previously neglected by western ICT companies (e.g. Africa). This indeed requires attention. The lack of a central database for digital Silk Road infrastructure projects is a significant gap. One should be created, preferably in living format, to better understand the scale of digital ICT infrastructure under the BRI.

A deeper look at projects being pushed forward as part of the “digital Silk Road” illustrate that China’s digital aspirations go beyond the construction of fibre-optic cables and encompass the sale and exportation of a wide range of technologies as China races ahead to become a world leader not just in ICT infrastructure but in technology more generally. Thus, **thinking of the digital Silk Road as solely about infrastructure is a costly mistake that would blind donors from some of its biggest impacts**. Like many of the other activities carried out in the more general BRI, it can be challenging to define the parameters of the digital Silk Road. This is a very light review of the initiative and does not claim to define or cover all of its parameters. Areas of the digital Silk Road covered in this report include: digital devices, e-commerce, smart cities, and the Digital Belt and Road Program Science Plan. **Some areas for further exploration include the development implications of China’s increasing prominence and potential exportation of frontier technologies including**: nanotechnology, quantum computing, and artificial intelligence.

The literature on ICTs and the SDGs uncovers both synergies and potential trade-offs between accelerating ICT adoption and achieving complex development goals. This complex relationship will necessarily have implications for the digital Silk Road. Although digital technologies could be a force for good and help us achieve the SDGs, this trajectory is not automatic, nor is it a given, and in many regards current trends show the contrary. The SDGs have explicitly called for accelerating ICT adoption in three of the SDG goals and targets (SDGs 9.C, 5.B, and 17.8). However, some Information Communications Technology for Development (ICT4D) scholars have argued that ICTs can have impacts across the SDGs (both positive and negative) and that this was not well captured when they were drafted. ICT companies (including Chinese companies), development actors, and governments (including the Chinese government) have been overemphasising the potential positive impacts ICTs can have on economic growth and the SDGs and have largely neglected the potential for ICTs to increase inequality, leave the unconnected and most marginalised behind, generate massive amounts of e-waste, emit too many greenhouse gases, and support child and forced labour in the supply chain, amongst others. Achieving the SDGs in an increasingly digital world will necessarily mean tackling the negative side effects of digital development and finding ways to deal with challenges emerging from greater ICT adoption. The challenges highlighted in this report are not minor and it is unclear whether ICTs will have a net positive or net negative impact on the SDGs. The outcome will depend on the actions we take: ensuring ICTs holistically enable SDG achievement requires concerted actions – above and beyond building infrastructure – from a wide range of actors. Due to the complexity of the relationship between ICTs and the SDGs, no single actor is well equipped to tackle these issues alone. Including Chinese actors will be a necessity given their increasing profile across ICT-related areas.

Traditional donors should use their convening power to bring together a wide range of stakeholders to work through the synergies and trade-offs of expanding ICTs and achieving the SDGs. As Sharafat & Lehr (2017: 30) argue, many factors need to be considered and coordinated including “government policies and actions, infrastructure investment, applications and content, markets and competition, government budgets, and ICT skills and education”. Given the complexity of the interaction between ICTs and the SDGs, governments, businesses, civil society, citizens and development actors will need to look beyond targets and plans for ICT-specific SDGs and consider how ICTs can contribute – both positively and negatively – to all the other SDGs and set targets accordingly (Unwin 2017). Working through this complexity will require action and coordination between many actors including government, the private sector, civil society, and citizens – including the unconnected and those at risk of being left behind – to come up with solutions that stand the chance of being successful and sustainable (ibid.). Bringing in citizens themselves – especially the most marginalised – will be necessary as they have historically not been part of the conversation and are most affected. This will necessarily include China and Chinese citizens, but success will be most likely if involvement is as diverse and inclusive as possible (ibid.).

Traditional donors should act as honest knowledge brokers with BRI – **and other** – **country governments**. There is no conclusive evidence that ICT adoption alone leads to economic growth or SDG gains, yet African country ICT strategies, China, and Chinese ICT companies push forward a simple narrative of the relationship as causal and linear. Huawei goes as far as to claim that small incremental increases in ICT adoption will lead to significant gains in SDG indicators. Although their claims are based on data, they are based on a series of correlations that do not prove causation. Such claims risk the implementation of very narrow and simplistic ICT strategies for problems that are complex and multifaceted. Traditional development actors should push back on this narrative to ensure that challenges emerging from ICT usage are also dealt with.

