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Explorations in ICT4D Research and Practice: Examples from Nigeria and Pakistan

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Abstract

This thesis explores the field and practice of Information and Communications Technologies for Development. ICT4D is a field of research at the intersection of technology studies and development studies, a policy area for countries, and a practice of using ICTs or digital technologies to effect socioeconomic change at a country-wide level or at the level of poor and marginalized communities. Two ICT4D initiatives or projects in Nigeria and Pakistan each are examined. Through the case studies and the subsequent discussion and analysis, this thesis aims to provide a brief but incisive exploration of the research and practice of ICT4D. This thesis invites further research assessing ICT4D initiatives in developing countries – examining their successes, limits, and ideological bases – as well as calls for an ever-increasing focus on the poor and marginalized in the planning, implementation, and assessment of ICT4D initiatives in all countries whether they are developed, developing, or all that exists in between.

Introduction

The concept of Information and Communication Technology for Development, or ICT4D, accounts for "the ways through which [ICTs] have become entwined with both the theory and the practice of development."[1] ICT4D is a field of research at the intersection of technology studies and development studies, a policy area for countries, and a practice of using ICTs or digital technologies to effect socioeconomic change at a country-wide level or at the level of poor and marginalized communities wherever they exist. Walsham (2017) summarizes: "The main focus of both research and practice in the field is the so-called developing countries, and in particular, emphasis is often placed on the less materially advantaged members of those societies."[2] ICT4D is now often also referred to as digital development.

ICT4D is a particularly significant and fascinating field to explore as, since the mid-2000s there has been a great escalation in the introduction and proliferation of digital and internet technologies and services in developing countries (particularly evident in the spread of the mobile phone).[3] Under ICT research and practice, researchers as well as policy makers explore broad questions such as if and how ICTs can be effectively utilized to improve socioeconomic conditions or spur economic growth. They also have the opportunity to engage with more granular questions such as what development means, what context-specific digital divides look like, what types of ICT4D initiatives work where and why they do, what infrastructure is needed in developing countries to support greater digital development, etc.

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[1] Tim Unwin, Reclaiming Information & Communication Technologies for Development (Oxford: Oxford University Press, 2017), 1.
[2] Geoff Walsham, "ICT4D Research: Reflections on History and Future Agenda," Information Technology for Development 23, no. 1 (2017): 18.
[3] Walsham, "ICT4D Research," 22.

As it stands, ICT4D and other digital development measures are being intensely pursued by governments of developed countries and developing countries alike.[4] At this moment there are also extensive interventions by private sector actors and civil society actors in ICT4D. One reason for this is the understanding that a rapidly digitizing global economy – the global digital economy has grown two and half times faster than global GDP over 15 years, accounting for %15.5 of global GDP, as of 2017 – demands sufficient infrastructure and accessible digital services.[5] Developing countries are where this urgency is most acutely felt as they often have more infrastructural, economic, and political hurdles to address and overcome as they strive to establish and reap the benefits of ICTs and digital development.

Considering this pertinency, the goal of this thesis is to engage critically with the concept and practice of ICT4D through the examination of a selection of ICT infrastructure and digital development projects in two developing countries: Nigeria and Pakistan. This exploration will hopefully facilitate a greater understanding of Nigeria, Pakistan, developing countries, and ICT development at this current moment.

Methodology

[4] The use of the term "developing countries" and what the term really means is a contested subject. Overall, it typically accounts for countries with lower GDP or GNI levels or those with certain socioeconomic deprivations or challenges. Some argue that the developing-developed distinction is outdated and simplistic where others appreciate that it highlights the possibility of growth in these countries. The NPR article "Memo to People of Earth: 'Third World' Is an Offensive Term" (cited in this paper's bibliography) highlights a few of the different perspectives on how we categorize countries according to their socioeconomic status. This paper uses the term "developed countries" with the understanding that it is a form of shorthand for addressing a group of countries that are varied in where progress/development is needed.

[5] "Digital Development: Overview," World Bank, accessed December 26, 2021,

This research was designed based on my interest in digital technology and where it intersects with the international studies discipline. In many ways, the advances in and proliferation of digital capabilities is the major infrastructural, social, political, and economic project of our time, not just within countries but between them. This is true in the sense that now more than ever access and use of digital and internet technologies are seen as one of the most significant determinants in how countries, their economies, and their standard of living can progress positively into the future. To these points, my primary intention for this project is to engage with the practice of ICT4D, to better understand its successes, its limits, and its ideological purities and impurities as it is effectuated in certain contexts.

This research analyzes a selection of digital and ICT infrastructure projects, plans, and initiatives in Pakistan and Nigeria. These countries were chosen on the basis that they acquire certain characteristics that make their pursuit of digital development notable. For example, both Nigeria and Pakistan have a large youth population and a significant urban-rural divide. That being said, the resulting analyses are not necessarily an exercise in strictly comparing Pakistan and Nigeria, though similarities and differences between the two countries do emerge and have analytical value. I rather primarily characterize this research as an exercise in exploring what stands out within and between the ICT and digital development initiatives in these two countries principally in relation to the concept and practice of ICT4D. My hope is to gain some insights into the state of digital development and ICT4D for these and other developing countries.

This research is supported by a unique mix of sources. Contemporary, regional articles from online newspapers, journals, and magazines are used throughout the case studies, as well as the official plans and policies released by governments or government agencies or by the civil organizations involved. Some of these sources are popular, and in some cases potentially

unfamiliar, but with the very current nature of the initiatives in question, I was drawn to, and somewhat had to, use similarly current and local sources. In the prior scholarship section and in the discussion and analysis section books and articles from peer-reviewed journals are used to ground the research in the multi-dimensional fields of International Studies, Media Studies, Infrastructural Studies, and Development Studies (to name a few). Though limited, this research will be an addition to such interdisciplinary scholarship in that it provides a refreshed exploration of the topic of ICT4D using the specific examples of two countries with ever-growing political and economic power both within their regions and on the international stage.

The paper will proceed as follows: The Prior Scholarship and Context section will discuss in more detail the definitive elements of ICT4D in its current state and offer development profiles for Nigeria and Pakistan. The next section contains the Case Studies where two ICT or digital development projects in each country will be detailed, including factors such as the project's general timeline, goals, setbacks, important actors, and future expectations. Additionally in this section, before the projects and initiatives for each both countries are discussed, digital and ICT history and current challenges in the respective countries will be offered as further context. The penultimate section entitled Discussion and Analysis will cover important findings and questions extracted from the case studies. Finally, the Conclusion section will be a conclusion to the paper and suggestions for future research.

Prior Scholarship and Context

ICT4D

Existing scholarship on ICT4D often attempts to find a balance between extolling the benefits of ICT and digital development for developing countries and pushing against this idea by highlighting how the process of digital development is a complicated one for developing countries and emerging economies. This optimistic view can be illustrated in part by the oft-appearing term *leapfrogging*. *Leapfrogging* refers to how rapid digitalization may help less developed economies "skip a technological development stage and thus catch up more quickly with highly developed countries."[6] This type of optimistic view is often supported and reflected by international organizations such as the International Telecommunication Union (associated with the United Nations) and the World Bank[7] as well as by policy makers in developing countries who push for greater and faster digitalization in these countries.[8] This focus on improved ICT and digital infrastructure is primarily reasoned as the means for these developing countries and their economies to stay competitive and relevant in the global economy. Thieß Peterson writes, "If the necessary infrastructure is successfully established, the international competitiveness of emerging and developing countries, which until then had been underdeveloped, will improve significantly – and at the same time facilitate their integration into

[6] Thieß Peterson, "Digitalization: Curse or Blessing for Developing Economies?," BTI Blog, September 18, 2019.
[7] Felix O. Bankole, Farid Shirazi, and Irwin Brown, "Investigating the Impact of ICT Investments on Human Development," The Electronic Journal of Information Systems in Developing Countries 48, no.1 (2011): 3.
[8] Marcel Matthess and Stefanie Kunkel, "Structural Change and Digitalization in Developing Countries: Conceptually Linking the Two Transformations," Technology in Society 63 (2020): 1.

the world economy…the economic catching-up process of emerging and developing countries could be accelerated."[9]

The alternate angle that ICT4D research often features is that which explores the rather complicated relationship between digital development and developing countries. A primary conclusion made in the field points to the fact that the positive potential effects of ICT infrastructure development and digitalization are in fact better realized by developed countries/economies than they are by developing countries.[10] Additionally, Matthess and Kunkel (2020) write that in terms of policy makers in developing countries moving towards greater and faster digital development, "the envisioned impacts of digitalization are rarely grounded in theoretical or empirical evidence and it is still unclear how digitalization will impact structural change."[11] In essence, it remains unclear to what extent digitalization can facilitate meaningful changes for developing countries and their economies. Some even make the argument that the direction of resources towards ICT4D efforts "risk draining resources away from meeting more basic needs in development contexts"[12] especially where these efforts are both practically and ideologically misguided. Leye (2009) hinges her argument on this more critical point as she contends that realizing the benefits of ICT4D in relevant contexts rely on "political and institutional decisions about this technologies' development, diffusion, and implementation" but

[9] Peterson, "Digitalization."
[10] Bankole, Shirazi, and Brown, "Investigating the Impact of ICT Investments," 3; Matthess and Kunkel, "Structural Change and Digitalization," 10.
[11] Matthess and Kunkel, "Structural Change and Digitalization," 1.
[12] Leye, Veva. "Information and Communication Technologies for Development: A Critical Perspective." Global Governance 15, no. 1 (2009): 32.

also that these benefits will never be realized if overreaching political economic inequalities are not addressed.[13]

In his book, *Reclaiming Information & Communication Technologies for Development*, Tim Unwin follows in the critical approach of Leye (2009). He provides a thorough break down to theorizing and analyzing the connection between Information and Communication Technologies and "development." Unwin's main position, drawing from Critical Theory,[14] lies in this sentence: "Instead of 'ICTs for Development' (ICT4D) we have become increasingly and surreptitiously enmeshed in a world of 'Development for ICTs' (D4ICT), where governments, the private sector, and civil society are all tending to use the idea of 'development' to promote their own ICT interests."[15] Essentially, a change has occurred in the field of ICT4D, Unwin posits, where actual "development" has been deprioritized in the ICT4D equation in favor of what improvements in ICT can do to benefit governments, the private sector, and civil society organizations.

