Internet Censorship and Economic Impacts: A Case Study of Internet Outages in India

Completed Research

Nivitha Raveendran
Montclair State University
raveendran1@montclair.edu

Christopher S. Leberknight
Montclair State University
leberknightc@montclair.edu

Abstract

The objective of this research paper is to provide a methodology for measuring the financial impacts of Internet outages. The financial impacts are measured against a Nation's Gross Domestic Product (GDP) for several states in India to project the aftermath of Internet outage episodes. In addition historical trends are analyzed to help derive predictive logic for Internet outages in order to forecast Internet shutdown incidents based on antecedent events. Results demonstrate the proposed method for determining economic loss highlights several factors and may at times be influenced by the frequency of events compared to overall size of GDP. In addition, historical trend analysis of Internet outages suggests that a predictive model to forecast future outages can help reveal underlying policies toward Internet censorship.

Keywords

Censorship, Gross Domestic Product, Internet Outage

Introduction

The Internet and associated services has significantly transformed all facets of society and it is now regarded as a "general purpose technology" (Rajat et al., 2016). Several economic sectors such as education, finance, manufacturing, and agriculture all benefit from technological advancements linked to this infrastructure. However, there is also a dark side of the Internet that consists of various governmental agencies that enforce policies and restrict the civil liberties of its citizens by monitoring and restricting access to online information. There are many examples that demonstrate the increasing threats to Internet Freedom (Morozov, 2012) for many citizens around the world such as: (1) June 2009, the Iranian government headed by President Mah-moud Ahmadinejad blocked several websites and text messages to deter protesters supporting Presidential candidate Mir Hussein Moussavi (Chen, 2011). The popular social networking site, Twitter, was widely used by Iranian citizens to circumvent censorship to communicate current events outside of Iran. (2) On January 2011, the Tunisian government selectively blocked many sites during the political uprising against existing President Zine el-Albidine Ben Aliin (Allagui and Kuebler, 2011) (3) On January 28, 2011 in response to political unrest, the Egyptian government shut down Internet connections for several days. Citizens in Egypt were not able to use satellite communications, Twitter feeds, and land lines to continue to communicate outside of the country (Chen, 2011). On 5 February 2014 the Turkish Parliament adopted a controversial new Internet law to promote Internet regulation in Turkey that: (1) allows the telecommunications authority (TIB) to block any website within 4 hours without first seeking a court ruling; and (2) requires Internet providers to store all data on web users' activities for two years and make it available to the authorities upon request (Gurbuz, 2014). These examples and many others highlight the need to develop new circumvention technologies that enable freedom of expression, speech, and assembly for citizens in societies that heavily enforce Internet censorship.

In developing nations, Internet use and growth are consistently increasing, but due to the lack of proper governance and appropriate policies, Internet freedom for citizens in these nations are particularly vulnerable. In the most extreme case, authorities have resorted to Internet shutdowns to discourage collective action that may have a potential to disrupt the status quo. Considering the rapid rise of Internet shutdowns and the Internet's contribution to Gross Domestic Product (GDP) a cost benefit analysis will

help reveal a nation's underlying policy toward online censorship. A logical first step in this analysis is to investigate the financial impact of censorship by examining the economic impact associated with Internet shutdown events. The main focus of this research is to propose a systematic method for quantifying the impact vis-a-vis a case study of Internet shutdowns in India. Despite the profound impact the Internet has on our lives and the contribution to GDP – the key performance indicator of economic health – a systematic approach for measuring the digital economy with regard to Internet shutdowns has yet to be established.

This paper begins with a simple definition for Internet shutdowns and its impacts on public life. Then a discussion on related work is presented that explains the censorship ecosystem and the need for impact measurement. Following the literature review, a methodology is presented that measures the economic impacts based on National Gross Domestic Product. The experimental analysis uses country-wide publicly available data for India. Results reveal the economic loss associated with Internet shutdowns across various regions in India. The pattern analyzing module worked on one particular political incident to show how the predictive logic can be derived to foresee internet shutdowns. The paper is concluded with its takeaways and the future scope of this research study.

Internet Censorships and Internet Shutdowns

Internet censorship is the control over what information can be accessed, published or viewed online. Internet Shutdown is a category of Internet censorship and it is the total disruption of the Internet, intentionally for a specific population, over a course of time, to control the flow of information (Olukotun, 2016). This makes the internet or internet applications entirely ineffective during the outage period.

