INTENTIONAL INTERNET DISRUPTIONS IN AFRICA

Estimating Impact in Observable and Shadow Economies

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EXECUTIVE SUMMARY

On 5 October 2016, the Ethiopian railway corporation launched a 750 KM rail-line connecting the landlocked country from its capital, Addis Ababa, to Djibouti, its strategic economic link to global commerce.[1] A few hours later, the communication ministry completely shut down all Internet connectivity across the country, with the stated aim of quelling protests in parts of the country.[2]

The effects of these intentional Internet disruptions have ranged from increased citizenry backlash, economic losses, and eroded international reputation. Several studies have estimated economic costs of these shutdowns, with one study showing India losing as high as $1 billion dollars annually.[3] What is interesting though, as seen from the Ethiopian vignette above, is how this contradicts the very economic plans of such countries. On the one side, countries are investing heavily on communication and transport infrastructure for economic connectivity yet easily reversing the marginal gains made by their intentional Internet disconnections.

Accordingly, this study seeks to expound on the nature of internet disruptions in the African region, and the effects it has on the economy and society. Our interest in this study though will be the shadow economy, which has often been overlooked.

Why do we need to measure the impact on observable and shadow African economies?

Increase in internet penetration in a country has been demonstrated to raise its economic productivity. A quantification of this increase has been attempted, majorly on the economic front, by mirroring the contribution of the Internet to national economies. The simple equation being, if the Internet contributes x to the economy, denial of Internet access leads to losses amounting to x. These have been proved by studies by Organization for Economic Cooperation and Development (OECD), Brookings Institute, Deloitte among others. However, these studies omit the shadow economy.

According to Friedrich Schneider, a 2013 estimate on the of the proportion of 'unrecorded economy' in 49 countries in Africa reveals and average of 37.65% of economic activity goes unreported by government statistical offices [Friedrich Schneider, The Shadow Economy and Work in the Shadow (Bonn: IZA, 2012)]. We therefore believe that in evaluating economic costs of Internet disruptions we ought to also put this 'shadow economy ' into consideration. These being economic activities and the income derived that circumvents or otherwise avoids government regulation, taxation or observation.

The Internet has important effects on the shadow economy. There is an inverse relationship between Internet usage and the shadow economy in low GDP per capita economies (like Sub-Sahara Africa) but as the GDP per capita rises, the inverse relationship weakens, even breaking off to a direct relationship in higher GDP per capita economies.[4] Seeing productivity

1 Agence France-Presse, "Next stop the Red Sea: Ethiopia opens Chinese-built railway to Djibouti," The Guardian, October 05, 2016, accessed October 30, 2017, https://www.theguardian.com/world/2016/oct/06/next-stop-the-red-sea-ethiopia-opens-chinese-built-railway-to-djibouti.

2 Abdi Dahir, "Internet Shutdown Could Cost Ethiopia's Booming Economy Millions of Dollars", Quartz, last modified 2017, accessed October 15, 2017, https://qz.com/812689/oromo-protests-ethiopias-internet-shutdown-could-drain-millions-of-dollars-from-the-economy/.

3 Darrell West, Internet Shutdowns Cost Countries $2.4 Billion Last Year (Washington, DC: Brookings Institute, 2016), accessed October 17, 2017, https://www.brookings.edu/wp-content/uploads/2016/10/intenet-shutdowns-v-3.pdf.

4 Ceyhun Elgin, "Internet Usage and the Shadow Economy: Evidence from Panel Data" Economic Systems 37, no. 1 (2013): 111-121, accessed March 10, 2017, https://papers.ssrn.comso13/papers.cfm?abstract_id=2569631

and taxation are key determinants of the shadow economy, empirical data shows a strong relationship of internet usage on the shadow economy through productivity in countries with lower GDP per capita (like Sub-Sahara Africa) while the effect through taxes is stronger in richer countries. Stated otherwise, Sub Sahara Africa's shadow economy grows faster as its population uses the Internet.

Recommendations

Nature of Shutdowns: Attribution: Intentional or accidental, Internet disruptions involve tampering with access completely as to cause a total blackout or lowering the quality of the connectivity to make it hard or impossible to transmit data across such a platform. Due to their shared features, either one of them can be confused for the other. Attribution should be done carefully, in light of the implications of either options. According to the Internal Cable Protection Committee, an organization that documents causes of Internet cable disruptions, shipping vessels pose the highest risk to submarine disruptions, not governments.

Economic: A recognition of Shadow Economy in socio-economic reality is not just rational but necessary, considering how significant this in the overall estimates.

Social: Human stories on the everyday impacts of Internet disruptions are particularly powerful. Collecting and amplifying such stories, as AccessNow have done recently, is an effort that deserves more attention.

Research:

- Commercial companies can help immensely in understanding the 'state of the networks'. They are in all geographies, networks and services. Concerns around privacy, authoritarian government backlash, and competitive edge against other companies may limit their disclosure of available data. However, anonymizing the raw data and using it to give general trends across regions by leading commercial Internet companies would go a long way to solve the issue of data on Internet disruptions. Google Traffic Transparency reports currently visualize the longitudinal network of their products but would do more to disaggregate to administrative regions.
- Partnership with Internet technical organizations to build a database of historical incidences of Intentional disruptions. Open source dataset.
- Browser traffic: Mozilla, Chrome, Safari, Opera/Mini. e.g. Firefox health report collects usage statistics also called telemetry.
- Internet user testing. Mobile apps, orchestrations, distribution of probes to partner organizations.
- Have an alert system, triggered by sharp drop in traffic, to interested organizations and individuals in form an email or bot channel.
- Flexible visualizations of data to especially assist journalists and reporters during time sensitive scenarios.

Policy

- Ensure the functional independence of Communication Regulators.
- ISP licenses should have clauses cushioning licensees from affecting blanket censorship without court orders. s

Advocacy: Bring in real life impacts of to the economy and social life community. The unobserved economy may make the case. Local business communities and power influence nodes.

INTRODUCTION

On 5 October 2016, the Ethiopian railway corporation launched a 750 KM rail-line connecting the landlocked country from its capital, Addis Ababa, to Djibouti, its strategic economic link to global commerce. [1] A few hours later, the communication ministry completely shut down all Internet connectivity across the country, with the stated aim of quelling protests in parts of the country.[2]

Spending millions of dollars to connect a country to the world through a railway, while intentionally shutting down the country's Internet connectivity on the same day is a quite a paradox. To consider a whole city, or even a country, intentionally disconnected off the Internet for days by their government, may sound quite abstract, but more than fifty incidences like these were recorded globally in 2016, of which for every two of these, one was happening in Africa.[3]

Internet disruptions happen almost every day mainly due to cable cuts in marine or terrestrial surfaces.[4] The immediate effect of 'no Internet connection' screen for most Internet users can be assumed to be a slight technical hitch, easy and quick to resolve independently. However, the scenario escalates when this is an intentional, prolonged disconnection affecting indiscriminately affecting all or majority of Internet users in a given location.

The effects of these intentional Internet disruptions have ranged from increased citizenry backlash, economic losses, and eroded international reputation. Several studies have estimated economic costs of these shutdowns, with one study showing India losing as high as $1 billion dollars annually.[5] What is interesting though, as seen from the Ethiopian vignette above, is how this contradicts the very economic plans of such countries. On the one side, countries are investing heavily on communication and transport infrastructure for economic connectivity yet easily reversing the marginal gains made by their intentional Internet disconnections.

This study seeks to understand the nature of internet disruptions in Africa, and how we can quantify the effects of such incidences from a socio-economic angle.

To respond to these questions, the report focuses on African countries due to the high frequency of intentional disruptions experienced and the unique Internet ecosystem across the fifty four countries. The first section conducts an audit of how Internet disruptions have been defined, detected, attributed, costed and responded to, section two looks into how to quantify effects of Internet disruptions in Africa, section three presents the findings of these quantifications, section four discusses some cases from the findings and section five presents research and policy recommendations.

1 Agence France-Presse, "Next stop the Red Sea: Ethiopia opens Chinese-built railway to Djibouti," The Guardian, October 05, 2016, , accessed October 30, 2017, https://www.theguardian.com/world/2016/oct/06/next-stop-the-red-sea-ethiopia-opens-chinese-built-railway-to-djibouti.

2 Abdi Dahir, "Internet Shutdown Could Cost Ethiopia'S Booming Economy Millions Of Dollars", Quartz, last modified 2017, accessed October 15, 2017, https://qz.com/812689/oromo-protests-ethiopias-internet-shutdown-could-drain-millions-of-dollars-from-the-economy/.

3 Tonderayi Mukeredzi, "Uproar Over Internet Shutdowns | Africa Renewal Online", Un.Org, last modified 2017, accessed October 30, 2017, http://www.un.org/africarenewal/magazine/august-november-2017/uproar-over-internet-shutdowns.

4 Maurice Kordahi et al., "Worldwide Trends In Submarine Cable Systems", in Suboptic (Monaco: Submarine Cable Improvement Group, 2016), accessed October 20, 2017, http://suboptic.org/suboptic-2016/.