Unwin's concern for this reality of ICT4D is based in two broader points: 1) past scholarship, and, in some ways, popular understanding, has often undiscerningly lauded the benefits of ICT for economic development[16] and, 2) the question of if the poor and marginalized, often the implied focus of development initiatives, are effectively being helped by initiatives that

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[13] Ibid., 34.

[14] Unwin explains his approach to being "critical" on pages 5-6: "…the present book argues for a rather different approach to the notion of being 'critical'. It does so by drawing on the ideas of members of the Frankfurt School of Critical Theorists, and particularly the work of Jürgen Habermas…the conceptual, and indeed practical, tradition of such Critical Theory. I adopt this approach in part because of a belief that these ideas provide valuable insights into the ways through which poor people might be able to benefit from such technologies…". He then goes on to discuss items such as theory and praxis, knowledge-constitutive interests, and positive vs normative approaches to enquiry.

[15] Unwin, Reclaiming, 9.

[16] Ibid., 8-9.

address ICT and digital technologies.[17] The former point reflects the main idea in the first paragraph of this section, but Unwin adds: "The belief that ICTs are inherently good, and will therefore undoubtedly contribute effectively to development practice, is all-pervasive and implicit in most ICT4D initiatives."[18] In contrast, he explains that depending on how development is conceptualized, ICT4D initiatives can contribute to a range of changes, positive and negative. Addressing the latter of his two basic points, he explains: "although the design and introduction of such technologies has immense potential to do good, all too often this potential has had negative outcomes for poor and marginalized people, sometimes intended but more often than not unintended."[19] Expounding upon this sentiment, Unwin in *Digital Economies at Global Margins* writes:

> Many examples of successful projects seem to support such arguments for digital development at global margins, from the use of mobiles for financial transactions to health-care interventions, the provision of timely information for farmers, and the use of tablets connected to the Internet in schools. There is thus good evidence that some poor people do indeed benefit economically and socially from greater connectivity. Yet, all too often, such initiatives do not go to scale, or are unsustainable, and therefore larger numbers of poor people more generally do not benefit appropriately from such digital interventions[20]

[17] Ibid., 1, 7.
[18] Ibid., 24.
[19] Ibid., 1.
[20] Tim Unwin, "Digital Economies at Global Margins: A Warning from the Dark Side," in Digital Economies at Global Margins, ed. Mark Graham (Cambridge: MIT Press, 2019), 43.

As hinted at above, another relevant aspect of Unwin's book is his reassessment and clarification of the multivalency of "development." Colloquially, development in a social, political, or economic context is associated with the general ideas of positive improvements, growth, or progress, whether that be in a certain industry or sector, or for an entire nation. Unwin posits two primary understandings of development: one where development is concerned with economic growth and the other where development is concerned with reducing inequality.[21] The conception of development as economic growth is the one, Unwin posits, that has become hegemonic. And what is believed in tandem with that idea is that economic growth is a prerequisite for reducing inequality and alleviating poverty.[22] Subsequently, Unwin states, as a defining aspect of his analysis, that "most uses of ICTs in development have been focused on delivering the hegemonic agenda of economic growth, but because ICTs are an accelerator this has also led to much greater inequalities in the world."[23]

The final aspect of ICT4D for which Unwin provides a useful breakdown is that of stakeholders. The three common stakeholders connected to ICT4D initiatives are the private sector, the public sector, and civil society. Each of these stakeholders play their roles in the planning, implementation, and assessment of ICT4D initiatives and therefore their interrelation is crucial to examine. For example, Unwin emphasizes that each of these stakeholders bring their own motivations and approaches to the forming of ICT4D initiatives. For instance, the private sector, largely characterized at this moment by major global corporations, bring a profit-motivated approach where their primary concern is their shareholders.[24] In contrast, the public

[21] Unwin, Reclaiming, 14.
[22] Ibid., 17.
[23] Ibid., 21.
[24] Ibid., 106.

sector's intended primary service is to citizens or the public.[25] Particularly with the private sector where major global ICT companies "attempt to shape the world economy in their own interests," their growing influence is seen as a problem by Unwin. In a sense, there is the fear that, global ICT and digital technology companies such as Google, Meta[26], Huawei, Intel, Cisco, and ZTE, have even more voice and influence on the international stage than developing countries who might not "have the capacity, or the financial resources, to participate" in those forums where decisions are made.[27]

Also interesting to Unwin, and relevant to the following case studies are civil society organizations. Unwin characterizes civil society organizations as the definitive tertiary actor, less noted because of the prevalence of private-public partnerships (PPPs).[28] Still, civil society organizations such as the Internet Society or the International Telecommunication Union (ITU) as part of the UN, just like those in the public and private sectors, have their own motivations and conflicts:

> Civil society organizations are themselves fraught with the internal political dynamics that are encountered in the other two sectors, and in their pursuit of continued funding often become self-seeking entities that are more concerned with their own survival than with the purpose for which they were originally created. Moreover, whether they have any real power to transform the existing global governance agenda that has become

[25] Ibid., 107.
[26] As of October 28, 2021, Meta is the new name for the Facebook company.
[27] Unwin, Reclaiming, 105.
[28] Ibid., 78-79.

> dominated by the alliance between governments and the private sector seems very unlikely.[29]

The final point that Unwin makes regarding stakeholders reflects the question of whether the poor and marginalized, often the implied focus of development initiatives, are effectively being helped by initiatives that address ICT and digital technologies. Unwin makes the simple, seemingly obvious but yet-unsaid point that "[p]oor and marginalized people are as much stakeholders as are the companies and governments seeking to implement ICT4D initiatives."[30] This point, along with the rest of Unwin's rigorous evaluation, bring forth a set of components, questions, and trends in ICT4D research and practice that will be revisited in the Discussion and Analysis section.

Development Profile of Nigeria

Nigeria, located in West Africa, is an economic and cultural hub of the region (Figure 1).[31] It comprises 36 states and its Federal Capital Territory where Abuja, the capital city, is located. It is the most populous country in Africa with approximately 201 million people living within its borders. Its neighboring countries are Niger to the north, Chad and Cameroon to the east, and Benin to the west. To the south, giving Nigeria a coast, is the Gulf of Guinea of the Atlantic Ocean. Lagos, a state that lies on that very coast, in the southwest of the country, is the most productive state in Nigeria where "over 65% of the country's commercial activities are

[29] Unwin, Reclaiming, 78-79.
[30] Ibid., 112-13.
[31] All figures located in Appendix.

carried out."[32] Despite the importance of its urban centers, such as Lagos and Ibadan, still about 50% of Nigeria's population lives in rural areas.

In terms of development, Nigeria ranks in the middle-to-low levels of most used metrics for current economic status and concurrent growth or progress. Nigeria has a GDP per capita of $2,097.1 for 2020.[33] Its 2020 GNI per capita, PPP value is $4,739.7.[34] Both measurements[35] place Nigeria in the lower middle-income category of countries according to the World Bank. Nigeria's HDI (Human Development Index)[36] value for 2019 of 0.539 positions the country in the low human development category – numbered 161 out of 189 countries and territories. The country also stands out in the Multidimensional Poverty Index (MPI) metric.[37] From the Human Development Report 2020 (that refers to survey data from 2018),[38] 46.4% of Nigeria's population is in multidimensional poverty and 19.2% are classified as vulnerable to multidimensional poverty. The dimension that contributes the most to multidimensional poverty in Nigeria is Standard of Living (40.9%), meaning that there are deprivations with household

[32] Shakirat Adepeju Babatunde, "Government Spending on Infrastructure and Economic Growth in Nigeria," Economic Research-Ekonomska Istraživanja 31, no. 1 (2018): 1000.
[33] "GDP (Current US$) - Nigeria | Data," World Bank, accessed October 19, 2021.
[34] "GNI per Capita, PPP (Constant 2017 International $) - Nigeria | Data," World Bank, accessed December 22, 2021.
[35] In comparison, according to the World Bank, the United States' 2020 GDP per capita was $63,413.5 and its GNI per capita, PPP value was $60,949.7.
[36] The Human Development Index is described by the United Nations Development Program as "a summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable and have a decent standard of living." It is used in this research as an important supplementary to GDP and GNI to gauge socioeconomic status/development.
[37] "Global Multidimensional Poverty Index," Oxford Poverty & Human Development Initiative, accessed October 19, 2021; The MPI measures "acute multidimensional poverty...deprivations in health, education, and living standards that a person faces simultaneously."
[38] United Nations Development Programme. "Briefing Note for Countries on the 2020 Human Development Report: Nigeria." in Human Development Report 2020: The Next Frontier - Human Development and the Anthropocene, 2020:

access to cooking fuel, sanitation, drinking water, electricity, and assets such as radios, TV, telephones, computers, cars, refrigerators, and other items commonly held as essential.