Generally, Internet and social media shutdowns are employed in nations by authorities to control controversial information leakage among public, during state of affairs like political elections, civilian protests, and public demonstrations. Though there might be justifications for these restrictive actions, the imposed shutdowns might have obstructive effects on totally unassociated public tasks, for whom Internet service will be inaccessible. Corporate, financial and public healthcare facilities as well as many other Internet dependent organizations are all affected during these disruptions that in sum impact the nation's digital economy.

Related Work

Several examples discuss approaches for measuring the value of Internet related activities by estimating the size of the Internet economy relative to the GDP using official data (Rajat Kathuria et al, 2016). Previous studies capture the effect of computers on firm level productivity, even as economy wide effects were captured much later (Brynjolfsson, & Hitt, 1998, Lehr & Lichtenberg, 1999). Prior research approaches for measuring the Internet economy can be broadly divided into three categories: (1) total expenditure methods, (2) growth models, and (3) value chain analysis. Total expenditure methods are abundant in the literature (Boston Consulting Group, 2009, Boston Consulting Group, 2010, Boston Consulting Group 2011, McKinsey & Company, 2012) and estimate the size of the Internet economy by aggregating the consumption expenditure, private investment expenditure, government expenditure and net exports. However, most of these reports do not provide detailed methodologies or data sources and thus call for some caution in interpretation (Kathurai et al, 2016). Growth models are used to measure openness, competition and innovation as it is believed they are the key drivers for promoting economic growth (Barro, 1990, Alesina & Rodrik, 1994, Eberhardt, & Presbitero, 2015). More recent work applies growth models with a panel of socio-economic variables such as per capita gross state domestic product, gross capital formation, and total number of persons engaged in labor (Rajat Kathurai et al, 2016). Value chain analysis facilitates a bottom up (Chaabane, et al., 2014) value-added estimation that can provide a more accurate estimate of the digital economy. However, countries use different industry classification systems that make it difficult to compare Internet activities from different regions of the world (Kathurai et al, 2016).

While the aforementioned studies prescribe approaches for measuring the digital economy, there are also relevant contributions that have inspired our work relating to Internet censorship. Techniques used to enforce censorship and corresponding circumvention strategies require a more fine-grained model for determining the financial impact. In addition to publicly available country-wide government data our work will also consider more localized data. Previous work on Internet censorship presents methods and analyzes for detecting censorship that will be used to explore economic loss in terms of social utility theory.

Data from the OpenNet Initiative (https://opennet.net/) describes numerous censorship techniques and technologies used by countries around the world (Gill, et al., 2015). Furthermore, measurement analysis from proxy logs in Syria details the various traffic filtering methods for targeting sensitive data and the techniques used by Syrian users to evade censorship (Chaabane, et al., 2014). A study on intense Internet outage episode in Egypt and Libya, circa 2011 details the methodologies utilized for traffic filtering and thereby denying 93% of population's access to the Internet. BGP interdomain routing control plane data; RIR delegation files; and MaxMind's geolocation database were explored systematically to trace the Internet outage techniques (Dainotti, et al., 2011).

The evolving landscape of censorship techniques and methodologies suggests that a comprehensive model must include measure of economic impacts caused by these web filtering episodes.

Gross Domestic Product, GDP, is a statistical measure of a nation's economic performance. It measures the value of all services and goods of a nation over a period of time. (McCulla & Smith, 2007) present details for calculating GDP and discuss measuring techniques to estimate the national economy. This same statistical measure is utilized to present the financial impact of web censorship (West, 2016). In this research the estimated cost of 81 Internet shutdowns for 19 countries in 2015 was 2.4 billion dollars. This provides an approach for the measurement of economic impact, based on national GDP. It describes GDP impacts across various countries over a one year period. In this study, India is found to be one among top five countries that experience the economic loss by Internet shutdown events. Unlike limitations with previous research as described by Kathurai et. al (2016), our paper makes several contributions by presenting:

1. A detailed methodology and data sources that can be followed to compute economic impacts caused by the Internet outage in India. The aftermath of any Internet shutdown practice can be presented in terms of a nation's GDP.
2. A detailed study of Internet outages in the states of India and the impact on the Internet-based GDP economy
3. A detailed study on Internet outage timelines to derive a predictive logic to forecast upcoming shutdown incidents. That is, a probability assessment for the occurrence of an Internet outage based on location specific antecedent events.