5 Darrell West, Internet Shutdowns Cost Countries $2.4 Billion Last Year (Washington, DC: Brookings Institute, 2016), accessed October 17, 2017, https://www.brookings.edu/wp-content/uploads/2016/10/intenet-shutdowns-v-3.pdf.

INTERNET DISRUPTIONS: A LOOK AT EXISTING LITERATURE

Background

The exercise of power by controlling what kind of information populations can access or share is an old practice that has shaped the evolution of states and the societies they are set in. Internet predecessors - print works, radio, television - have all been targets of government in one form of control or the other. Governments will likely limit access when these media channels are distributing information likely to erode their authority, while expanding access when this information is likely to solidify it. The Internet has changed the landscape of information control, from limited control points, for example known book publishers, to distributed ones, for example decentralized web host servers. Even as states and corporations continue to centralize the Internet landscape, there is inherently a semblance of contest between states and their citizens on control of access to information.

The OpenNet Initiative (ONI), a decade-long research program (2003 - 2013), investigated and documented ways governments took active measures to control Internet access.[6] During this period of study, Internet filtering was for the most part targeted towards specific content for longer periods of time. In a break from this norm however, an interesting phenomenon on just-in-time blocking gradually became visible, where "access to content and information communication technologies are blocked in response to sensitive political situations when the technology and content may have the greatest potential impact."[7] Kyrgyzstan was among the first places to block websites in this format during the March 2005 election period.[8] This trend spread across countries and events like in Belarus' March 2006 elections where websites belonging to political parties and independent media were targeted,[9] and other elections in Tajikistan, Bahrain, Uganda, Cambodia and Yemen.[10] Protests, like the Saffron ones of Burma in 2007/08,11 and Xinjiang province protests in China.[12] These incidences were geographically partial and temporal denials to the Internet, targeting particular content deemed too sensitive as to impact election outcomes or stability in those countries.

In Cyberspace Under Siege (2015), a summary of generations of information controls on the Internet is presented, drawn from the ONI research in this area.[13] Internet disruptions can be considered as a combination of several of these generations. For example, the second and fourth generations may be combined to explain legal or regulatory measures taken by governments to censor or block social media during elections under national security justifications.

6 See OpenNet Initiative, https://opennet.net/about-oni, Accessed 12 June, 2017

7 Ronald Deibert and Rafael Rohozinski, "Good For Liberty, Bad For Security? Global Civil Society And The Securitization Of The Internet", in Access Denied: The Practice And Policy Of Global Internet Filtering, Ronald Deibert, Jonathan Palfrey and J Zittrained. (eds) (Cambridge, MA: MIT Press, 2008), 123-50, accessed May 5, 2017, http://access.opennet.net/?page_id=61.

8 "Special Report: Kyrgyzstan", Opennet.Net, last modified 2005, accessed March 5, 2017, https://opennet.net/special/kg/.

9 "Belarus", Freedomhouse.Org, last modified 2006, accessed April 8, 2017, https://freedomhouse.org/report/freedom-world/2006/belarus.

10 Ronald Deibert and Rafael Rohozinski, "Good For Liberty, Bad For Security? Global Civil Society And The Securitization Of The Internet", 143

11 "Shots Fired On Myanmar Protest", Aljazeera.Com, last modified 2007, accessed April 5, 2017, http://www.aljazeera.com/news/asia-pacific/2007/09/2008525143133771420.html.

12 Ben Blanchard, "China Tightens Web Screws After Xinjiang Riot", Reuters, last modified 2009, accessed April 5, 2017, https://www.reuters.com/article/us-china-xinjiang-internet/china-tightens-web-screws-after-xinjiang-riot-idUSTRE5651K420090706.

13 Ron Deibert, "Cyberspace Under Siege", Journal of Democracy 26, no. 3 (2015): 64-78, accessed July 4, 2017, https://muse.jhu.edu/article/586479.

Information Controls Generation	Characteristics	Example
First	Demarcation of cyberspace along national borders to prevent citizens accessing foreign information	China Great Firewall
Second	Extension from technical controls to legal and policy instruments	Censorship and speech regulation laws
Third	Targeted espionage online as a form of surveillance	Remote tracking malware eg BlueCoat
Fourth	Control of international level norm making platforms	'Multistakeholder' platforms contests eg ICANN and IGF

Table 1: Categorization of information controls online. Source: "Cyberspace Under Siege" (Deibert 2015)

The just-in-time blocking captured global attention early 2011, when Egypt ordered a complete blackout in the country, as a response to the escalating protests, in what would be known as the Arab Spring and the eventual ouster of long time ruler, Hosni Mubarak.[14] Bahrain and Libya experienced complete blackouts as the Arab Spring wave swept across the region.[15],[16] Syria, facing an unrelenting wave of mass protests and armed resistance, disconnected almost the entire country, a possibility enabled by the centralized Internet infrastructure through which most of Syrian traffic passed.[17]

As ONI's work noted, sub-Saharan Africa had the least Internet controls between 2003-2013 relative to other parts of the world, in part because there was limited Internet access to begin with. The hypothesis then was that with increased Internet access, incidences of Internet filtering would increase. In 2016, for example, the African region reported 23 just-in-time Internet disruptions, some of them being complete Internet disruption but majority targeting social media websites and platforms during protests or fears of protests around major political moments like elections.18 As the obstacles of infrastructure and economics are gradually overcome in these countries, and civil networks tapped into it, States realized the need to control the Internet.

14 Charles Arthur, "Egypt Cuts Off Internet Access", The Guardian, last modified 2011, accessed April 5, 2017, https://www.theguardian.com/technology/2011/jan/28/egypt-cuts-off-internet-access.

15 Dan Goodin, "Internet Use Disrupted In Bahrain As Protests Turn Bloody", Theregister.Co.Uk, last modified 2011, accessed April 5, 2017, https://www.theregister.co.uk/2011/02/18/bahrain_internet_disruption/.

16 Jim Cowie, "Libyan Disconnect | Dyn Blog", Dyn.Com, last modified 2011, accessed April 5, 2017, https://dyn.com/blog/libyan-disconnect-1/.

17 Jim Cowie, "Syrian Internet Shutdown | Dyn Blog", Dyn.Com, last modified 2011, accessed April 5, 2017, https://dyn.com/blog/syrian-internet-shutdown/.

18 See our Findings section.

Definition

How a disruption is defined shapes its attribution and subsequent policy, advocacy, and technical responses. Various definitions have been presented to address Internet disruptions.

The OpenNet Initiative, as highlighted above, defined the temporal censorship as the just-in-time blocking as experiences when "access to content and information communication technologies is blocked in response to sensitive political situations when the technology and content may have the greatest potential impact."[19]

AccessNow, an advocacy organization focused on defending digital rights for users at risk, defines an Internet disruption as "an intentional disruption of internet or electronic communications, rendering them inaccessible or effectively unusable, for a specific population or within a location, often to exert control over the flow of information."[20] AccessNow, the conveners of the global campaign #keepiton have also referred to these incidences as "blackouts" or "kill switches".[21]

Freedom House, which runs the annual Freedom on the Net (FOTN) index, restricts itself from using 'shutdown' as a general category of all Internet disruptions, preferring rather to consider them under the general category of censorship and treat incidences case-by-case.[22] In the FOTN methodology section and subsequent Internet Controls summary, focus is on restrictions on ICT connectivity and access.

Afrinic, the regional registry for Internet number resources serving the African Internet Community, defines an Internet shutdown incidence as when it can be proved that there was an attempt, failed or successful, to illegally restrict access to the internet to a segment of the population irrespective of the provider or access medium that they utilize.[23]

The definitions above highlight key aspects of disruptions to Internet access: intentionality (accidental or willed), legality (judicially warranted or not), geography (national or regional), population affected (all or sections of individuals and/or businesses), duration (short or extended), services and networks affected (complete or partial).

This study adopts a working definition of Internet connection disruptions as willful disconnection of access to the Internet or reduction in quality of connectivity by an actor (e.g. a government or terrorist) targeting a specific population within a geographic area for a set duration of time with the intention of limiting Internet communication to or from the area affected.

19 Ronald Deibert and Rafael Rohozinski, "Good For Liberty, Bad For Security? Global Civil Society And The Securitization Of The Internet", in Access Denied: The Practice And Policy Of Global Internet Filtering, Ronald Deibert, Jonathan Palfrey and J Zittrained. (eds) (Cambridge, MA: MIT Press, 2008), 123-50, accessed May 5, 2017, http://access.opennet.net/?page_id=61.

20 "#Keepiton - Access Now", Access Now, last modified 2017, accessed October 19, 2017, https://www.accessnow.org/keepiton/.

21 "#Keepiton - Access Now", Access Now, last modified 2017, accessed July 16, 2017, https://www.accessnow.org/keepiton/#resources.

22 See for example the methodology section https://freedomhouse.org/report/freedom-net-methodology and Questions A3 & B1 and https://freedomhouse.org/report/key-internet-controls-table-2016 third column 'social media or communications apps blocked'.