One of the main hindrances to Nigeria's economic development is the country's dependency on oil. According to the World Bank, 80% of Nigeria's exports are attributed to oil as well as half of government revenues.[39] Still, oil contributes very little to Nigeria's GDP: only about 9% in 2020.[40] This type of dependency on a single resource, particularly while still experiencing stunted economic growth and large scale poverty, is sometimes referred to as a "resource-curse."[41] As is the case with other oil dependent economies, volatility in the oil sector due to changing prices also renders the economic outlooks for the country highly uncertain. For example, with the Covid-19 pandemic, global oil prices dipped and with them, Nigeria's oil revenues. Even as the country recovers from this economic downturn, the precarity of the oil market means that Nigeria's economy remains relatively unstable.[42] Within, the strive towards ICT and digital development is the need for Nigeria to diversify their economy and overhaul their dependency on oil.[43]

Development Profile of Pakistan

Pakistan, officially the Islamic Republic of Pakistan, is a South Asian country neighbored by Iran, Afghanistan, and India (Figure 2). It shares a border with China to the north. Pakistan is the fifth-most populous country in the world with a population of approximately 220.9 million.

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[39] "The World Bank in Nigeria," World Bank, accessed December 22, 2021.
[40] "Nigeria Faces a Tough Time Diversifying from Oil," Deutsche Welle, accessed December 22, 2021.
[41] John Campbell, "Nigeria Is Oil Dependent, Not Oil Rich," Council on Foreign Relations, February 13, 2019.
[42] "The World Bank in Nigeria"
[43] Ibid.

Its largest city is Karachi, capital of the Sindh province and located on the coast of the Arabian sea. It is where most industrial and commercial activities are concentrated. The other major city is Lahore, capital of the Punjab province. Like Nigeria, there is a large rural population with the World Bank calculating the percentage of Pakistan's rural population out of the total population in 2020 at approximately 63%.[44]

Pakistan is a developing country, often ranking in the lower levels of current economic conditions and economic growth in comparison to other countries. It has a GDP per capita of $1,193.7 for 2020.[45] Pakistan's 2020 GNI per capita, PPP value is $4,790.[46] With these indexes, the World Bank places Pakistan in the lower-middle income category of countries, just as with Nigeria. Pakistan's HDI value for 2019 of 0.557 ranks the country number 154 out of the 189 countries included, in the medium human development group. Like Nigeria, Pakistan's MPI measure is relatively significant to consider as poverty is a major development challenge that the country needs to overcome. Referring to survey data from 2017 and 2018, 38.3% of Pakistan's population are multidimensionally poor with 12.9% classified as vulnerable to multidimensional poverty.[47]

Possibly the most important factor of Pakistan's development is their population. Pakistan is the fifth-most populous country in the world. According to the World Bank, as of 2020, their population growth rate is 2% annually. But what is particularly important is that demographically, Pakistan's population is overwhelmingly young (Figure 3). Approximately,

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[44] "Rural Population (% of Total Population) - Pakistan | Data," World Bank, accessed November 8, 2021.
[45] "GDP per Capita (Current US$) - Pakistan | Data," World Bank, accessed November 8, 2021.
[46] See note 35 for comparison to U.S.
[47] United Nations Development Programme. "Briefing Note for Countries on the 2020 Human Development Report: Pakistan," in Human Development Report 2020: The Next Frontier - Human Development and the Anthropocene, 2020:

63% of the population is between the ages of 15 and 33.[48] Pakistan's youth bulge presents two different possibilities for the country's economic future: either a young, skilled, and educated workforce can secure well-paying employment and spur growth and development in relevant industries or pitfalls in socioeconomic factors such as employment, health, and technological education and access will acutely burden the youth population and thus Pakistan's economy.[49] The concern over youth employment, poverty, and access to technology is apparent in much of Pakistan's development plans and initiatives that concern digital technology and ICT infrastructure.

[48] Ahsan Kamray, "Youth Bulge in Pakistan: Bane or Boon?," The Express Tribune, July 14, 2021.
[49] Erum Hafeez and Tayyaba Fasih. "Growing Population of Pakistani Youth: A Ticking Time Bomb or a Demographic Dividend." Journal of Education and Educational Development 5, no. 2 (2018): 212.

Case Studies

Nigeria

ICT and Digital Infrastructure in Nigeria

Before looking at the selected initiatives, it is useful to provide some brief general notes on ICT infrastructure, digital technology, and internet technologies in Nigeria. The internet first became available in Nigeria in 1996 when the Nigerian Communications Commission (NCC) licensed 38 internet service providers (ISP). The first ISP to start commercial operations in 1997 was Linkserve Limited.[50] By 1998, the internet had become more widely accessible to Nigerians and by 2001, the NCC had licensed over 150 internet service providers.[51] The NCC, the main regulatory body for the telecommunications industry and ICT infrastructure in Nigeria, was only established in 1992. Currently, Nigeria is considered "Africa's largest ICT market with 82% of the continent's telecoms subscribers and 29% of internet usage"[52] the latter of which translates to 33.6 % of Nigeria's population being individual internet users.[53]

Access to and use of the internet is concentrated in urban areas, namely: Lagos. This concentration in internet activity and access is further highlighted by the fact that at this moment, all fiber optic subsea cables with landings in Nigeria, including those that have been announced but are not yet serviceable, land exclusively in Lagos, excluding the planned Globacom-2 cable

[50] "Internet: 13 Years of Growth from Ground Zero in Nigeria from 1960- 1996," Vanguard News, October 26, 2010.
[51] Esharenana E. Adomi, "Internet Development and Connectivity in Nigeria," Program: electronic library and information systems 39, no. 3 (2005): 259
[52] "Nigeria - Information and Communications Technology," International Trade Administration, accessed December 22, 2021.
[53] "Individuals Using the Internet (% of Population) - Nigeria | Data," World Bank, accessed December 22, 2021.

which will have additional landing sites in Bonny and Kwa Ibo (Figure 4).[54] Lastly, the World Bank Group in their Digital Economy Diagnostic Report for Nigeria highlight that one major challenge for Nigeria has been an overdependency on mobile broadband for internet access rather than fixed broadband.[55] This is an example of just one point in the diverse array of ICT infrastructure and digital development challenges that Nigeria currently faces.

Projects and Initiatives

In this case study, these two ICT4D projects are significant for Nigeria in the following ways:

- Digital Switch Over (DSO) promises a range of benefits for Nigerians by way of new digital services. It also serves as an example of a long-term project that has faced many setbacks in its implementation.
- 2Africa serves as an example of a very recent large-scale project created by private entities where Nigeria is not the sole focus but still stands to benefit by its inclusion from fiber-optic cable infrastructure.

Digital Switch Over

Digital Switch Over (DSO), or Digital Terrestrial Transmission (DTT), is a project started in Nigeria in October 2008. Digital switch over is the process of converting or shifting from analog TV broadcasting to digital broadcasting (Figure 5). For Nigeria, DSO was truly initiated even earlier than 2008, by the signing of the GE06 Regional Agreement in 2006 where

[54] Alan C. O'Connor et al., "Economic Impacts of Submarine Fiber Optic Cables and Broadband Connectivity in Nigeria (Working Paper)," RTI International: 6.
[55] World Bank Group, "Nigeria Digital Economy Diagnostic Report," World Bank, 2019: 12.

118 other member states of the International Telecommunication Union (ITU)[56] agreed on the switch from analogue to digital broadcasting as part of the Regional Radiocommunication Conference in Geneva, Switzerland.

According to the ITU, digital switch over necessitates 3 steps. The first is establishing the digital services on temporary frequencies and simulcasting analogue and digital services as necessary. The second step calls for switching off the analogue services. The final third step is to bring the digital services to their final frequencies if it is necessary.[57] The ITU set a deadline for the completion of these three steps for June 2015, but the Nigerian government self-mandated an earlier deadline of June 2012. Within Nigeria, the handling of DSO was put primarily under the jurisdiction of the NBC, or the National Broadcasting Commission.

The perceived benefits of DSO in Nigeria are wide-ranging. Addressing stakeholders and those in the broadcasting industry in 2021, Alhaji Lai Mohammed, the Minister of Information and Culture, explained:

> The Federal Ministry of Information and Culture considers the DSO as one of its priority projects because of its potential to create jobs, bring governance closer to the people through better access to information, thus deepening democracy, bring the Internet to millions of homes and provide quality programming, especially those produced locally,

[56] The ITU is a specialized UN agency for ICTs that works to "allocate global radio spectrum and satellite orbits, develop the technical standards that ensure networks and technologies seamlessly interconnect, and strive to improve access to ICTs to underserved communities worldwide."

[57] "ITU-R FAQ on the Digital Dividend and the Digital Switchover," International Telecommunication Union, 2020: 4.

> to Nigeria's estimated 24 million television households, with high fidelity pictures and sound.[58]

Additionally, Mohammed has explained that DSO would help bridge the digital divide in Nigeria by connecting "underserved populations and remote communities".[59] DSO could also help free up spectrum for use in other industries, particularly for Nigeria's ICT industry.[60]

The DSO project in Nigeria has been primarily characterized by slow implementation and numerous setbacks.[61] Upon missing the self-asserted deadline in June 2012, it was resolved to aim for the ITU-set deadline of June 2015. When that deadline arrived, the country was still extremely behind on converting to digital broadcasting. At that point, an extremely low percent of television stations in Nigeria had been technologically prepared or adequately funded to perform this migration.[62] Nigeria then appealed to the ITU to extend their deadline to 2017. Still in 2017, the DSO project had only made progress in Abuja, the capital city, and Jos where DSO was enacted in April and December of 2016, respectively. This first phase of real movement with DSO continued into 2017 and 2018, finishing with Osun State at the end of February 2018.