The digital Silk Road has the potential to improve SDG outcomes across a wide range of SDGs. ICT infrastructure built as part of the BRI and the more affordable contextual devices made by Chinese device manufacturers will likely improve outcomes towards SDG 9.C by improving the availability and affordability of digital connectivity. Moreover, ICT adoption can have impact across the SDGs. There is evidence that Chinese device manufacturers are investing in research and development and innovation in developing countries and tailoring products to those markets (SDG 9.B). Chinese internet giants are helping provide financing to technology start-ups in BRI countries (SDG 8.3). Alibaba’s eWTP initiative seeks to promote the growth of SMEs by providing them with access to external markets through e-commerce and with financial and other services (SDG 8.3 and 9.3). Smart cities are also being promoted in the digital Silk Road and can have positive impacts across several SDGs including ones related to health and wellbeing (SDG 3), clean water and sanitation (SDG 6), climate action (SDG 13), and sustainable cities and communities (SDG 11) among others. Lastly, the Digital Belt and Road Program Science Plan promises to have positive impacts across seven SDGs.

However, **there are also signs that the digital Silk Road risks exacerbating negative labour rights and environmental outcomes if current trends are not reversed**. Like the rest of the ICT sector, Chinese-built ICT networks, data centres, and digital device manufacturing are likely to continue consuming more energy and emitting more greenhouse gases over the years as more people go online and the demand for more data-intensive content increases. Chinese companies have been found to be untransparent about their energy sources and are believed to mainly rely on coal and non-renewable energy (Greenpeace 2017a). Moreover, there are concerns about Chinese digital device manufacturer supply chains. The sector overall is highly dependent on child and forced labour at the mineral extraction stage. In addition, Chinese device manufacturers have been found to be untransparent about the inclusion of harmful chemicals in their devices that may pose health risks to waste pickers and e-waste recyclers (Greenpeace

2017b). Furthermore, the desire to spread e-commerce in a similar way to which it spread in China requires a significant increase in packages which may pose environmental and health risks if not fully recyclable and recycled by citizens. Meanwhile, the SDGs stress that economic growth should be decoupled from economic degradation. These challenges are not necessarily unique to Chinese digital activities and will need to be tackled by the diverse set of partners and stakeholders mentioned earlier.

The digital Silk Road does not currently seem to take adequate steps to tackle the potential for ICTs to exacerbate inequality and leave marginalised people and small businesses behind. Actors in the initiative seem to treat digital inequalities as solely an issue of supply (e.g. infrastructure, devices, and platforms) and do not take adequate steps to deal with some of the demand side barriers that often hinder individuals from using digital technologies. Connecting the most marginalised and at risk of being left behind requires more than building digital infrastructure. Partners will also need to work on overcoming demand side barriers. Some of these include: the affordability of connectivity and device ownership; awareness of digital technology and its usefulness; abilities to use devices and to extract value from them both in everyday life and in the world of work; making digital technologies and services accessible to disabled people; overcoming social norms that limit women's agency and desire to get online; and content that is relevant to contexts and in the languages spoken by the disconnected. In regards to smart cities, there is a need to ensure that bottom-up processes inclusive of marginalised groups also feed into their design to ensure that these cities do not mainly serve the elite at the cost of overlooking the rights, needs, expectations, and inclusion of offline populations. These challenges are not necessarily unique to Chinese digital activities and will need to be tackled by the diverse set of partners and stakeholders mentioned earlier.

Moreover, although Alibaba frames the eWTP and DFTZs as facilitators of "inclusive globalisation", smaller businesses are consistently shown to be online less and receive orders online significantly less than larger firms. There are also digital inequalities between SMEs: those in major cities are more likely to be online than SMEs in rural areas and SMEs differing in digital capabilities. So far, this trend seems to have been replicated rather than overcome in the first DFTZ. Jack Ma envisions a future in which SMEs that do not go global go out of business. By introducing platforms that facilitate "inclusive globalisation" he may paradoxically accelerate the failure of firms unable to go global or compete in a digital economy. For SMEs to take full advantage of e-commerce rather than be passive exporters waiting for buyers, they require an advanced set of skills including the ability to conduct and respond to market research, find and market to new customers online, and to comply with foreign standards, rules and regulations.