23 Andrew Alston, Ben Roberts and Fiona Asonga, "Anti-Shutdown-01", Afrinic.Net, last modified 2017, accessed June 12, 2017, https://www.afrinic.net/en/library/policies/2061-anti-shutdown-01.

Detection

However dramatic an Internet disruption incidence may appear to be, the cases that attract public attention are still a subset of all disruptions that happen. Detecting Internet disruptions is a layered exercise, related to the extent of affected population or services.

Internet users in affected region or services are the 'first-line-of-detection' during disruptions. Due to their popularity, disconnecting Internet messaging services like WhatsApp and Viber and social networking platforms like Facebook and Twitter draws quick attention. At this stage, it is usually not clear what the nature of disruption is and using available communication channels, users report these incidences.

Media organizations pick these user reports and broadcast them to wider audiences while probing further with government authorities and Internet service providers on possible causes, orders and justification. This is an important phase in Internet disruption research since governments get to confirm or deny the incidences. Most governments have remained silent about the outages and it is at this point that having technical data to verify government positions comes in handy.

Several projects have created dashboards and applications to visualize the 'state of disruptions' using data collected from various sources. The Internet Outage Detection and Analysis (IODA) by The Center for Applied Internet Data Analysis (CAIDA), is a prototype hoping to monitor the Internet, in near-real-time, with the goal of identifying macroscopic Internet outages significantly impacting a network or a large fraction of a country.[24] Despite the above efforts, there still lacks validated, publicly available, scalable models to detect and alert, in real-time, connectivity disruptions across geography layers and networks.

Attribution

Social context and technical confirmations raise questions of intentionality and chain of causality. Government Communication Regulators and Internet service providers are important actors in the attribution phase of Internet disruption. Internet service providers are contractually expected to explain to their customers why they cannot deliver services while simultaneously expected to implement the requests of their licensing office as a legal duty.[25]

Intentional disruptions have occasionally been officially communicated to the ISPs or general public and in some cases explained retrospectively by relevant government bodies.[26] In what looks like a typical disruption scenario, national security and public order concerns are used as justifications. National Security Committees, of which Ministers heading ICT departments are members, issue requests to communication sector regulators to order Internet disruptions.[27] These orders are communicated to ISPs for technical implementations within set timelines.[28] That may explain why most intentional disruptions are effected after midnight,

24 The Center for Applied Internet Data Analysis (CAIDA) is an inter-organizational collaboration aimed at promoting greater cooperation in the engineering and maintenance of a robust, scalable global Internet infrastructure. https://www.caida.org/projects/ioda/

25 Internet Service Providers are licensed by the governments of countries they operate in. As such, they are bound by the laws of those countries, most of which place legal responsibilities to respond to regulator requests within legal bounds.

26 Nikhil Pahwa, "Government Of India Issues Rules For Internet Shutdowns - Medianama", Medianama, last modified 2017, accessed October 29, 2017, https://www.medianama.com/2017/08/223-internet-shutdowns-india/.

27 Sheila Naturinda, "UCC Orders 24-Hour Shutdown Of Facebook", Daily Monitor, last modified 2017, accessed October 30, 2017, http://www.monitor.co.ug/News/National/688334-1147082-ansfnqz/index.html.

28 "Ethiopia Blocks Internet During Exams", BBC News, last modified 2017, accessed October 30, 2017, http://www.bbc.com/news/technology-40118378.

after office hours or Friday evenings because they are centrally coordinated.[29] In some cases unintentional disruptions are often communicated to customers by ISPs without necessarily involving government authorities, especially when the incidences do not affect traffic in a significant way. In April 2017, however, the Kenyan communication regulator ordered a report on the context of an Internet disruption by the country's leading provider, Safaricom, after the former's network went off for over six hours.[30] This was a converse of the causality chain during intentional Internet disruptions, and may serve as a best practise on accountability during disruptions on the side of governments.

Observable and Hidden Impact of Intentional Disruptions

Just as an increase in Internet penetration has been demonstrated to raise the economic productivity of a country, whether developing or developed or during periods of recession or growth phases, denial of access slows down economic productivity. A quantification of these costs has been attempted, majorly on the economic front, by mirroring the contribution of the Internet to national economies. The simple equation being, if the Internet contributes x to the economy, denial of Internet access leads to losses amounting to x.

The Organization for Economic Cooperation and Development (OECD) estimates that the Egyptian economy gained 3-4% of its GDP from the Internet in 2011.31 Internet disruptions at the height of the Arab Spring thus translated to around USD 18 million per day. This was one of the initial study to reverse the Internet-contribution logic to estimate costs of Internet disruption, possibly due to its dramatic effect and the media coverage the disruption received.

Using the same logic, Brookings Institute, in Internet Shutdowns cost countries $2.4 billion last year (2015), estimates the National Internet Shutdown Costs by factoring the contribution of digital economy to the National GDP across time and population affected.[32] To compute total economic impact of an Internet disruption, the study provides for a multiplier factor to the direct economic costs. This multiplier factor is derived from research on Internet and jobs, with some findings showing that one Internet related job supports 1.56 others.[33]

Further, Deloitte has developed an econometric model that separates various forms of Internet disruptions – complete, partial, platform and quality – while providing for the kind of economy affected. In The Economic Impact of Disruptions to Internet Connectivity, Deloitte applies estimates based on the impact of broadband usage and speed.[34] The study uses measures that reflect marginal changes in productivity that would be associated with changing the intensity of usage and quality of broadband rather than longer-term structural changes in the economy. The study relies on BCG e-Intensity Index,[35] which measures each country's

29 See for example Gabon, Internet Intelligence, "Internet Curfew In Gabon Lifted (23 Nightly Blackouts Later)", Twitter, last modified 2016, accessed October 30, 2017, https://twitter.com/dynresearch/status/781483184445882368.

30 Macharia Kamau, "Communication Authority Gives Safaricom A Week To Explain Network Glitch", The Standard, last modified 2017, accessed October 30, 2017, https://www.standardmedia.co.ke/business/article/2001237776/communication-authority-gives-safaricom-a-week-to-explain-network-glitch.

31 Taylor Reynolds and Arthur Mickoleit, "The Economic Impact Of Shutting Down Internet And Mobile Phone Services In Egypt", Oecd.Org, last modified 2011, accessed October 24, 2017, http://www.oecd.org/countries/egypt/theeconomicimpactofshuttingdowninternetandmobilephoneservicesinegypt.htm.

32 Darrell West, Internet Shutdowns Cost Countries $2.4 Billion Last Year (Washington, DC: Brookings Institute, 2016), accessed October 17, 2017, https://www.brookings.edu/wp-content/uploads/2016/10/intenet-shutdowns-v-3.pdf.

33 ibid p.6

34 Deloitte, The Economic Impact Of Disruptions To Internet Connectivity (London: Deloitte, 2016), accessed June 22, 2017, http://globalnetworkinitiative.org/sites/default/files/The-Economic-Impact-of-Disruptions-to-Internet-Connectivity-Deloitte.pdf.

35 Paul Zwillenberg, "The Internet Goes Local", Www.Bcgperspectives.Com, last modified 2011, accessed July 18, 2017, https://www.bcgperspectives.com/content/interviews/technology_software_the_internet_goes_local_zwillenberg/.

level of enablement (the amount of Internet Infrastructure that it has in place), expenditure (the amount of money spent on online retail and online advertising), and engagement (the degree to which businesses, governments, and consumers are involved with the Internet) to compute contribution of the Internet to the economy.

The studies referred to above and their sources use GDP as the exclusive representation of national economies. Due to the availability of GDP data in almost all countries, the studies above offer a reasonable tool to estimate costs of Internet shutdowns. The reliability of GDP estimates in understanding the state of the economy depends largely on the quality of macroeconomic data available. Most national statistics offices in Africa face significant challenges in recording economic activities within their jurisdictions.[36] A 2013 estimate on the proportion of 'unrecorded economy' in 49 countries in Africa revealed an average of 37.65% of economic activity goes unreported by government statistical offices.[37] In evaluating economic costs of Internet disruption we ought to put this 'shadow economy' into consideration, generally defined as economic activities and the income derived that circumvents or otherwise avoids government regulation, taxation or observation.[38] The Internet, by significantly lowering business entry barriers, powers a significant economy that is not adequately captured through the formal regulatory structures of licensing and taxation.

The rationale for concealing some of these activities may be to avoid paying tax and/or regulatory burdens like social security contributions and labor standards.[39] Since shadow economy may include illegal activities, for the purpose of this study, and drawing from Schneider's definition, illegal activities are excluded from the estimates.

The Internet has important effects on the shadow economy. There is an inverse relationship between Internet usage and the shadow economy in low GDP per capita economies (like Sub-Sahara Africa) but as the GDP per capita rises, the inverse relationship weakens, even breaking off to a direct relationship in higher GDP per capita economies.[40] Seeing productivity and taxation are key determinants of shadow economy, empirical data shows a strong relationship of internet usage on the shadow economy through productivity in countries with lower GDP per-capita (like Sub-Sahara Africa) while the effect through taxes is stronger in richer countries. Stated otherwise, Sub Sahara Africa's shadow economy grows faster as its population uses the Internet.