After a three-year pause, accredited to the difficulties in financially and politically managing the project,[63] phase 2 of DSO began with implementation in Lagos in April 2021.

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[58] Seye Olumide and Sunday Aikulola, "DSO Will Create One Million Jobs in Three Years, Says Mohammed," The Guardian Nigeria, April 13, 2021.
[59] Kola Oyelere-Kano, "FG Launches Digital Switch Over in Kano, Deploys 500,000 Decoders," Tribune Online, November 2, 2021.
[60] "Nigeria Switching from Analogue to Digital Broadcasting in Television and Radio," Oxford Business Group, accessed December 23, 2021.
[61] "Nigeria: Issues With the DSO Programme," AllAfrica, July 26, 2021.
[62] Omale, Gloria Eneh, Daniel Ofomegbe Ekhaerafo, and Coleman Fidelis Essien. "Digital Terrestrial Transmission Failure in Nigeria: Implications for Sustainable Development." International Conference on Information and Communication Technology and Its Applications, (2016): 154-55.
[63] Adeyemi Adepetun, "Nigeria's 2022 Digital Switchover Target Uncertain as FG Slows on Timeline," The Guardian Nigeria, July 19, 2021.

With this recommencement, the Nigerian Government detailed in a Twitter thread the progress of DSO made by the NBC thus far and the timeline for the future. This Twitter thread also doubled down on several positive changes that DSO could bring (Figure 6). Namely, one of the more intriguing possible outcomes of the DSO is how it could bolster Nigeria's entertainment industry. The claim is that through efforts such as the prioritization of local content and advertising-related revenues,[64] the industry would be stimulated with more capital and jobs. Also, related to jobs and employment, among the many numbers floated among articles detailing the DSO, this twitter thread makes the claim that the DSO is expected to create 1 million jobs with an emphasis on jobs in Lagos.

Most recently, DSO was implemented in Kano in November 2021. Currently, Nigeria's federal government plans to complete DSO country-wide by December 7, 2022, though there has been a slowdown in their progress towards that goal.[65] Because of its many setbacks and other logistical concerns (such as the affordability and practicality of digital services subscriptions), the project seemingly remains an object of skepticism for the Nigerian public. For example, a TheCable opinion article written by a former director at the NCC, Okoh Aihe expresses many concerns, but primarily that because of the costs associated with DSO (particularly getting the set-top boxes) "ordinary Nigerians" might be excluded from the switch.[66] This one opinion does not, of course, reflect the full range of possible opinions or skepticisms towards the project.

2Africa

[64] Adeyemi Adepetun, "DSO May Trigger $350m Advertising Revenue in Lagos," The Guardian Nigeria, May 5, 2021.
[65] Adepetun, "Nigeria's 2022."
[66] Okoh Aihe, "For DSO, a Little Consideration for the Ordinary Nigerian," TheCable, June 2, 2021.

2Africa is a subsea cable project that implicates the entire African continent, as well as parts of the Middle East, not just Nigeria (Figure 7). Introduced in March 2020 by Meta, then Facebook, and launched in May, it is a product of a multi-party partnership of private entities that include Meta, China Mobile International, MTN GlobalConnect, Orange, stc, Telecom Egypt, Vodafone, WIOCC (West Indian Ocean Cable Company), and Alcatel Submarine Networks (ASN).[67] On the project's website the final vision of the project at its conception is described:

> At 37,000km long, 2Africa will be one of the world's largest subsea cable projects and will interconnect Europe (eastward via Egypt), the Middle East (via Saudi Arabia), and 21 landings in 16 countries in Africa. The system is expected to go live in 2023/4, delivering more than the total combined capacity of all subsea cables serving Africa today, with a design capacity of up to 180Tbps on key parts of the system. 2Africa will deliver much needed internet capacity and reliability across large parts of Africa, supplement the fast-growing capacity demand in the Middle East and underpin the further growth of 4G, 5G and fixed broadband access for hundreds of millions of people.[68]

The project progressed at a quick speed after its launch in May 2020. The 2Africa website's Project Updates page reported that by August 2021 much of the subsea survey activity had been completed and, a crucial part of the project, the Egypt terrestrial crossing connecting landing sites on the Red Sea and the Mediterranean Sea were completed at that point as well. The

[67] "Home," 2Africa Cable, accessed October 19, 2021.
[68] "Home," 2Africa Cable.

company chosen to build the actual cable, Alcatel Submarine Networks (ASN),[69] had also started to manufacture the cable and other relevant units.[70]

Despite the project's broad scope, Nigeria has particular importance to the 2Africa plan. In August 2021, the 2Africa consortium announced that they would add, amongst four other landing sites, a landing site in the southeast of Nigeria (Lagos). This landing site, it is proposed, could prove to be beneficial for Nigeria as it is stipulated that in countries where the cable lands, telecommunications service providers and internet service providers will be able to access carrier-neutral data centers or open-access cable stations on, the consortium claims, a "fair and equitable basis."[71] This aspect of the project, if carried out, could support better access and overall experience of connectivity for service providers, businesses, and consumers in Nigeria. Additionally, Nigeria stands to benefit from the overall goal of the initiative to bring more jobs to African countries, including those outside of major cities, a quality that is especially relevant for Nigeria where internet activity is concentrated in big cities such as Lagos.[72]

One of the major questions with the 2Africa project revolves around Meta's involvement. Meta is a major partner in the project. It was first announced to the world by the company, and, despite the multiple corporate partners involved, the cable's construction has primarily been attributed to Meta by news and magazine articles. Meta itself seems to take primary ownership the 2Africa project as they emphasize it as one of the many investments in Africa that the firm has made and plans to make. The firm illustrated this trend of investments in Africa in their

[69] According to their website, ASN is a part of the Nokia corporation. The company manufactures, lays, and manages submarine cables worldwide.
[70] "Home," 2Africa Cable.
[71] Matthew Du Plessis, "Inside Facebook's Big Bet on Africa," The Mail & Guardian, May 25, 2020.
[72] Du Plessis, "Inside."

summary infographic "Meta Africa 2021 Year in Review" published in December 2021. 2Africa is therefore, according to Meta and as Kezia Anim-Addo, Director of Communications for the Sub-Saharan Africa region at Meta puts it, a key part in how the firm has an 'ongoing role in helping unlock Africa's potential."[73] Further, in reference to Meta's size and reach, apprehensions to 2Africa point to the possible anti-competitive behavior that the involvement of companies such as Meta and Google in internet infrastructure in Africa could bring.[74]

As the 2Africa project is a new and current project, much of the outcomes are still to be seen. The cable is meant to go live by 2023 or 2024. The most recent update is the addition of the "2Africa Pearls" segment that includes landing locations in places such Saudi Arabia, Iraq, India, and Pakistan, which will make the cable 45,000 kilometers (approx. 28,000 miles).[75] Overall, there seems to be optimism towards how the cable will help internet penetration and access in Africa on a whole. Quoted in South Africa's *Mail & Guardian*, Kenyan technologist, and CEO Phares Kariuki explains: "On the face of it this appears to be exactly what is needed to drive down costs...For the countries that have not had the luxury of proper connectivity, this cable will solve that problem. It's what Google, Microsoft or Amazon should have done years ago".[76] Still, it is important to note that in looking for and reading articles on the initiative, there is a noticeable dearth of Nigeria-based perspectives on the 2Africa project and the landing site to come.

Pakistan

[73] "Meta Unveils Its 'Africa Year in Review' for 2021," Vanguard, December 10, 2021.
[74] Du Plessis, "Inside."
[75] Kevin Salvadori, "2Africa Pearls Subsea Cable Connects Africa, Europe, and Asia to Bring Affordable, High-Speed Internet to 3 Billion People," Engineering at Meta, September 28, 2021.
[76] Du Plessis, "Inside."

ICT and Digital Infrastructure in Pakistan

Just as before, it is useful to provide some brief notes on ICT infrastructure, digital technology, and internet technologies in Pakistan. The internet first became available in Pakistan between 1993 and 1995 (when broadband was introduced). In its early iterations in 1993, internet services were mainly dedicated to providing dial up and e-mail for the public as well as have applications in education settings.[77] The Pakistan Telecommunication Authority (PTA) was established in in 1996 and COMSATS launched its internet service provider in the same year in Karachi, Lahore, and Islamabad.[78] Going into 2002, the country had around 50 internet service providers.[79] Currently, internet penetration in Pakistan stands at 54%. Illustrating a drastic rural-urban divide in internet access and use, 66% of internet users are located in urban areas, such as Karachi, Lahore, and Islamabad, and 47% are located in rural areas.[80]

As suggested by the above statistic, Pakistan is like Nigeria in its concentration of internet and digital access and use in its urban areas and big cities. Other than the more conventional dynamics of this type of digital division – commercial interests of internet service providers, economic inequality and affordability of internet services, poor quality networks, low digital literacy – the issue of internet shutdowns are also quite prevalent in Pakistan.[81] Internet shutdowns are when internet access is purposefully restricted or cut off. According to the Internet Society, Pakistan and India had the most documented internet shutdowns in 2019.[82] Often internet shutdowns are enacted on the grounds of security concerns and in Pakistan these

[77] "Technology: Evolution of the Internet in Pakistan," DAWN, January 30, 2010.
[78] "History of Internet in Pakistan," ISPAK, March 19, 2020.
[79] "Technology: Evolution of the Internet in Pakistan," DAWN.
[80] "Country's Internet Penetration Stands at 54%," The Express Tribune, July 30, 2021.
[81] Shah Meer Baloch and Zafar Musyani, "Pakistan's Great Digital Divide," accessed December 23, 2021.
[82] "Policy Brief: Internet Shutdowns," Internet Society (blog), accessed December 23, 2021.

security concerns are typically directed at certain regions such as the Gilgit-Baltistan region that is disputed between India and Pakistan (and China at certain times).[83] Internet shutdowns such as these exacerbate the already existent troubles with internet access and use in remote, rural areas.