Traditional donors can add value by promoting offline service delivery for the unconnected. The overarching SDG of leaving no one behind emphasises prioritising the hardest to reach first. As governments, the private sector, and other actors begin to implement digital first and digital by default services, efficiency gains and rapid spread of technology may include many people for the first time – the digital "low-hanging fruit"; however, these strategies risk leaving behind those without digital connectivity or digital skills if offline channels are not built alongside digital ones. The digitisation of services relevant to the SDG has not been studied in depth in developing countries and more work is needed to fully understand the scope of the phenomenon. There may also be elements of digital by default and digital first strategies in the digital Silk Road (e.g. smart cities). Traditional donors may add value by supporting parallel offline channels to new digital ones, which although not "cutting edge", may be the only way the unconnected stand a chance of not being left behind in an increasingly digital world.

Traditional donors can add value by focusing on the future of work and digital skill improvement. The digital Silk Road does not seem to have a roadmap for dealing with some of the tensions between ICT adoption and the potential introduction of automating technologies in the workplace that may displace or disadvantage less connected, less digitally literate, and less educated workers. Traditional donors already have momentum. The topic was covered in the 2016 World Development Report and is the focus of the 2019 World Development Report.[9]

Traditional donors may need to weigh the risks of being directly involved in BRI-branded digital infrastructure projects. Traditional donor country governments have grown weary of Chinese 5G infrastructure amidst fears that Chinese ICT equipment suppliers may be required to share intelligence information with the Chinese government. Some traditional donor countries have banned Chinese ICT equipment manufacturing companies altogether and others have considered it. For these countries, supporting Chinese ICT projects in BRI countries may be seen as applying a double standard on what infrastructure is good enough for them versus developing countries. Moreover, five of the seven countries China is partnering with on the digital Silk Road rank as “Not Free” on the *Freedom on the Net* index and the other two are not ranked but also likely to have an unfree internet. This is not surprising given that China promotes the idea of “internet sovereignty” which advocates for greater state control of internet content and each country being able to survey and control its internet as it sees fit. This is in contrast to ideas of “net neutrality” and multi-stakeholder internet governance, which are widely supported by citizens in traditional donor countries. Furthermore, there is a more overarching risk that digital technologies exported as part of the digital Silk Road – including ICT infrastructure and beyond – may make it easier for governments across the BRI to breach citizen human rights and curtail freedom of speech. Although the language in the SDGs makes it difficult to criticise the digital Silk Road from this angle, traditional donor country taxpayers care about human rights and privacy. Similar to how Google’s decision to build a censored version of its browser led to an open letter signed by 14 human rights organisations (Access Now et al. 2018), funding digital infrastructure projects that may eventually undermine human rights risks public backlash against donors at a time when donors are already under increasing scrutiny. However, Chinese-led infrastructure in BRI countries and other digital Silk Road projects will move forward whether or not traditional donors engage with these infrastructure projects and this will occur in many traditional donor priority countries. Some traditional donors may have to find a balance between complementing the digital Silk Road, helping tackle some of the challenges raised by it, and ensuring their efforts do not negatively impact human rights or issues their country’s citizens care about.

This report was limited in its ability to engage with the digital Silk Road and has only scratched the surface. The report was restricted to only seven days of research in August 2018 and was not able to delve deeply into potential links between the digital Silk Road and the SDGs. These links thus require further analysis and scrutiny. Moreover, this review was illustrative rather than exhaustive. There are likely many other elements branded under the “digital Silk Road” not covered in this report. **Some areas for further exploration include**: nanotechnology, quantum computing, artificial intelligence, and “emerging technologies” more generally. There is also a need to understand the potential implications for the SDGs of surveillance technologies and of the Chinese social credit system.

[9] http://www.worldbank.org/en/publication/wdr2019

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