Considering the significance of the size of shadow economy in Sub Sahara Africa, and having recognized the direct positive effects the Internet has on it, a comprehensive assessment of the impact of Internet access, or disruption, benefits from its inclusion.

Response: Civil Society, the Market and Political Responses

There has been a spirited campaign by civil society organizations to push back against Internet disruptions. #KeepitOn, convened by AccessNow, is an umbrella body bringing hundreds of organizations and individuals to research, advocate and raise awareness on Internet disruptions and their effects in society.[41] The Global Network Initiative (GNI), a multi-stakeholder organization bringing together corporate and human rights interest organizations to protect and advance freedom of expression and privacy in the ICT sector, has been instrumental in bringing in the business community to support research and advocacy on the

36 See for example, Morten Jerven, Poor Numbers (Ithaca: Cornell University Press, 2013).

37 Friedrich Schneider, The Shadow Economy And Work In The Shadow (Bonn: IZA, 2012).

38 ibid. p6

39 ibid p.7

40 Ceyhun Elgin, "Internet Usage And The Shadow Economy: Evidence From Panel Data", Economic Systems 37, no. 1 (2013): 111-121, accessed March 10, 2017, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2569631.

41 "#Keepiton - Access Now", Access Now, last modified 2017, accessed October 19, 2017, https://www.accessnow.org/keepiton/.

question of Internet disruptions around the world.[42] Under the GNI convening, for example, studies have been commissioned and discussed through a business lens estimating costs of Internet disruptions on a global platform.[43]

Freedom Online Coalition (FOI), made up of 30 governments (as at July 2017) works to advance Internet freedom globally.[44] FOI has issued a joint statement condemning Internet disruptions and asking governments to take more responsibility in resisting the trend.[45]

The United Nations, at least on two main instances has condemned intentional Internet disruptions. The special rapporteur for the Right to freedom of expression recommended more vigilance from Internet service providers against state sponsored disruptions.[46] The Human Rights Council under resolution 32/13, condemned unequivocally measures to intentionally prevent or disrupt access to or dissemination of information online in violation of international human rights law.[47]

In two cases in Africa, Uganda and Cameroon, the communication regulators and Internet service providers have been sued by public interest organizations. Although none of the cases has been determined, they present interesting scenarios for understanding Internet disruptions from a human rights perspective.

In November 2016, Unwanted Witness-Uganda sued the Uganda Communications Commission, the communication regulator, for ordering an Internet disruption to its licensees, the telecom companies. Enjoined in the suit was the Attorney General (the government legal advisor) and eight telecom companies (the implementers of the disruption) for the February and May 2016 instances of Internet, cellular communication and mobile money disruptions.[48] The petition is premised on the breach of right to freedom of speech and expression, the right to work, livelihood and an adequate standard of living.[49]

In April 2017, Veritas Law of Cameroon and Media Legal Defence Initiative (MLDI) filed two separate petitions related to the early 2017 Internet disruption targeting Cameroonian Anglophone regions.[50] In the first case suit No HCF/006/OS/17 filed at the High Court of Buea – Southwest Cameroon, a consortium of five civil societies have sued the State of Cameroon and four ISPs (Cameroon Telecommunications, MTN Cameroon and Orange Cameroun, Viettel Cameroun) challenging the Internet disruption. In the second case filed at the Constitutional Council of Cameroon (registration No 439) against the State of Cameroon, the Ministry of Post and Telecommunications and Cameroon Telecommunications seeking legal

42 "The Consequences Of Network Shutdowns And Service Disruptions: A One-Page Guide For Policymakers | Global Network Initiative", Globalnetworkinitiative.Org, last modified 2017, accessed July 23, 2017, https://globalnetworkinitiative.org/news/consequences-network-shutdowns-and-service-disruptions-one-page-guide-policymakers.

43 See, for example, "The Economic Impact of Disruptions to Internet Connectivity," http://globalnetworkinitiative.org/news/%E2%80%8Bnew-report-reveals-economic-costs-internet-shutdowns

44 "About Us | Freedom Online Coalition", Freedomonlinecoalition.Com, last modified 2017, accessed October 31, 2017, https://www.freedomonlinecoalition.com/about/.

45 "FOC Issues Joint Statement And Accompanying Good Practices For Government On State-Sponsored Network Disruptions", Freedomonlinecoalition.Com, last modified 2017, accessed April 12, 2017, https://www.freedomonlinecoalition.com/news/foc-issues-joint-statement-and-accompanying-good-practices-for-government-on-state-sponsored-network-disruptions/.

46 http://www.ohchr.org/EN/Issues/FreedomOpinion/Pages/SR2017ReporttoHRC.aspx

47 "The Promotion, Protection And Enjoyment Of Human Rights On The Internet", Ap.Ohchr.Org, last modified 2016, accessed October 9, 2017, http://ap.ohchr.org/documents/dpage_e.aspx?si=A/HRC/32/L.20.

48 "Interview: Fighting For Freedom Of Speech In Uganda – The Untold Story", Civil Rights Defenders, last modified 2016, accessed August 9, 2017, https://www.civilrightsdefenders.org/news/interview-fighting-for-freedom-of-speech-in-uganda-the-untold-story/.

49 "Court Adjourns Social Media Shutdown Lawsuit. | Unwanted Witness", Unwantedwitness.Or.Ug, last modified 2017, accessed July 11, 2017, https://unwantedwitness.or.ug/?p=3904.

50 Veritas Consul, "Legal Challenge On Internet Shutdown In Cameroon", Veritasconsul.Com, last modified 2017, accessed June 9, 2017, https://www.veritasconsul.com/index.php/legal-challenge-on-internet-shutdown-in-cameroon.

determination on whether the Internet disruption was consistent with the rights to freedom of expression and access to information, and with language-based discrimination.[51]

The non-binding nature of International multilateral organizations limits the effectiveness of the resolutions made on Intentional disruptions while the reactive domestic public litigation efforts, where they exist, are limited by lengthy timelines against the brief, almost snapshot, incidences of Internet disruptions.[52]

Early 2017, the African Network Information Centre (AFRINIC) proposed a technical response to be incorporated in the comprehensive policy manual towards countries that disrupt Internet connectivity.[53] In the proposal, a government and its related entities that orders either a total or partial shutdown would not be allocated resources for a period of 12 months after the end of the shutdown.[54] Further, AFRINIC would not participate in any transfer of resources should there be an existing policy and all sub-allocations of space within said country would cease for 12 months. Should a government be a repeat offender (in this case 3 or more shutdowns in a period of 10 years), all resources to the government and its entities would be revoked with no allocations for the next 5 years.[55]

The policy sharply divided AFRINIC members and observers in April and May 2017 during the period preceding the Africa Internet Summit. Staff members sought further clarity on the definition and proof of a shutdown as the proposed definition was not sufficient to trigger the actions in the proposal. AFRINIC's legal counsel advised that the proposal would put the organization under significant legal exposure from affected governments and could not be implemented as written.[56] According to AFRINIC's policy development process, a draft policy proposal expires after one calendar year unless the Board of Directors approves it.

The Anti-Shutdown-02 draft of May 2017 is still available for discussion but faces intense opposition. The networking and resource allocation technical community questions whether AFRINIC has a mandate to deny resources to sovereign entities while civil society argue that denying resources to governments translates to denying connectivity to citizens, the very exact problem such a policy is meant to deal with. Even though it was not adopted, the proposed policy caught the attention of a wider audience outside legal and policy circles, further bringing to public debate the issue of Internet disruptions.

Several diplomatic missions have published travel advisories warning their citizens of heightened danger in countries that disrupt Internet communication options. In June 2017, the US Embassy in Ethiopia issued a travel advisory noting that:

> *"the Ethiopian government routinely restricts or shuts downs internet, cellular data, and phone services, impeding the U.S. Embassy's ability to communicate with U.S. citizens in Ethiopia and limiting the Embassy's ability to provide consular services."*[57]

The UK embassy issued a similar warning regarding Ethiopia:

51 İbid.

52 see for example adjournments in Cameroon: https://www.facebook.com/veritaslawoffices/posts/406325103102286

53 AFRINIC is the Regional Internet Registry (RIR) for Africa designed to distribute Internet number resources to the African Internet community.

54 Andrew Alston, Ben Roberts and Fiona Asonga, "Anti-Shutdown-01", Afrinic.Net, last modified 2017, accessed June 12, 2017, https://www.afrinic.net/en/library/policies/2061-anti-shutdown-01.

55 İbid.

56 See staff assessment https://www.afrinic.net/en/library/policies/2061-anti-shutdown-01

57 "Ethiopia Travel Warning", Travel.State.Gov, last modified 2017, accessed October 14, 2017, https://travel.state.gov/content/passports/en/alertswarnings/ethiopia-travel-warning.html.

> *"Internet services, disconnected on 30 May 2017, have now been restored. However internet and other mobile data services can be restricted without notice, hampering the British Embassy's ability to assist you. You should have alternative communication plans in place when travelling in Ethiopia."*[58]

Section Summary

Intentional Internet disruption has evolved alongside population access to the Internet, with its nature mutating depending on government imagination of its value in civil dissent. Definitions and detections may vary but attribution for intentional disruptions points overwhelmingly towards governments.