Projects and Initiatives

In this case study, these two ICT4D projects are significant for Pakistan in the following ways:

- Wireless for Communities (W4C) is an example of an initiative specifically directed at rural and remote areas in Pakistan and how to get communities to access and use internet and digital services.
- The China-Pakistan Economic Corridor is an initiative devised by the Pakistani and Chinese governments for the economic benefit of both countries. It is Pakistan's main role in China's expansive Belt and Road Initiative.

Wireless for Communities Program

The Wireless for Communities (W4C) program in Pakistan[84] was launched in 2015 by the Internet Society (ISOC)[85], a global nonprofit that focuses on developing internet infrastructure and connectivity, in partnership with COMSATS Internet Services (CIS),[86] a major ISP in Pakistan. According to the Internet Society, the initiative's primary aim is to "provide

[83] Baloch and Musyani, "Pakistan's Great Digital Divide."
[84] Other Wireless for Communities programs had been implemented in India and Nepal for at least five years prior to launching in Pakistan.
[85] The Internet Society is an America-based global non-profit that describes itself as an "organization empowering people to keep the Internet a force for good: open, globally connected, secure, and trustworthy."
[86]COMSATS, or Commission on Science and Technology for Sustainable Development in the South, was established in 1994. It is an "international, inter-Governmental science organization, aiming at socio-economic uplift of the third world." Pakistan is one of its Member Countries. COMSATS Internet Services was one of the first ISPs launched in Pakistan.

Internet connectivity by utilizing low-cost Wi-Fi-based equipment to connect and empower rural and underserved communities" and "address the lack of content, products and services originating from rural areas, which prevents economic benefits from percolating to the bottom of the pyramid."[87] Following these aims, in Pakistan, the W4C program was piloted in the rural community of Chak-5 Faiz, located near Multan in the Punjab province. According to the ISOC, this rural community "had limited access to the Internet and it was not being used for any activities in their daily lives."[88] CIS's role is to provide the backhaul connectivity needed for the wireless internet connection in the remote, rural area.[89]

There are four phases as well as three main elements of the administration of W4C's "holistic approach."[90] The three main elements are as follows:

1. Community training on establishing their community wireless network
2. Deployment of wireless network infrastructure
3. Broadening of internet access and usage through expanding Wi-Fi connectivity to surrounding areas[91]

The first phase of the initiative was completed in December of 2015. This meant that line-of-sight internet connectivity,[92] centered around a tri-pole tower, was set up in the community, establishing a two-kilometer (~1.25 miles) area of coverage using unlicensed spectrum (Figure

[87] "Wireless For Communities," Internet Society, accessed November 8, 2021.
[88] "The Wireless for Communities (W4C) Programme in Pakistan," Internet Society, accessed November 8, 2021.
[89] Naveed Haq, "Ensuring Local Ownership for Community Networks in Pakistan," Rising Voices, December 5, 2018.
[90] Internet Society, "Wireless For Communities."
[91] Ibid.
[92] Line-of-sight internet is a wireless internet connection (as opposed to internet connection that is provided by underground cables) provided by a pole or tower to a fixed area (in its line-of-sight). It is also sometimes referred to as fixed wireless connection.

8). The specificities of the intended four phases are not clearly delineated by the ISOC, but the ISOC webpage for Wireless for Communities in Pakistan claims that "the next phase [is] focused on training the community on the use of the Internet to improve their livelihood and wellbeing" and that the initiative is planned to launch in other Pakistani villages.[93] To this, Naveed Haq, a director of W4C in Pakistan, details how after the first phase of establishing connections, community trainings to educate the community on the many uses of the internet in different contexts were the next focus.[94]

In the Chak-5 Faiz community, the first to benefit from this new internet connectivity was a girls' school that previously had computers, but their internet connectivity was compromised as it was connected to a disconnected telephone line. With the client antenna set up in the school, the teachers and students had full access to internet services and were able to use the computers that they had. Internet services were also set up for the PAK German Polytechnic Institute for Agricultural Technology and a cluster of homes. In 2018, the ISOC shared a video that served as an update of (and an intended testament to the successes of) theses beginning phases of the W4C in Chak-5 Faiz.[95] The new set of advantages experienced by those who gained internet access and utility through the W4C pilot project are multifold, as one local farmer describes how it allows communication with relatives abroad and the ability to easily find solutions to issues he in his work, and students and teachers alike at the girls' school cite better online classes, online registration, and overall engagement in the school setting.[96]

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[93] Internet Society, "The Wireless for Communities (W4C) Programme in Pakistan."
[94] Haq, "Ensuring Local Ownership."
[95] Internet Society, "Internet Society W4C Pakistan Promo," accessed December 21, 2021.
[96] Ibid.

The main internet penetration issue for rural areas that W4C addressed is last-mile connectivity: how to get internet services to reach those unconnected or distanced from the main network.[97] Community networks, or communication networks that are owned, operated, and maintained by the community that uses it, address the problem of last-mile connectivity and the W4C program functions as a facilitator of establishing community networks. Line-of-sight internet connectivity also seems to relate to this issue of last-mile connectivity.

It is hard to know if one should speak in present or past tense with the Wireless for Communities program in Pakistan. Its status is relatively unclear, despite how an example of the possible duration of the program can be seen in the same program's run in India that went from 2010 up until at least 2016. Its successful pilot in Chak-5 Faiz would suggest that launching W4C in other rural communities in Pakistan could be fruitful. All the most recent updates on the Wireless for Communities Pakistan Internet Society webpage comes from 2018 but the ISOC Digital Dera initiative, which focuses on rural farmers in another rural Pakistan area, launched in 2020 seems to follow in the same community network framework as W4C.[98]

China-Pakistan Economic Corridor

China's Belt and Road Initiative (BRI) is the expansive, multinational infrastructure project launched in 2013 by the Chinese government under President Xi Jinping. As of January 2020, there are sixty or more countries signed on to or interested in signing on to BRI projects, a group "accounting for two-thirds of the world's population."[99]The largest project associated with

[97] Haq, "Ensuring Local Ownership."
[98] Naveed Haq, "Dera Brings the Internet to Farmers in Pakistan, Narrowing the Rural-Urban Divide," Internet Society, November 9, 2021.
[99] Andrew Chatzky and James McBride, "China's Massive Belt and Road Initiative," Council on Foreign Relations, January 28, 2020.

the Belt and Road Initiative is the China-Pakistan Economic Corridor (CPEC). Estimated to cost $62 billion, the CPEC consists of multiple projects directed towards connecting China to Gwadar Port on Pakistan's coast on the Arabian Sea (Figure 9). Prior to the BRI version of the CPEC, plans for an economic corridor between China and Pakistan had been nearly devised, though with a smaller price tag and timeframe.[100]

The CPEC as it exists today was officially launched in April 2015 under Pakistani Prime Minister Nawaz Sharif and Chinese President Xi Jinping. The Long-Term Plan (LTP) for the China-Pakistan Economic Corridor (2017-2030) was created by both the Chinese government and the Pakistani government in 2017. In the LTP, the two governments lay out their shared vision and shared goals, defining the project as "a growth axis and a development belt featuring complementary advantages, collaboration, mutual benefits and common prosperity" (See images from LTP).[101] Additionally, under the "Key Cooperation Area" of Connectivity, the Long Term Plan identifies the promotion of cross-border optical fiber cables between the countries, the construction of backbone optical fiber networks in Pakistan, Pakistan's adoption of China's Digital Terrestrial Multimedia Broadcasting standard, and the development of e-commerce as high priority items.[102] The LTP lists a handful of opportunities and possible challenges for the two countries undergoing this joint project. For Pakistan, the main opportunity posed is the ability to capitalize on macroeconomic gains that had already improving (as of 2015/2017). As far as possible challenges, the LTP diagnoses that "Pakistan needs to address major bottlenecks

[100] "The BRI in Pakistan: China's Flagship Economic Corridor," Mercator Institute for China Studies, May 20, 2020.
[101] "Long Term Plan for China-Pakistan Economic Corridor (2017-2030)," CPEC Authority Office, December 18, 2017: 4.
[102] "Long Term Plan for China-Pakistan Economic Corridor (2017-2030)," 14.

to economic and social development to sustain economic growth momentum."[103] These bottlenecks are related to energy, infrastructure, administration, and governance.