India: A case study of economic impacts

India is a diverse political nation with enumerable political episodes occurring across different states of India. These episodes can be linked to several Internet outage incidents that were imposed to control the dissemination of information. Based on national statistical reports India's Internet contribution to the national economy is high, resulting in immense economic loss during Internet outages. The choice of India as the candidate in this paper is based on four factors: (1) India is a diverse political nation (2) Internet usage is on the rise and (3) there is evidence of increasing Internet Shutdown practices and (4) this is the first detailed study to measure the economic impact in the states of India.

To gain a broad understanding of the Internet Governance framework and the practice of Internet shutdowns in India it is helpful to present a brief review of India's Internet history. The Internet in India begins with the very first government national Internet Service Provider (ISP) – VSNL. During its infancy the Internet experienced exponential growth with the emergence of multiple private ISPs across the nation (Subramanian, 2012). The rapid growth curve of Indian industries in the world economy is visible with the flourishing of offshore software services. India's software exporting industry is one of the world's most successful in information technology. A case study on India's offshore services details the evolution of India's export-oriented software industry (Dossani, et al, 2007). Political and business sectors of India are widely influenced by the Internet waves, with the ripples even reaching the rural areas. Subsequently, the rise of social media for effective political campaigns and increased public interference altered the political framework of the nation. A research study by Jaidka et al., (2014) shows the emergence of e-Democracy where social networks like Twitter are used by General Election parties. The reachability and effectiveness of these practices paved the growth of e-Democracy. Even with the emergence of e-Democracy the rapid growth of the Internet has outpaced the establishment of policies and rights to protect its citizens and has resulted in extreme measures for enforcing information control.

The scale and scope of the Internet highlights the influence it has on national and economic growth and one must consider the factors that can negatively impact India's burgeoning digital economy. India has a significant GDP growth rate due to the fast-growing service sectors. Internet sectors such as telecommunications, IT services, business process outsourcing services, and software services contribute a significant share to national GDP. One major factor that poses significant threat to the thriving economy is intentional disruption and cessation of the Internet. Internet outages are a practice that can water down this fast-growing digital nation. The work by Subramanian, 2012 indicates that the first, though unsuccessful, Internet blocking attempt in India is traced back to 1999, thereby initiating the need for well-put Internet rights and policies. The evolution of the Internet and surrounding polices as well as negative ramifications have been extensively detailed in the literature (Subramanian, 2012).

Methodology: Approach for Measuring Impacts of Internet Censorship

This study targets the states of India that experience Internet shutdown episodes. With a significant share of GDP from Internet sectors, the economic impact of an Internet outage can be measured based on GDP. In India, due to high Internet usage, the impact of Internet outages on the national economy will be high.

To depict the impacts of Internet outage, a relationship will be drawn between economic loss caused by Internet shutdowns and national GDP estimates. Figure 1 shows the step by step approach to compute the GDP impact by Internet outage episodes. To project the prime areas within a nation that require more attention, statewide analysis of GDP contribution and Internet practices need to be structured. So, data collection begins at the national level and then drills down to state level.