Economic impact estimates rely heavily on observable market revenues. A case is being made to include unobserved economic activities (shadow economy) as a way to fully comprehend what the effects of these disruptions are. Social effects are perhaps more severe and immediate to affected populations. However, due to lack of standardized units of social effects as compared to economic monetary figures, they may be ignored or assumed.

Regional disruptions pose significant challenges on detection and attribution. There are limited publicly available technical platform that publish regional Internet traffic. This is further complicated by under-reporting by Internet users in these regions, a combination that leads to apparent silence on most regional disruptions.

58 "Ethiopia Travel Advice - GOV.UK", Gov.Uk, last modified 2017, accessed October 31, 2017, https://www.gov.uk/foreign-travel-advice/ethiopia.

METHODOLOGY

To understand the socio-economic impact of Internet disruptions in Africa, we start from the observation that access and use of the Internet has direct positive contribution to society and economy. A denial of access thus is the converse of this relationship, in other words, Internet disruption costs equate to forgone benefits. There are also indirect costs associated with denial of access to the Internet. When Internet users seek communication alternatives on short notices, the associated financial expenses are for the most part unplanned for on top of paying for existing but disrupted connections.

This study proceeds by collecting data on intentional Internet disruptions in Africa for the last five years through desktop research. Media, advocacy and citizen reports, government's' communication, and Internet Service Providers' public statements provide sources of identifying instances in all African countries.

To verify the reported instances, technical confirmations are made from existing openly available historical network measurements. These sources include OONI measurements,[59] Google Transparency reporting (products traffic category),[60] RIPEstats from BGP data[61] and Dyn Archives.[62] They are chosen primarily for their historical data availability or open-source nature that allows for reproducibility.

To estimate impact of incidences verified above, the study uses existing econometric estimates and social impact studies on the contribution of the Internet to the economy. Deloitte estimation model is preferred for two main reasons. One, its granularity between mobile and fixed line connections, an occurrence common in Africa-region disruptions. Two, its focus on short-term economic gains in place of long-term ones is more relevant to the African scenario considering disruptions are for the most part temporary. To refine our estimate, we incorporate the shadow economy which is particularly significant in Africa.[63] The effects of internet usage on informality through productivity is more pronounced in countries with lower GDP per-capita, a feature of most African countries.

Internet usage is qualified as Internet users per 100 people in a select country, sourced from the International Telecommunication Union (ITU).[64] ITU aggregates and stores statistics from all member countries across the world which we use for the research scope.

This methodology focuses on country cases without bundling regions together. The model can then be applied individually to specific countries. If regional estimates are necessary, they will be a sum of individual countries under study, but it is not within our scope for this study. This is informed by the observation that countries in Africa are very differentiated in terms of Internet access and use, economic activities and their regulation.[65]

59 "OONI - OONI: Open Observatory Of Network Interference", Ooni.Torproject.Org, last modified 2017, accessed October 31, 2017, https://ooni.torproject.org.

60 "Transparency Report", Transparencyreport.Google.Com, last modified 2017, accessed October 31, 2017, https://transparencyreport.google.com/traffic/overview.

61 RIPE Centre, "RIPE Network Coordination Centre", RIPE Network Coordination Centre, last modified 2017, accessed October 31, 2017, https://www.ripe.net.

62 "Research Archive | Dyn Blog", Dyn.Com, last modified 2017, accessed October 31, 2017, https://dyn.com/blog/category/research/.

63 Schneider, 37

64 "ICT STATISTICS Home Page", ITU, last modified 2017, accessed October 31, 2017, http://www.itu.int/en/ITU-D/Statistics/Pages/default.aspx.

65See 'Resources' section on divergence in Internet penetration in Africa.

From theory and empirical data, Internet access disruptions take four forms;

Geography: These could be national level or subsets of it (regional disruptions like English speaking regions in Cameroon).

Service: These could be every service or subsets of them (service-specific disruptions like WhatsApp, Facebook or YouTube).

Platform: These could be across all devices or subsets of them (mobile connectivity, fixed line connectivity).

Quality: These could be complete disconnection (blackout) or partial (throttling of speed to connect to all or some of services for example).

Based on this taxonomy, we estimate what each form costs using two formats: the temporal estimate using input factors and the long term effects using national accounting factors.

The study uses 2016 as the reference year with economic data from the World bank estimates.[66] The dataset offers horizontal comparisons and historical inferences of a select country. To compute the total size of the economy, we sum up the observed and shadow economy. Shadow economy estimates are presented as fractions of the observed economy. Therefore:

Total Size of Economy = Observed GDP + shadow economy

= oGDP + X/100(GDP)

Where X is the percentage of shadow economy in an economy.

Geography Based Disruption (Geography understood as proxy for population)

National Level

This form affects the entire geographic territory of a country and its population.

Format	Temporal Short term costs (input factors)	Long term costs – National Accounts
Formulae (annual)	3G mobile data usage elasticities + fixed connectivity (using mobile scaling factor)*	Internet economy 4.9% of GDP**
Formulae (daily)	[3G mobile data usage elasticities + fixed connectivity (using mobile scaling factor)]/365days	Internet economy 4.9% of GDP/ 365days

Table 2: Quantifying National-level Disruption.

*see Deloitte (2012) "What is the impact of mobile telephony on economic growth?"

** see Boston Consulting Group, "The Internet Economy in the G-20", 2012 and Internet and productivity: Zaballos and López-Rivas, 2012

66 "Databank | The World Bank", Databank.Worldbank.Org, last modified 2017, accessed October 31, 2017, http://databank.worldbank.org/data/home.aspx.

Regional Level

Format	Temporal Short term costs	Long term costs – National Accounts
Formulae (annual)	(3G mobile data usage elasticities + fixed connectivity)/population percentage affected	Internet economy as 4.9% of total GDP/population percentage affected
Formulae (daily)	[(3G mobile data usage elasticities + fixed connectivity)/population percentage affected]/365	[Internet economy as 4.9% of total GDP/population percentage affected]/365

Table 3: Quantifying Regional-level Disruption.

Service Based Disruptions: The impact here depends on each service and the extent of its use in an economy e.g WhatsApp, Facebook or YouTube.

Format	Long term costs – National Accounts
Formulae (annual)	App economy as 0.23% of total GDP*
Formulae (daily)	App economy as 0.23% of total GDP/365
Formulae (region)	App economy as 0.23% of total GDP/percentage of population represented in said region.
Formulae (region/ day)	App economy as 0.23% of total GDP/percentage of population represented in said region/365

Table 4: Quantifying Service-level Disruption.

*Erik Brynjolfsson and JooHee Oh, "The Attention Economy: Measuring the Value of Free Goods on the Internet," Current Project.

Caveat: Some apps are more popular than others and thus constitute different value additions to the economy.

Platform: These could be across all devices or subsets of them (mobile connectivity, fixed line connectivity).

Format	Mobile Broadband costs	Fixed Broadband Costs
Formulae (annual)	0.5*2016 GDP per capita (constant 2010 US$)*	(Fixed broadband penetration*0.88/0.063)*net gain from mobile broadband usage
Formulae (daily)	0.5*2016 GDP per capita (constant 2010 US$)/365	(Fixed broadband penetration * 0.88/ 0.063) * net gain from mobile broadband usage/365
Formulae (region)	0.5*2016 GDP per capita (constant 2010 US$) / percentage of population represented in said region.	(Fixed broadband penetration * 0.88/0.063) * net gain from mobile broadband usage/ percentage of population represented in said region.
Formulae (region/day)	0.5*2016 GDP per capita (constant 2010 US$)/ percentage of population represented in said region/365	(Fixed broadband penetration * 0.88/0.063) * net gain from mobile broadband usage/ percentage of population represented in said region/365

Table 5: Quantifying platform-level disruption.

*Deloitte (2012), "What is the impact of mobile telephony on economic growth?

Quality: These could be complete disconnection (blackout) or partial (throttling of speed to connect to all or some of services for example).

Format	Long term costs – National Accounts
Formulae (annual)	50% less Internet speed costs 0.15% of GDP*
Formulae (daily)	50% less Internet speed costs 0.15% of GDP/365
Formulae (region)	50% less Internet speed costs 0.15% of GDP/percentage of population represented in said region.
Formulae (region/day)	50% less Internet speed costs 0.15% of GDP/percentage of population represented in said region/365

Table 6: Quantifying quality-level disruption.

*Rohman and Bohlin (2012), "Does broadband speed really matter for driving economic growth: investigating OECD countries"

Methodology Limitations

Some regions are more economically productive than others, have differentiated population density, and have different Internet penetration levels. As such, the uniform distribution of disruption effects in a country experiencing regional disruptions misses the nuance regional diversity.

FINDINGS: SOCIO-ECONOMIC IMPACTS OF INTERNET DISRUPTION

What is the nature of Internet Disruptions in Africa between 2012-2017?

[See ‘Instances annex]

Scoping the data collected using the definition above, we classify reported incidences between 2012 and 2017 as complete, partial (regional), partial (network), partial (service).