Although the BRI primarily works on traditional infrastructure such as highways, pipelines, and railways, since its launch in 2013 digital components have become a major part of the final total infrastructural vision, mainly consolidated under the crucial BRI component, the Digital Silk Road (DSR). The DSR, also launched in 2015, looks to improve "telecommunications networks, artificial intelligence capabilities, cloud-computing, e-commerce…and other high-tech areas" for partnered countries/recipients (Figure 10).[104] The DSR component of the BRI manifests in the CPEC with the Cross Border Optical Fiber Cable (OFC) and the Pilot Project of Digital Terrestrial Multimedia Broadcast. The Cross Border OFC is an 820 kilometer (approx. 509 miles) long fiber optic cable that extends from Rawalpindi in the south of Pakistan to Khunjerab in the north at the Chinese border. Work on this initial section of the cable occurred from October 2015 to July 2018, but there are plans to extend this cable to other cities, most importantly to Gwadar and Karachi.[105]

Outside of the CPEC but still related to the BRI, is the PEACE (Pakistan East Africa Connecting Europe) cable being constructed to connect Pakistan, East Africa, and Europe. The PEACE cable could reach a total length of 15,000 kilometers (approx. 9,320 miles) and is expected to be ready by February 2022.[106] In its first phase, it has connected Gwadar and Karachi in Pakistan to Marseilles, France, through different locations in African countries such as Kenya,

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[103] Ibid., 7.
[104] Joshua Kurlantzick and James West, "Assessing China's Digital Silk Road Initiative," Council on Foreign Relations, accessed December 23, 2021.
[105] "Potential Dual-Use China-Pakistan Fiber Optic Cable Comes Online," RWR Advisory Group, July 22, 2020.
[106] "GO Joins Undersea Cable Project That Will Link Malta to France and Egypt," Times of Malta, July 13, 2021.

Djibouti, Somalia, and Egypt. In its second phase, the cable will be extended to South Africa.[107] One important feature that connects the fiber optical cables, Cross Border OFC and the PEACE cable, is that they were and are being developed in large part by Huawei, China's foremost multinational technology corporation, who is also working on the development of 5G networks across Pakistan.[108] Lastly, in 2020, Pakistan was the first country to join China's BeiDou satellite navigation system.[109]

With the CPEC and BRI projects, the costs, long-term and short-term, have been a major concern. With Pakistan and the CPEC, the Mercator Institute for China Studies details:

> At times, the commercial logic of CPEC appears at odds with the overarching goal of bringing prosperity to Pakistan. Chinese companies have often obtained long-term contractual rights to operate road and energy infrastructure...these high prices threaten to put Pakistan at a disadvantage compared to regional competitors like Bangladesh.[110]

The CPEC could in fact be contributing to economic instability in Pakistan. The $60-$62 billion in pledges that the CPEC implicates is equivalent to about one-fifth of Pakistan's GDP[111] and there are monetary concerns on Pakistan's behalf that the CPEC introduces possibly high levels of debt.[112] The election of Prime Minister Imran Khan in 2018 marked a moment where the CPEC was seemingly being reconsidered on the grounds of the cost and debt, with the

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[107] Jevans Nyabiage, "Can China's 'Digital Silk Road' Secure Dominant Role in Communications?," South China Morning Post, March 21, 2021.
[108] Kurlantzick and West, "Assessing China's."
[109] Ibid.
[110] Mercator Institute for China Studies, "The BRI in Pakistan."
[111] David Sacks, "The China-Pakistan Economic Corridor—Hard Reality Greets BRI's Signature Initiative," Council on Foreign Relations, March 30, 2021.
[112] Logan Pauley and Hamza Shad, "Gwadar: Emerging Port City or Chinese Colony?," accessed December 23, 2021.

suggestion that certain aspects would be renegotiated. Very soon after this was reported, the Pakistan government and the Chinese government denied that there was any amount of trepidation by Pakistan with moving forward with CPEC.[113] Despite this, some aspects of the CPEC were scaled down since 2018 and by the end of 2019 the second phase that would focus most of special economic zones (SEZs) was announced.[114] It is also important to note that in July of 2019, Pakistan was approved for a $6 billion bailout from the IMF. Although Pakistan has a history with IMF bailouts, this monetary assist was related to some degree to the CPEC granted that Pakistan out of the amount of its debt that Pakistan would have to pay within the three year duration of the deal ($37 billion), about $15 billion was owed to China at that point.[115] With the debt that Pakistan is accruing, payment was delayed for another decade in 2021, especially necessary after Pakistan's economy struggled under the Covid-19 pandemic.[116] As the CPEC, and the BRI more generally, progresses it will be a significant attestation to China's globe-spanning project and to Pakistan's infrastructural and economic future to see if intended projects are completed to scale, and without compromising Pakistan's economy.

[113] Pauley and Shad, "Gwadar."
[114] Michael Kugelman, "Pakistan's High-Stakes CPEC Reboot," Foreign Policy (blog), accessed December 23, 2021.
[115] Kunwar Khuldune Shahid, "The IMF Takeover of Pakistan," accessed December 23, 2021.
[116] Sacks, "The China-Pakistan Economic Corridor."

Discussion and Analysis

At an initial and broad level of analysis, I posit that the featured initiatives from Nigeria and Pakistan, through their varied foci, involved actors, and other terms and outcomes of their implementation, illustrate this relatively urgent pursuit in and on behalf of developing countries to bolster their ICT infrastructure and path to becoming 'digitally developed'. They also give a snapshot of how these two countries have varying triumphs and challenges in efforts to improve internet infrastructure and digital services. This quality contributes to my support of the side of ICT4D research that highlights that ICT and digital development is a complicated, context-specific process. Further, as it is the purview of this research project, these respective case studies illustrate several salient realities about how ICT4D is being implemented at this current moment. Therefore, I intend to examine these case studies in relation to several components of or trends in ICT4D research and practice that emerged in the prior scholarship section. These components include:

- How ICT4D research and practice can be overtly optimistic about the benefits of ICT,
- How or if these initiatives account for social and/or economic realities in their respective countries,
- If these initiatives reflect Unwin's argument about the switch from ICT4D to D4ICT,
- Which conception of development – economic growth or reducing inequality – do these initiatives express,
- Who the stakeholders are and how they fulfill their roles,

- And do these initiatives have a direct relationship to the poor and marginalized in their respective contexts.[117]

Nigeria

Overall, the initiatives in Nigeria, Digital Switch Over and 2Africa, are two very different undertakings. DSO is a process predominately in the hands of the federal government whereas 2Africa is built, managed, and brought to Nigeria by a consort comprised of several firms. DSO has had a much more tumultuous timeline than 2Africa which has progressed in a timely manner. This difference, I find, highlights the advantages the private sector has over the public sector in having and mobilizing the resources needed to complete projects. With seven or eight partners, including Meta, one of the richest firms in the world, 2Africa has many sources of financial support and the opportunity to delegate responsibilities for the construction and management of the cable, as they did with Alcatel Submarine Networks' role in manufacturing the actual cable. DSO, on the other hand, is funded by the federal government and managed by the NBC (National Broadcasting Commission). Therefore, at a certain level the rollout of DSO is heavily affected by the intricacies of government funding as well as the nature of bureaucracy in Nigeria.[118] As the case study mentions, the project was stalled because of lack of funds, a concern that is seemingly non-existent for the 2Africa project.

Digital Switch Over

[117] I offer the important aside that there are many details in the four initiatives at the center of this research that can be discussed and analyzed. The following analyses try to pick out what is most relevant and interesting, but it is by no means exhaustive.

[118] Confidence Okwuchi, "Nigeria's Digital Switch Over Project Comes Alive in Kano State," Voice of Nigeria, November 2, 2021.

Focusing on DSO, one of the aspects that stand out in relation to ICT4D is the perceived benefits of the project. According to the Minister of Information and Culture, Alhaji Lai Mohammed, these benefits include more pragmatic items such as job creation, reaching remote communities in Nigeria,[119] and providing quality Internet access and content to Nigerian households, as well as broader goals such as deepening democracy, improving governance and information ecosystems and contributing to diversifying Nigeria's economy by invigorating the entertainment industry.[120] In terms of trends in ICT4D, these perceived benefits are significant in how they link larger sociopolitical or socioeconomic goals (deepening democracy, improving governance, diversifying economy) to a digital transformation/development project. These benefits might in fact play out, but regardless, the rhetoric of, and what is probably the real belief in, these benefits demonstrate to a certain degree the overt optimism about the promises of ICT or digital development that policymakers (not just researchers) carry with them in the pursuit of ICT4D projects. These projects hold a certain ideological weight connected to even broader aspirations for progress in these countries and their economies.

In addition, the DSO illustrates the work of civil society, one of the three primary stakeholders in ICT4D practice. I emphasize here that DSO in Nigeria was instigated by the ITU in 2006 at the Regional Radiocommunication Conference in Geneva, Switzerland where 119 countries, including Nigeria, agreed to undergo the switch from analogue broadcasting to digital broadcasting by June 2015. In this dynamic, the ITU wielded much influence over the earlier stages of DSO in Nigeria, as Nigeria attempted to work according to their timeline and followed their steps and standards for switching to digital broadcasting. Nigeria, in missing numerous

[119] Kola Oyelere-Kano, "FG Launches Digital Switch Over."
[120] Seye Olumide and Sunday Aikulola, "DSO Will Create One Million Jobs in Three Years, Says Mohammed," The Guardian Nigeria, April 13, 2021.

imposed deadlines, even incurred a sort of penalty where the ITU stipulated that after the June 2015 deadline, analogue transmissions in countries that had yet to turn them off would not be protected at the international level, meaning that countries like Nigeria would have to protect them themselves.[121] In this dynamic, we see a civil society organization that has great reach to organize countries/governments, supported by its mandate to ensure the interconnection of the international system of ICTs, but a question that prevails is if these forums and agreements are context-specific enough to aid along digital transformation in developing countries or do they inadvertently put countries like Nigeria at a disadvantage? Do they provide an accountability structure or are can they become a micro-managerial presence not attuned to the realities of specific locations?