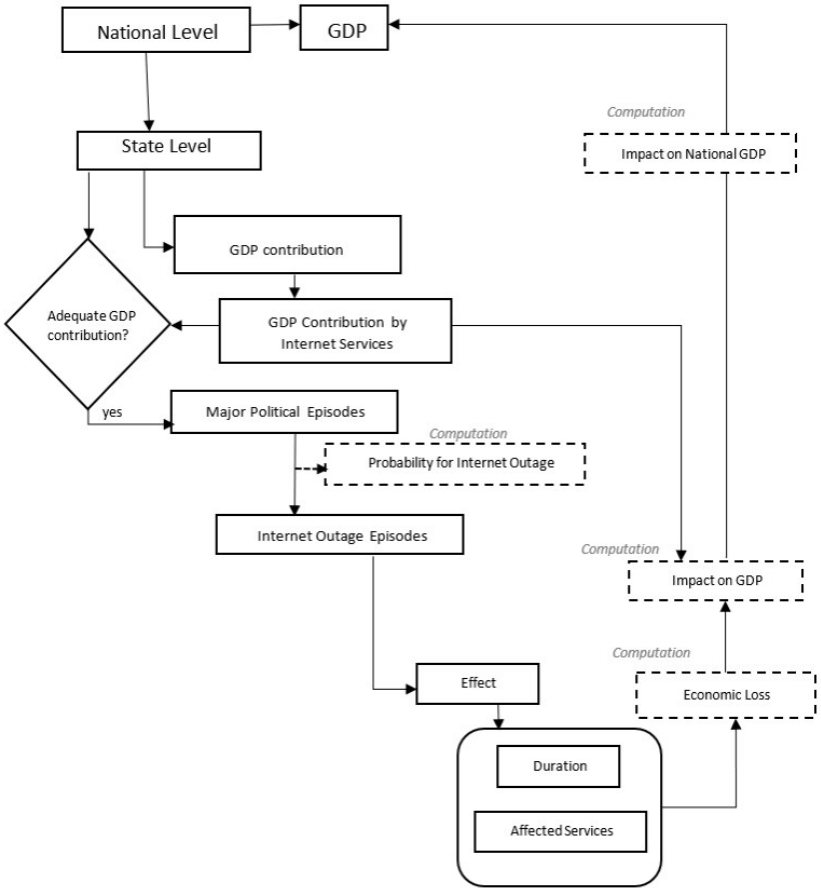

Figure 1: Research Proposal Model

Formulae

Input from available data sources are used to compute the economic loss for each district, *I*. The inputs include: (1) total population, (2) population for each city in each district, (3) Internet share of GDP and (4) the duration of each shutdown event. The total population for each district and cities in each district are sourced from available online resources (http://www.citypopulation.de/php/india-admin.php). Economic Loss by an Internet outage is computed as:

*Economic Loss= Duration*Percentage of total population affected*GDP share per day,* (1)

where *Duration* is the number of days the Internet services were banned, and *GDP share per day* is the average Internet based GDP from the entire state on a per day basis. The *Affected Population* used in the formula is the percentage of the total state population affected by an Internet outage incident (i.e, the districts/towns within the state that are involved in the Internet outage incident is identified). Each population will have its own style, pattern and technique of Internet censorship. Through appropriate analysis of political incidents and the frequency of Internet shutdown events, a prediction model can be derived specifically for a population. This method helps to highlight: (1) areas which increasingly experience Internet outages, (2) financial impacts by the Internet outage episodes and (3) political incidents with increased probability for causing an Internet outage. These inputs are used to derive the total economic loss for each district, *i*, with the following formulae:

Sum of population in each district
$$(P_i) = \sum_{i=1}^{n} \sum_{j=1}^{k} popl_{i,j} \quad (2)$$

Percent of Affected Population
$$(AP_i) = \frac{P_i}{TP_i} \quad (3)$$

GDP Share/Day (millions)
$$(GSPD_i) = \frac{Internet\ share\ GDP_i}{365} * (1000) \quad (4)$$

Economic Loss/Day
$$(ELSD_i) = (AP_i/100) * GPSD_i \quad (5)$$

Total Economic Loss
$$(TLE_i) = ELSD_i * Duration \quad (6)$$

Data Analysis

Data was collected for a set of selected political episodes in India, to study the GDP impact of Internet outage incidents in the country. This section details the input, output and evaluates the proposed process depicted in figure 1. At the National level, details are collected on: (1) the National GDP, (2) GDP contribution from the Internet sector and (3) Internet users across the country. In this case study of India, details are extracted for three consecutive years as shown in Table: 2. As per BCG analysis (Boston Consulting Group), in India, the share of Internet to National GDP is 5% as of 2015 and is estimated to reach 7.5% by 2020. National GDP and National Internet User statistics are extracted from sources of KNOEMA dataset and Telecom Regulatory Authority of India (TRAI), respectively.

No.	Year	National GDP (in trillion)	Internet Economy share to GDP (in billion)	Total Internet Subscribers (in million)
1	2015	$2.09	$104.50	319.42
2	2016	2.264	$113.20	391.50
3	2017	2.439	$121.95	429.23

Table 1: National Level GDP and Internet Statistics

In this case study, a few major Indian states with increased political incidents are analyzed and data was obtained as shown in Table: 3. GSDP of Indian states are extracted from data sourced by Indian Brand

Equity Foundation. The national census report provides data on state level population and TRAI (Telecom Regulatory Authority of India) provides state level internet statistics. Internet shutdown incidents are extracted from the Internet Shutdown Tracker web application by Software Freedom Law Centre, SFLC, India.