Nature of disruption/Year	2012	2013	2014	2015	2016	2017
Complete	1	1	0	1	7	2
Partial (Regional/Service/platforms)	2	2	4	7	12	5
Total	3	3	4	8	19	9

Table 7: Summary of Internet Disruptions in Africa between June 1, 2012 and 31 May 2017.

Source: CIPIT Compilation (see annex 1)

For comparative purposes, we show here a count of accidental disruptions that had significant observable effects on connectivity for citizens.

Year	2012	2013	2014	2015	2016	2017
Accidental	1	0	1	1	1	3

Table 8: Accidental Internet disruptions between June 2012 - May 2017.

What is the cost of Internet Disruptions at the National, Regional, service or platform layer?

[See ‘Econometric data annex]

Using geography, service, platform, and quality as variables, econometric models have been used to estimate economic impact of intentional internet disruptions on African countries. Subsets of the data can be derived from the national figures.

Geography: These could be national level or subsets of it (regional disruptions like English speaking regions in Cameroon).

Service: These could be every service or subsets of them (service-specific disruptions like WhatsApp, Facebook or YouTube).

Platform: These could be across all devices or subsets of them (mobile connectivity, fixed line connectivity).

Quality: These could be complete disconnection (blackout) or partial (throttling of speed to connect to all or some of services for example).

A summary of economic estimates are tabulated below, with more data on Annex--

Disruption	Temporal Short term costs (input factors) – National Population	Long term costs – National Accounts – National Population
Daily Costs	[3G mobile data usage elasticities + fixed connectivity (using mobile scaling factor)]/365 days	Internet economy 4.9% of GDP/365 days
Cameroon	US$ 2,161,093	5.761 US$ millions
Ethiopia	US$ 8,397,062	9.495 US$ millions
Kenya	US$ 5,492,802	9.615 US$ millions

Table 9: Geography-based disruption (Geography understood as proxy for population)

Regional Level (example 1/3 of the population)

Format	Temporal Short term costs	Long term costs – National Accounts
Formulae (daily)	[(3G mobile data usage elasticities + fixed connectivity)/0.33]/365	[Internet economy as 4.9% of total GDP/population percentage affected]/365
Cameroon	US$ 713,160	US$ 1.90113
Ethiopia	US$ 2,771,030	US$ 3.13335
Kenya	US$ 1,812,624	US$ 3.17295

Caveats: some regions are more economically engaged than others.

Service based Disruptions: The impact here depends on each service and the extent of its use in an economy e.g WhatsApp, Facebook or YouTube.

Format	Long term costs – National Accounts
Formulae (daily)	App economy as 0.23% of total GDP/365 = 0.23/100*GDP/365
Cameroon	0.270430249 (US$ millions)
Ethiopia	0.445705797 (US$ millions)
Kenya	0.451338123 (US$ millions)
Formulae (region/day)	App economy as 0.23% of total GDP/percentage of population represented in said region/365 Eg A third of Cameroon without WhatsApp = 0.270430249 (US$ millions)/0.33 = 0.090134402 (US$ millions)

Table 10: Service-based disruption.

**Erik Brynjolfsson and JooHee Oh, "The Attention Economy: Measuring the Value of Free Goods on the Internet," Current Project.*

Caveat: Some apps are more popular than others and thus constitute different value addition to the economy.

Platform: These could be across all devices or subsets of them (mobile connectivity, fixed line connectivity).

Format	Mobile Broadband costs	Fixed Broadband Costs
Formulae (daily)	0.5 * 2016 GDP per capita (constant 2010 US$) / 365	(Fixed broadband penetration * 0.88/0.063) * net gain from mobile broadband usage/365
Cameroon	587891.8472 USD	1574532.959 USD
Ethiopia	968911.5965 USD	7460501.796 USD
Kenya	981169.847 USD	4511632.367 USD
Formulae (region/day)	0.5 * 2016 GDP per capita (constant 2010 US$)/percentage of population represented in said region/365 eg A third of Ethiopia without mobile Internet for a day = 0.009461732*0.33 = 152841.9185 USD	(Fixed broadband penetration*0.88/0.063) * net gain from mobile broadband usage/ percentage of population represented in said region/365 eg A third of Ethiopia without fixed line broadband Internet for a day = 0.072854189*0.33 = 1176864.294 USD

Table 11: Platform-based disruption.

*Deloitte (2012), *"What is the impact of mobile telephony on economic growth?*

Quality: These could be complete disconnection (blackout) or partial (throttling of speed to connect to all or some of services for example).

Format	Long term costs – National Accounts
Formulae (annual)	50% less Internet speed costs 0.15% of GDP*
Formulae (daily)	50% less Internet speed costs 0.15% of GDP/365
Cameroon	0.15*42916.10/365/100 = 0.176367553 (US$ millions)
Ethiopia	= 0.290677693 (US$ millions)
Kenya	= 0.29435095 (US$ millions)
Formulae (region/day)	50% less Internet speed costs 0.15% of GDP/percentage of population represented in said region/365
Example	Kenya throttling Internet for a fifth of the country = national cost*0.2 = 0.05887019 (US$ millions)

Table 12: Quality-based disruption.

*Rohman and Bohlin (2012), "Does broadband speed really matter for driving economic growth: investigating OECD countries"

Sense Testing daily impact of a national disruption in Kenya

Study	Estimate	CIPIT estimates	% missed	Remarks
Brookings1	7.4 million	9.6 million	29.72	Brookings uses national accounts estimates (long term effects on the economy).
Deloitte2	4.3 million	5.5 million	27.90	Deloitte uses input factors (short term factors)
CIPESA3	6.3 million	7.5 million	19.04	CIPESA combines both short and long term factors into one estimate.

Table 13: Comparing three methodologies for day-based disruption.

Sector-Specific Economic Effects of Internet Disruptions

An increase in Internet penetration has been demonstrated to raise the Gross Domestic Production of a country, whether developing or developed or during periods of recession or growth phases. A vibrant research field has evolved around this relationship with thematic findings clustered as:

A strong positive relationship exists between broadband and productivity.[67]

For example, 10-percentage points increase in Internet penetration rate raises real GDP per capita by 0.63 percentage point when the economy is growing and 0.52 percentage point during recession.[68]

Countries in Latin America that increase broadband penetration by 10 percent have associated increases of 3.19 percent in GDP.[69]

Doubling Internet speed in an economy increases GDP by 0.3 percent.[70]

Internet is positively related to trade and macroeconomic growth.[71]

A 10 percentage points increase of per capita internet is estimated to lead to a 3.9 percentage points increase of the openness ratio which in turn will lead to a 0.17 percentage points increase of economic growth.72

The impact of Internet use for trade in non-high income countries is much higher than it is for high-income countries.73

67 see , for example, Zaballos and López-Rivas, 2012, Dewan and Riggins, 2005;Oliner and Sichel, 2000, 2003; Varian et al. 2002; Roller and Waverman, 2001and Choi and Yi, 2009)

68 Chu, Shan-Ying. "Internet, economic growth and recession." Modern Economy 4, no. 5 (2013).

69 García Zaballos, Antonio, and Rubén López-Rivas. Socioeconomic Impact of Broadband in Latin American and Caribbean Countries. Inter-American Development Bank, 2012.

70 Ericsson, Arthur D. Little, Chalmers University of Technology, Socioeconomic Effects of Broadband Speed, Chalmers University of Technology, 2013

71 See, for example, Romer, 1990; Davies and Quinlivan, 2006; Freund and Weinhold(2000, 2004)

72 Meijers, Huub (2012). Does the internet generate economic growth, international trade, or both?. UNU-MERIT.

73 ibid.

Internet penetration lowers costs of doing business in a country.[74]

Internet allows the acquisition of valuable skills that in turn reduce the cost of acquisition of new technologies.75

Adoption of information technology is associated with a dramatic reduction in price dispersion, the complete elimination of waste, and near-perfect adherence to the Law of One Price.[76]

Internet penetration increases and sustains entrepreneurship in a country.[77]

Creation of network capital, a context with more knowledge, will generate more entrepreneurial opportunities since these opportunities are systematically created by knowledge investments by incumbent organizations.[78]

The Internet has the potential to make markets more contestable by lowering entry barriers for non-traditional players.[79]

High speed Internet spurs flexible high risk entrepreneurship.[80]

A survey of 4,800 SMEs in 12 countries finds that SMEs utilizing the Internet for business functions grew at twice the rate of those that did not.[81]

Internet creates more transparent labor markets.[82]

The Internet has diversified job search methods both for the employed and unemployed resulting in observable movements in employment-employment and unemployment-employment.[83]

Incorporation of global workforce in production, albeit with negative effects of relative poor pay for developing region residents.[84]

74 See, for example, Benhabib and Spiegel, 2005; Jensen 2007.

75 Benhabib, Jess, and Mark M. Spiegel. "Human capital and technology diffusion." Handbook of economic growth 1 (2005): 935-966.

76 Jensen, Robert. "The digital provide: Information (technology), market performance, and welfare in the South Indian fisheries sector." The quarterly journal of economics 122, no. 3 (2007): 879-924.