2Africa

Switching focus to the 2Africa cable, its response to the question of stakeholders and their roles stands out. As it has been explained, the 2Africa cable is a product of a partnership between eight private firms that are based in various locations in the world. China Mobile International is a Chinese state-owned telecommunications company. MTN GlobalConnect is a South African mobile telecommunications firm that is the largest mobile network operator in Africa and is very commercially active in Nigeria. Orange is a French multinational telecommunications corporation and Telecom Egypt is the primary telephone company in Egypt. Vodafone is similarly a British multinational telecommunications company. The WIOCC, or the West Indian Ocean Cable Company, is telecommunications wholesaler owned by 14 African telecom operators. And finally, Meta is a multinational technology conglomerate based in the

[121] "ITU-R FAQ on the Digital Dividend and the Digital Switchover," International Telecommunication Union, 7.

United States. This wide range of firms underscores how the 2Africa project is a project at the global scale, organized and executed by private entities that operate at the global scale. As mentioned above, this contributes to what I see as the very streamlined, tidy nature of the project. This tidiness is most interestingly demonstrated by how information on the project accessible in news stories or other forms of announcements was homogenous across sources. Most descriptions or updates found in my research had similar wording to each other and to that of the 2Africa website. There was also a lack of extensive commentary or critique on the project. How this reflects on the research or practice of ICT4D serves as a curious question for further thought.

In his discussion on the private sector and the growing power and influence of private multinational technology companies such as Google, Meta, and Huawei, Unwin suggests this growing trend in the practice of ICT4D: developing countries get tacked onto the large and ambitious plans of multinational corporations. I posit that this is not necessarily a problem but a dynamic to observe and to be wary of. Countries like Nigeria might in fact benefit greatly from being a part of these plans – the 2Africa cable is meant to improve internet services and access for ISPs, business, and consumers in Nigeria – but it is possible that a company like Meta is embodying Unwin's D4ICT argument that says that central actors in ICT4D are using the idea of development to really just further their ICT interests. The main factor that suggests as much for me is Meta's emphasis on their investments in Africa. Along with Meta's highlighting of their successes in Africa, such as in the "Meta Africa 2021 Year In Review," that appears all very altruistic, there remains the understanding that Meta is a profit-driven entity and that their investments are exactly that: investments waiting for a return. Their growth depends on more users and as they help get more people connected to the internet, their opportunity for more users

becomes greater.[122] Although I find that Unwin's idea of D4ICT is difficult to situationally discern and thus illustrate, Meta and the 2Africa cable could be seen as emblematic of what he describes.

The final notes on the two initiatives in Nigeria relate to the fundamental question of what kind of development they are proposing and the kind of relationship they have with the poor and the marginalized in their respective contexts. With both the DSO and the 2Africa cable, there is greater alignment with the idea of development of economic growth as opposed to development as inequality reduction. Promotion of the DSO does highlight the form of inequality that is the digital divide, particularly as it relates to "underserved populations and remote communities"[123] but there is also the emphasis on the number of jobs that would come from Lagos (seen in the tweets from the Government of Nigeria account). The rural-urban divide in Nigeria, or how internet access and use is concentrated in urban areas and decidedly lacking in rural, remote areas, is a major hurdle to expanding internet access in Nigeria.[124] Knowing this, the 2Africa project in relation to Nigeria exhibits a certain imprecision, if it was concerned with really reaching the poor and marginalized in the country (which, to be fair, it does not necessarily highlight). Although it makes sense for the landing site to be in Lagos as it is a major port city, it does not ensure that those remote areas of Nigeria will overwhelmingly benefit from the cable.

Pakistan

[122] Leo Sun, "Facebook Will Bring Expanded Internet Access to Africa in $1 Billion Project," The Motley Fool, May 22, 2020.
[123] Oyelere-Kano, "FG Launches Digital Switch Over."
[124] "Nigeria's First Digital Economy Diagnostic Reveals a Vibrant Entrepreneurial Ecosystem but Rural Areas Are Still without Internet Access," World Bank, accessed December 26, 2021.

The initiatives explored in Pakistan, Wireless for Communities (W4C) and China-Pakistan Economic Corridor, have differences that are similar to the differences shared between Nigeria's two initiatives. The W4C program is a project that exists on a much smaller scale than the CPEC. Whereas the W4C program was implemented by a nonprofit organization, the CPEC, as part of the China's Belt and Road Initiative, is a major undertaking by the two governments that also implicates some private companies in both China and Pakistan. Between the two, the W4C exhibits more clear success in its goals than the CPEC and its goals so far. With Pakistan's initiatives in this research, the larger, more demanding project is the more complicated one, though that could be expected as the CPEC raises questions not only about project management and implementation across two countries, but also about overall geopolitical and economic dynamics between China and its competitors. The W4C has decidedly smaller implications on the world stage.

Wireless for Communities (W4C)

The Wireless for Communities program is the initiative out of all the initiatives covered here that I find most demonstrably interested and engaged in the poor and marginalized in its context, though, as with the Nigerian initiatives, that label of 'poor and marginalized' is intentionally oversimplified to mean those in rural, remote areas. Nevertheless, the Internet Society's (ISOC) approach emerges to me as the most grounded approach to solving digital divisions as they exist in its context, in its case rural Pakistan. The project's description highlights that the solution it provides is low-cost and interested in getting the economic benefits of connectivity "to the bottom of the pyramid."[125] Additionally, the initiative features several concepts that are direct questions and answers to how internet access and use can be better

[125] "Wireless For Communities," Internet Society, accessed November 8, 2021.

developed for rural communities: line-of-sight internet connectivity, last-mile connectivity, community networks, community trainings (in reference to there being deficits in digital literacy and skill). It is evident that, in terms of ICT4D research and practice, this is an initiative that is more deeply invested in the point of view that development means inequality reduction than development as principally a matter of economic growth, especially macroeconomic growth.

The W4C initiative is also the only initiative out of the ones explored here that, through research, one could easily access and obtain an understanding of its effects through the words of those affected. Though the accounts on how the W4C helped the Chak-5 Faiz area were provided by the ISOC, the basic improvements of internet connectivity, access, and use in such specific settings such as higher education, communication abroad, and online classes are good indicators of the overall success of the program in that community. I find that this success reflects Billon et al.'s (2010) finding that regional initiatives work better than country-wide strategic plans in extending internet access.[126] Though the authors are specifically coming to that conclusion for what they call "middle-digitalization countries,"[127] it is potentially a useful takeaway for all countries, developed and developing, that are trying to find solutions to rural-urban divides in internet access and digital services. Still, what is troubling about the W4C program is that, though it was seemingly successful in the Chak-5 Faiz community, its future implementation in other communities in Pakistan is unclear. The ISOC does not have much information for the W4C past 2018 and it is not clear why the initiative might have stalled after the pilot program.

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[126] Margarita Billon, Fernando Lera-Lopez, and Rocío Marco, "Differences in Digitalization Levels: A Multivariate Analysis Studying the Global Digital Divide," Review of World Economics 146, no. 1 (2010): 66.

[127] Billons et al. base the distinction between high-, medium-, and low-digitalization countries on their own regressions that they conducted to form a digitalization index. Both Pakistan and Nigeria classify as low-digitalization countries in their research.

This leads to questions about ICT4D such as what are the mechanisms that facilitate the continuation of smaller projects, especially those prove that to be successful?

China-Pakistan Economic Corridor

In the purview of this research, the CPEC is the project with the most international economic and political weight. Admittedly, its inclusion was not a certainty at the beginning of this paper as it is an initiative that is more concerned with the traditional infrastructure of roads and pipelines than with ICT infrastructure and digital development, although that has become a large part of the CPEC and BRI as time has progressed. With its inclusion, it is compelling to put this massive infrastructural project into conversation with the field of ICT4D. For instance, with the question of stakeholders, particularly if the poor and marginalized are really placed as main stakeholders in the calculus of this particular initiative, the CPEC has stakeholders in the two governments of China and Pakistan as well as other private companies such as the Chinese company Huawei that is playing a large role in the Digital Silk Road; in my research, I did not find any major focus by the CPEC on the poor and marginalized or even a real focus on rural communities and remote areas in Pakistan that have a need for better internet connectivity. Rather the project is expressly interested in the political-economic partnership between the two countries and, primarily, how China can benefit from being connected to Pakistan's Gwadar port. For Pakistan in particular, the benefits are purely a matter of macroeconomic growth that could come from infrastructure additions such as the Cross-Border Fiber Optic Cable. In this way, the initiative also definitely corresponds most with the development as economic growth conception.

The CPEC with Pakistan is like the 2Africa project with Nigeria where Pakistan is a part of a much larger project (BRI) that has also progressed relatively quickly as it is headed by a well-resourced actor in China. In contrast to the 2Africa project, the CPEC has had notable

setbacks and is entangled, as mentioned already, in political-economy discourses about "debt-trap diplomacy"[128] and geopolitical strategy. Whether these debated concerns are warranted, I posit that the particular concern over the cost of CPEC for Pakistan and how Pakistan's own economic conditions have affected the progress of the CPEC at the least do well to illustrate Leye's point that the benefits of ICT4D practices can often only be realized if overall political economy issues have been addressed in the relevant contexts.[129] Interestingly, the CPEC Long Term Plan devised by the two governments accounted for this reality in its Possible Challenges section. The LTP acknowledged from early in the CPEC that Pakistan would need to "address major bottlenecks" related to energy, infrastructure, and other areas to benefit from the CPEC.[130] The beginning ICT4D question that one is left with is whether country-to-country partnerships are an effective way to organize ICT4D initiatives? Further: Is this model accessible for other developing countries that may not have a wealthy neighbor or ally such as China? Or, considering Pakistan's complicated relationship with the CPEC, is this model even ideal for developing countries where there might be imbalances between countries in these partnerships?