77 See, for example, Audretsch and Keilbach, 2007; Bloom et al 2011; Goes and Hsieh, 2002; Moshiri and Nikpour, 2010.

78 Audretsch, David B., and Max Keilbach. "The theory of knowledge spillover entrepreneurship." Journal of Management Studies 44, no. 7 (2007): 1242-1254.

79 Goel, Rajeev K., and Edward WT Hsieh. "Internet growth and economic theory." Netnomics 4, no. 2 (2002): 221-225.

80 Bloom, Nick, Tobias Kretschmer, and John Van Reenen. "Are family- friendly workplace practices a valuable firm resource?." Strategic Management Journal 32, no. 4 (2011): 343-367.

81 Manyika, James, and Charles Roxburgh. "The great transformer: The impact of the Internet on economic growth and prosperity." McKinsey Global Institute 1 (2011).

82 Stevenson, 2009; Moshiri and Nikpour, 2010; Bloom et al, 2011; Patricia and Vincent; 2016

83 Stevenson, B. (2009). The Internet and job search. In: D. H. Autor (Ed.), Studies of labor market intermediation (pp. 67–86). Chicago: University of Chicago Press.

84 Mazepa, Patricia, and Vincent Mosco. "A political economy approach to the Internet." Handbook on the Economics of the Internet (2016): 163.

Other economic factors affected by the Internet include international marketing and tourism which lead to more markets for local goods and services;[85] Organizational management which has been shown to lead to effective macroeconomic environment for business establishment, productivity, taxation and continuity.[86] These are examples of research conducted to attempt a qualification of how the internet affects the macro and micro elements of an economy, without limiting unquantified or unquantifiable impacts.

Social Effects of Intentional Internet disruptions

While the Internet has been used by individuals to hold their representatives to account, access more options in the market and connect with family and friends across long distances, the same has been used by authorities and commercial nodes to gain firmer grip on power and social influence through surveillance, remote attacks and censorship. This dialectic presents the fundamental social context of technology, which is, its influence on information (as)symmetry. With the control of Internet firmly under government's' control (infrastructure, licensing of service providers, and designing sector policies), the influence on when citizens or markets can use it favors the former. However, even to those with empirical evidence on how authorities have used the Internet for their self-preservation and against the common good, they have been clear on the positive effects the Internet has had on society.[87]

The social effects of the Internet may be clustered as:

Internet access and usage has observable improvement on citizen participation.[88]

The Internet reduces generational apathy to public life.[89]

The Internet lowers limitations of gender participation in public life.[90]

The use of social media technologies to create, preserve, and disseminate indigenous knowledge and skills to communities in East Africa.[91]

85 See, Levin, 2011; Parikhet al, 2007; Naude and Saayman; 2005

86 See, Moshiri and Nikpour, 2010; Kalathil, 2003; Acemoglu et al, 2001; Kodila-Tedika & Mutascu, 2014

87 Indeed, between the camps of technology for liberation or control in society, the premise of contention is not whether the technology is good or bad, but is its application for the common good or for further domination of the few over the majority in society.

88 See, for example, New spaces of citizenship? Rethinking gendered participation and empowerment in South Africa; The New Generation of Public Participation: Internet-based Participation Tools (Jennifer Evans-Cowley & Justin Hollander 2010); S.A. Owiny, K Mehta, A. N. Maretzki 2014; Mossberger, K., & Tolbert, C. J. (2010); Ruthann Weaver Lariscy Spencer F. Tinkham Kaye D. Sweetser 2011; Fatimata 2002; Fatimata Seye Sylla, 2002; Behl, 2017

89 Evans-Cowley, Jennifer, and Justin Hollander. "The new generation of public participation: Internet-based participation tools." Planning Practice & Research 25, no. 3 (2010): 397-408.

90 McEwan, Cheryl. "New spaces of citizenship? Rethinking gendered participation and empowerment in South Africa." Political Geography 24, no. 8 (2005): 969-991.

91 Owiny, Sylvia A., Khanjan Mehta, and Audrey N. Maretzki. "The use of social media technologies to create, preserve, and disseminate indigenous knowledge and skills to communities in East Africa." International journal of communication 8 (2014): 14.

Increased Internet access and usage enhances public accountability.[92]

The Internet has been shown to activate the most basic "level" that citizens have in holding their state to account in terms of the use of the public purse, and the policies pertaining to rights and development: the power to demand information about how decisions are made.[93]

Internet platforms have been used extensively to report corruption due to their potency to offer anonymity to whistleblowers.[94]

Internet access has a significant effect on social transparency and Press Freedom.[95]

There is a direct positive relationship between Internet penetration in a country and its press freedom.[96]

ICT tools, the Internet included, offers paths for local level political interactions between citizens and authorities which has direct benefits compared to long term national lee public goods provision.[97]

The Internet offers alternative media sources challenging the monopoly of information flows and the influence cycle associated with it.[98]

The Internet has a positive effect on social inclusion and cohesion.[99]

Communities in rural areas are eight times more likely to watch content from their community than from outside.[100]

Internet usage lowers barriers to social inclusion, much as it is a feature of digital exclusion on the access layer.[101]

Marginalized communities find spaces on the Internet to bring socially 'taboo' debates to blic with minimal risk.[102]

92 See, Schuppan, 2009; Calland, 2011; Gaventa, John, and Rosemary McGee. "The impact of transparency and accountability initiatives." Development Policy Review 31, no. s1 (2013).

93 Calland, Richard. "The right of access to information: The state of the art and the emerging theory of change." Access to information in Africa: Law, culture and practice (2013): 13-26.

94 Goel, Rajeev K., Michael A. Nelson, and Michael A. Naretta. "The internet as an indicator of corruption awareness." European Journal of Political Economy 28, no. 1 (2012): 64-75.

95 Calvert, 2013; Sussman 2000; Calvert 2013; Reporters Without Borders, 2013; Herman Wasserman, 2010; Okolloh, 2009

96 Sussman, Leonard R. "Censor dot gov: the Internet and press freedom 2000." Journal of Government Information 27, no. 5 (2000): 537-545.

97 Kalathil, Shanthi, and Taylor C. Boas. "Open Networks, Closed Regimes: The Impact of the Internet on Authoritarian Rule, 136." (2003).

98 Mudhai, O., Wisdom Tettey, and Fackson Banda, eds. African media and the digital public sphere. Springer, 2009.

99 Johnson et al 2011; Christian Fuchs & Eva Horak, 2006; Dana Ott & Melissa Rosser, 2000.

100 Johnson, David L., Veljko Pejovic, Elizabeth M. Belding, and Gertjan Van Stam. "Traffic characterization and internet usage in rural Africa." In Proceedings of the 20th international conference companion on World wide web, pp. 493-502. ACM, 2011.

101 Fuchs, Christian, and Eva Horak. "Africa and the digital divide." Telematics and informatics 25, no. 2 (2008): 99-116.

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The Internet aids in coordination during and after emergencies.[103]

Kenya Red Cross use of social media during emergencies.[104]

Transit agencies have turned to social media during severe weather disruptions, thanks to how communication cycles can be controlled through timing, automation and importantly, tapping on feedback both for service improvement and crowdsourced input.[105]

How Kenya turned to social media after mall attack.[106]

Ushahidi used in South Africa during xenophobic attacks in 2008 and in Eastern Congo 2008.[107]

Back Channels on the frontlines: Social media and disasters and Ushahidi's Going digital in emergencies.[108]

In general, the Internet is understood as a technology that grounds spaces for the long term creation of social capital (emergent positive effect of interaction among participants in a social network) that triggers other socially desired ends like cooperation and accountability.[109] This core output of the Internet is denied to populations in moments of disruptions.

103 (Yates, Paquette 2011); (Jaeger et al 2007); (Houston et al 2014); (Merchant etal 2011); (Magro 2012); (Keim & Noji 2011); (Sutton et al 2008); (Alexander2014); (Clay 2010); (Adebimpe 2015)

104 Valerie Hamilton, "When There's No 911, Kenya Tweets For Help", Public Radio International, last modified 2013, accessed June 15, 2017, https://www.pri.org/stories/2013-09-24/when-theres-no-911-kenya-tweets-help.

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DISCUSSION: INTENTIONAL INTERNET DISRUPTIONS IN AFRICA

The Shadow Economy in Africa on average accounts for 30% of direct costs to Internet disruptions

The shadow economy, that share of the economy that goes unobserved by official statistics, is a common feature both in developing and developed economies, but is generally more pronounced in the later. From econometric estimates in 2013, 37% of Africa's economy went unobserved, compared to 20% in the OECD countries.[110] This unobserved economy is also significantly affected by Internet usage but this study used the conservative estimates since it was not focusing on the impact of Internet usage on the shadow economy.[111]

> *From the results in the previous section, incorporating the shadow economy in estimating costs of Internet shutdowns reveals 28.8% of direct costs were missed by previous studies.*

This has two effects on our understanding how Internet usage disruptions affect societies. On the one side, that is a significant direct economic cost that adds to the already staggering financial losses occasioned by these intentional disruptions. On the other side, this gives us a peek into the uncharted terrain of how Internet usage looks like outside formal institutionalized structures. *A common example of this would be the 'WhatsApp Economy' sweeping across the region. This involves individuals or small businesses using messengers (especially WhatsApp and Telegram) and social media platforms (especially Facebook, Instagram, and Twitter) to market their wares or services, aided by mobile money and boda boda (motorbike couriers) to complete transactions without any registered business or additional tax responsibilities. Its size, who it employs and turnover is a tough assignment for governments but it is not illegal. There is a strong case to be made for more research into this space.* If 30% of an economy goes unobserved, at very conservative levels, government decisions may be significantly underestimating the impacts of Internet disruptions in their economies and societies. Motivations for Internet disruptions may be reconsidered with the realization that a vast section of the population than statistically documented depend on it for employment and livelihoods.

110 Mai Hassan and Friedrich Schneider, Size And Development Of The Shadow Economies Of 157 Countries Worldwide: Updated And New Measures From 1999 To 2013, Discussion Paper (Bonn: The Institute for the Study of Labor (IZA), 2017).

111 For the effects of Internet usage on the shadow economy, see Ceyhun Elgin, "Internet Usage And The Shadow Economy: Evidence From Panel Data", Economic Systems 37, no. 1 (2013): accessed March 10, 2017, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2569631.

The more integrated an economy is to the Internet, the less the chances of disrupting the Internet.

Ten countries in Africa account for 60% of all Internet disruptions experienced in the last five years. If we take Autonomous Systems (ASN) as a proxy of how a country is integrated and diversified into the Internet, we see a start difference between countries that have had instances of Internet disruptions and those that have not.[112] On average, countries that have had at least one recorded instance of a disruption in the last five years have 16ASNs while those without any instance of disruption have 38ASNs on average. Internet value proposition to an economy is premised on efficient information spread in the form of exchange of ideas and market signals. The more users adopt the Internet, the more benefits accrue to existing users without the latter bearing extra costs. This network capital is important in understanding the macro level effects of access to the Internet, and why it is systemically undesirable or even inconceivable to disconnect a country. The cost benefit analysis favors a 'keepiton' in such economies. It gives credence to the observation that increasing access to the Internet is a force against disruptions.

Liberal Countries are less prone to Internet disruptions, especially where sufficient oversight exists over the Executive Arm of Government

The chain of command for Internet disruptions point to a trend; political actors raise an issue as a national security priority to the security bodies. These bodies contact the communication regulator with instructions on what communication channels ought to be controlled. The regulator then reaches out to its licensees based on license conditions seeking the execution of such orders. In a context where institutions lack functional independence to act rationally, there is bound to be securitization of political insecurities through security sector agencies who owe their allegiance to the political heads. Midway the chain, the communication regulators may be appointed by the political heads and in practical sense may effect such orders not out of their necessity but out of patronage linkages with the government of the day. They may see an election not just as critical for the politicians but for their appointments too. If their political patron loses, they may most likely lose their appointment in such high offices. In thinking about how to inculcate institutional independence in such organizations, the practical political experiences are just as important as the legal philosophy of separation of power. For example, the appointment of the board of a communication regulator should not be an exclusive executive mandate, and the appointees must have tenure, with clear responsibilities and exit scenarios. The board can then be held responsible for all decisions committed or omitted.

No major telecommunication company in Africa operates away from the eye of the government of the day. Being a high capital investment, the relationship with political and executive officers is usually very close, because they are fully or partially government-owned, they own them through proxies, or they want to extract rents from them. Communication sector thus becomes a highly politicized zone, requiring political patrons to survive. This may explain why ISPs face dilemmas of disconnecting their consumers and hence revenue streams or playing ball with their political patrons.

Countries with only government owned telecommunication companies, like Ethiopia, Eritrea are the most vulnerable to Internet disruptions, particularly because such decisions are simple inter-departmental communiques, without independent oversight.

112 An AS is defined as a 'connected group of one or more IP prefixes run by one or more network operators which has a SINGLE and CLEARLY DEFINED routing policy.'. See RFC 1930 https://tools.ietf.org/html/rfc1930 accessed 5 October 2017.

Detection and Attribution is improving but regional disruptions remain a daunting task.

Most remote network measurements from both open and closed Internet platforms by design give the state of national level connectivity. Popular examples include Google transparency traffic reports, Dyn Research, RIPE Atlas, OONI, Psiphon, Akamai and Tor network. As much as a single platform can offer confirmatory proof of a disruption, it often than not requires more than one technical approach to figure out the nature of the disruption especially because in any specified country, Internet is accessed from different service providers, regions and platforms. The granularity required for certainty can be elusive and combining different methods helps avoid false positives.

Technical detections and confirmation of Internet disruptions are premised on observed change on network capacity, reachability of vantage points in a target geographic location, and visibility on Internet exchange points with the rest of the world. Using longitudinal data, a drop in traffic may be inferred as a sign of a disruption. The steeper the drop, the more significant the disruption. The advantage of this model is its independence from the target region. In other words, even without an active measurement in that location, one can infer changes on the network based on historical trends. This method however makes it very hard to detect or even confirm regional disruptions.

The option of actively probing networks from a vantage point in the target location requires physical presence of probes that can do two things – try to reach Internet service endpoints – like WhatsApp servers, and/or be reached by a control server outside the tested network. If the probe can be reached, it implies there is no complete shutdown. If the probe 'on-location' cannot reach Internet services like WhatsApp in this case, but the control server that is not running on the same network as the probe can reach it, then it means there is disruption happening on the tested network. This allows for more granular testing, and thus allows for the detection of both partial (geography or service), network level and national level disruptions. The challenge with this method is the limited number of vantage points out in the target regions and even when on location, their reliability that they will run tests in time.

Distribution of these probes and running them properly remains a challenge. *If more organizations could take up more probes and run them properly on as many networks and regions as possible, detecting Internet disruptions or censorship would be easier.* Current distributions and connections are limited to urban centres on popular networks and are thus limited in probing rural or less-popular networks.

RECOMMENDATIONS

Nature of Shutdowns

Attribution: Intentional or accidental, Internet disruptions involve tampering with access completely as to cause a total blackout or lowering the quality of the connectivity to make it hard or impossible to transmit data across such a platform. Due to their shared features, either of them can be confused for the other. Attribution should be done carefully , in light of the implications of either options. According to the Internal Cable Protection Committee, an organization that documents causes of Internet cable disruptions, shipping vessels pose the highest risk to submarine disruptions, not governments.[113]

Economic

A recognition of Shadow Economy in socio-economic reality is not just rational but necessary, considering how significant this in the overall estimates.

Social

Human stories on the everyday impacts of Internet disruptions are particularly powerful. Collecting and amplifying such stories, as AccessNow have done recently, is an effort that deserves more attention.

Research

Considering any Internet user is a potential probe, owing to the services they run on their devices connecting to servers outside their networks, commercial companies can help immensely in understanding the 'state of the networks'. They are in all geographies, networks and services. Concerns around privacy, authoritarian government backlash, and competitive edge against other companies may limit their disclosure of available data. However, anonymizing the raw data and using it to give general trends across regions by leading commercial Internet companies would go a long way to solve the issue of data on Internet disruptions. Google Traffic Transparency reports currently visualize the longitudinal network of their products but would do more to disaggregate to administrative regions.

Why is it easy to disrupt Internet in some countries and not in others, despite facing similar political and economic situations?

Partnership with Internet technical organizations to build a database of historical incidences of Intentional disruptions. Open source dataset.

Browser traffic: Mozilla, Chrome, Safari, Opera/Mini. Eg Firefox health report collects usage statistics also called telemetry (about:preferences#advanced)

Internet user testing. Mobile apps, orchestrations, distribution of probes to partner organizations.

Have an alert system, triggered by sharp drop in traffic, to interested organizations and individuals in form an email or bot channel.

Flexible visualizations of data to especially assist journalists and reporters during time sensitive scenarios.

Policy

113 Maurice Kordahi et al., "Worldwide Trends In Submarine Cable Systems", in Suboptic (Monaco: Submarine Cable Improvement Group, 2016), accessed October 20, 2017, http://suboptic.org/suboptic-2016/.

Ensure the functional independence of Communication Regulators.

ISP licenses should have clauses cushioning licensees from affecting blanket censorship without court orders.

Advocacy

Bring in real life impacts of to the economy and social life community. The unobserved economy may make the case. Local business communities and power influence nodes.

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ANNEXES

1. A spreadsheet hosted by CIPIT on *Instances of Internet disruptions in Africa* in view mode only. https://docs.google.com/spreadsheets/d/1jo4DQe1LqPs6mAvqbFfcm3UD3a614j2LEQ2_jpF6jd0/edit#gid=1294477198
2. A spreadsheet hosted by CIPIT on *Economic Effects of Internet disruptions across* all African countries disaggregated by platform and region. https://docs.google.com/spreadsheets/d/1jo4DQe1LqPs6mAvqbFfcm3UD3a614j2LEQ2_jpF6jd0/edit?usp=sharing

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