Conclusion

As stated in the introduction, the goal of this project is to engage critically with the notion and practice of ICT4D through the examination of a selection of ICT infrastructure and digital development projects in two developing countries: Nigeria and Pakistan. Through the case studies and the subsequent discussion and analysis, what I hope is obtained is a brief but incisive

[128] "Debt-trap diplomacy" is a concept in international political economy, international financing, and foreign policy that refers to how powerful lending countries or institutions extend debt to a borrowing nation as a means for the lending countries geopolitical ends. Whether China is enacting "debt-trap diplomacy" with its BRI project is highly disputed.
[129] Leye, "A Critical Perspective," 34.
[130] "Long Term Plan for China-Pakistan Economic Corridor (2017-2030)," 7.

exploration of the research and practice of ICT4D and how it has touched Nigeria and Pakistan. Although in the prior section, some judgements and conclusions were made, what is most important are the questions that came into view for me and will have come into view for readers of this research. This thesis invites and suggests further research assessing ICT4D initiatives in developing countries – examining their successes, limits, and ideological bases.

Lastly, this thesis also agrees with Unwin as it calls for an ever-increasing focus on the poor and marginalized in the planning, implementation, and assessment of ICT4D initiatives in all countries whether they are developed, developing, or all that exists in between. The process of digitizing economies and societies are by no means going to slow down soon, and thus the research and practice of ICT4D should continuously emphasize its role in bringing in the marginalized and ensuring that their position as primary stakeholders are well realized and accounted for.

Appendix

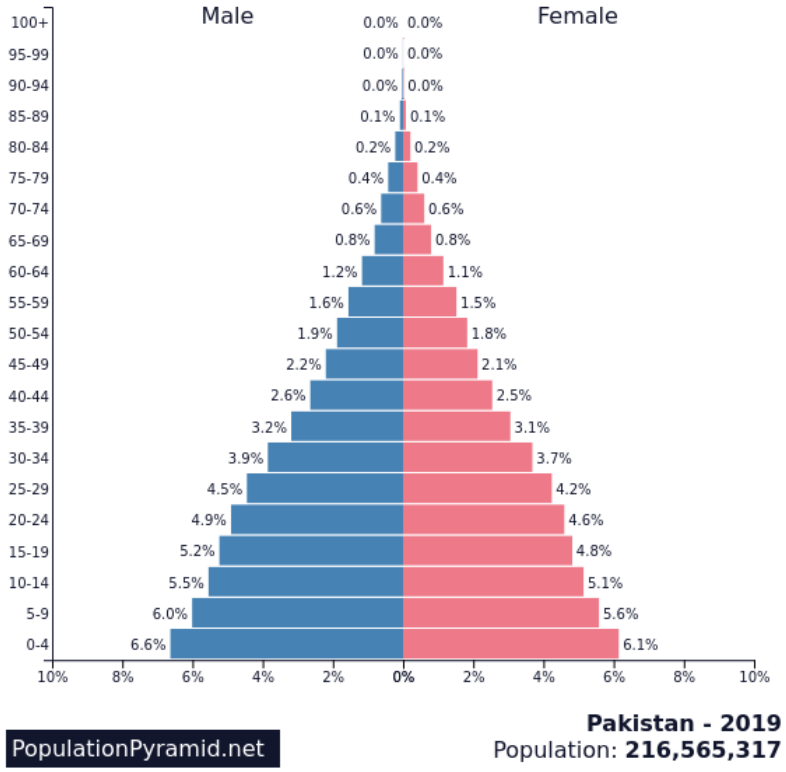
Figure 1. Map of Nigeria.

https://www.nationsonline.org/oneworld/map/nigeria-political-map.htm

Figure 2. Map of Pakistan.

https://www.nationsonline.org/oneworld/map/pakistan_map.htm

Figure 3. Population pyramid of Pakistan from 2019.



https://www.populationpyramid.net/pakistan/2019/

Figure 4. Table of subsea cable landing in Nigeria.

Table 3. Subsea Cables Landing in Nigeria

CABLE	DESIGN CAPACITY (TBPS)	LOCAL LANDING STATION(S)	READY FOR SERVICE YEAR
Africa Coast to Europe (ACE)	12.8	Lagos	2013
Globacom-1 (Glo-1)	12.8	Lagos	2010
MainOne Cable	28.8	Lagos	2010
Nigeria-Cameroon Cable System (NCSCS)	15.36	Lagos	2015
South Atlantic 3	54	Lagos	2002
West Africa Cable System (WACS)	55	Lagos	2012
2Africa (announced)	180	Lagos	2023
Equiano (announced)	100	Lagos	2021
Globacom-2 (Glo-2) (announced)	225	Lagos, Bonny, and Kwa Ibo	2021

Source: Telegeography's Submarine Cable Map and STF Analytics' Submarine Cable Almanac.

https://www.rti.org/publication/economic-impacts-submarine-fiber-optic-cables-and-broadband-connectivity-nigeria/fulltext.pdf

Figure 5. The difference between analog broadcasting and digital broadcasting.

https://von.gov.ng/2021/04/02/nigeria-to-earn-1bn-from-digital-switch-over/

Figure 6. Part of Government of Nigeria's Twitter thread on Digital Switch Over.

https://twitter.com/NigeriaGov/status/1387780148590747654

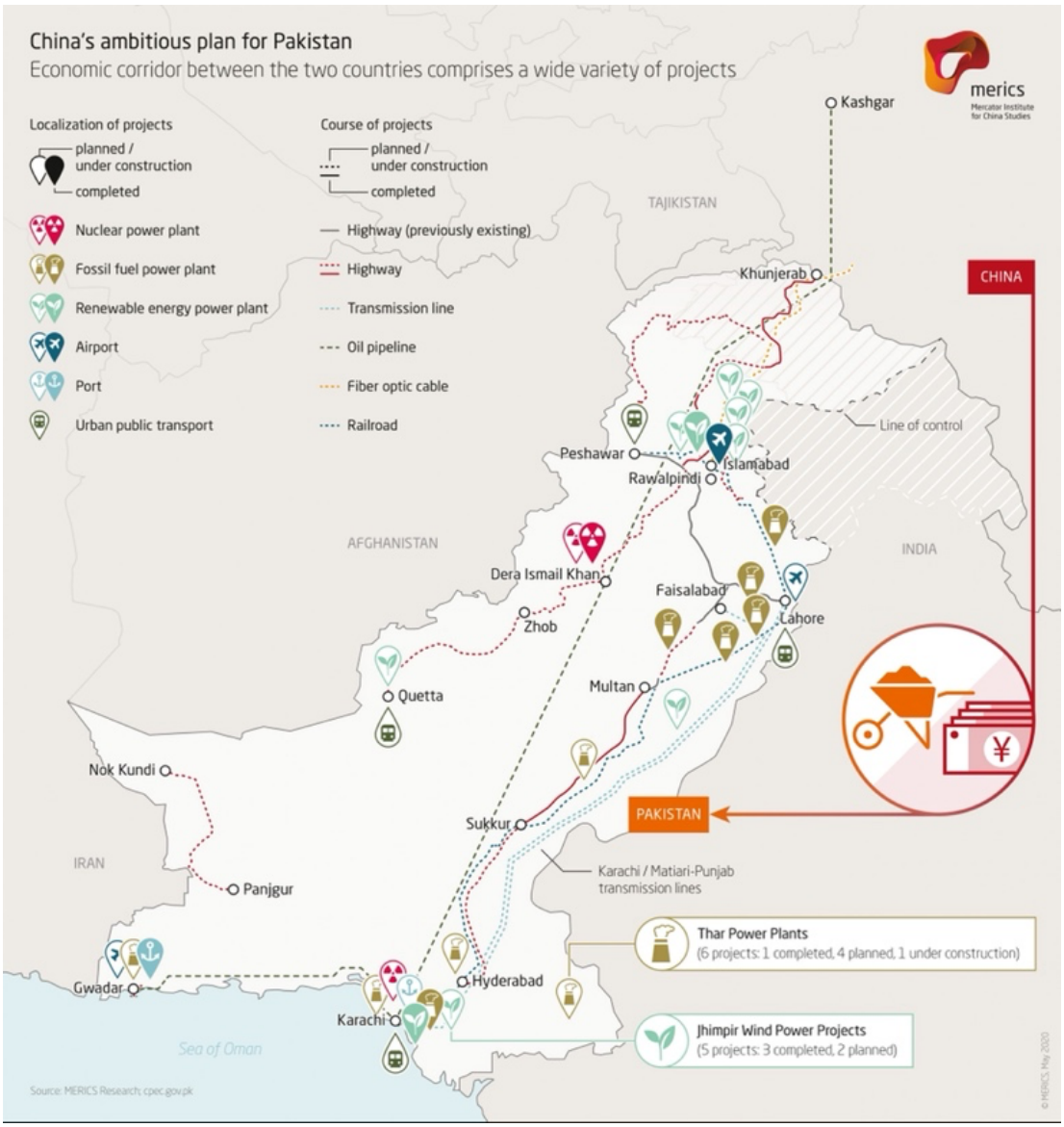
Figure 7. Map of 2Africa Cable.

https://engineering.fb.com/2020/05/13/connectivity/2africa/

Figure 8. Top of the tri-pole tower set up in Chak-5 Faiz for the Wireless for Communities program.

https://youtu.be/vcjAWKu6Kfs.

Figure 9. Map of the different CPEC projects in Pakistan.



https://merics.org/en/analysis/bri-pakistan-chinas-flagship-economic-corridor

Figure 10. China's two fiber optic cables as part of the Digital Silk Road (DSR).

https://asia.nikkei.com/Spotlight/Belt-and-Road/China-builds-Digital-Silk-Road-in-Pakistan-to-Africa-and-Europe.

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