No.	Year	State	GSDP (in billion)	Total Population (in million)	Internet Subscribers (in million)	No. of Internet Shutdowns	Impacted Districts	Duration (Days)
1	2016	Haryana	$75.30	25.35	8.58	4	3	10
2	2017	Haryana	$85.00	25.35	9.92	8	11	15
3	2016	Rajasthan	$103.00	68.55	19.54	6	4	8
4	2017	Rajasthan	$116.40	68.55	21.67	10	11	25
5	2015	Jammu and Kashmir	$15.60	12.54	3.53	5	11	6
6	2016	Jammu and Kashmir	$18.40	12.54	3.02	10	12	27
7	2017	Jammu and Kashmir	$23.60	12.54	4.79	32	11	56
8	2015	Gujarat	$142.40	60.44	19.44	5	26	14
9	2016	Gujarat	$158.20	60.44	21.1	3	26	5
10	2017	Gujarat	$200.00	60.44	27.3	1	2	5
11	2016	Bihar	$59.30	10.41	19.63	2	3	9
12	2017	Bihar	$68.00	10.41	24.1	3	7	13
13	2016	Uttar Pradesh	$177.60	199.81	39	2	2	5
14	2017	Uttar Pradesh	$203.00	199.81	48.51	2	1	15
15	2016	Maharashtra	$300.50	112.37	29.48	1	1	1
16	2017	Maharashtra	$340.00	112.37	35.94	1	1	2
17	2017	Punjab	$66.40	27.74	16.65	1	20	3
18	2017	Madhya Pradesh	$99.40	72.63	24.77	1	6	6

Table 2: State level GSDP, Internet statistics and Internet outage Data

Using the data in Table 2, values are computed for (1) Affected Population-which is computed with the population of the state and affected districts. Average internet users are thence derived for the affected districts from the state Internet users. (2) Total Economic Loss–is computed by *Duration*Affected Population*Internet GDP share (per day basis)*. Internet GDP share is the GDP based on state internet users (3) impact on state level Internet GDP - is computed by (Total Economic Loss/ Internet GDP share by state (per year basis)). Computed information is as shown in Table: 3.

Results

By analyzing results in Table 2, it can be deduced that, in India, the states of Jammu Kashmir and Rajasthan are experiencing comparatively increased practice of Internet shutdowns. Also, from results in Table 3 it can be inferred that that the economic loss by Internet outages are high in the states of Jammu Kashmir, Rajasthan and Gujarat. It can be noticed that though the GDP contribution of Jammu Kashmir is the lowest in India, the state ranks in top three for the economic loss caused by Internet shutdowns. This is due to the increased Internet shutdown episodes in the state. Also, it is evident that the practice of Internet blanket bans has been steadily increasing over the past several years.

No.	Year	State	Affected Population (in percentage)	Internet GDP Share per day (in million)	Total Economic Loss (in million)	Impact on State Level Internet GDP
1	2016	Haryana	13.69%	$6.80	$9.30	0.37%
2	2017	Haryana	56.03%	$7.72	$64.90	2.30%
3	2016	Rajasthan	12.01%	$15.48	$14.87	0.26%
4	2017	Rajasthan	42.21%	$16.87	$178.01	2.89%
5	2015	Jammu and Kashmir	67.13%	$3.16	$12.74	1.10%
6	2016	Jammu and Kashmir	70.93%	$2.39	$45.82	5.25%
7	2017	Jammu and Kashmir	67.13%	$3.73	$140.16	10.30%
8	2015	Gujarat	100.00%	$17.42	$243.94	3.84%
9	2016	Gujarat	100.00%	$16.71	$83.57	1.37%
10	2017	Gujarat	3.31%	$21.25	$3.52	0.05%
11	2016	Bihar	11.32%	$15.55	$15.84	0.28%
12	2017	Bihar	13.36%	$18.76	$32.57	0.48%
13	2016	Uttar Pradesh	4.15%	$30.89	$6.41	0.06%
14	2017	Uttar Pradesh	1.73%	$37.76	$9.83	0.07%
15	2016	Maharashtra	5.43%	$23.35	$1.27	0.01%
16	2017	Maharashtra	5.43%	$27.98	$3.04	0.03%
17	2017	Punjab	100.00%	$12.96	$38.88	0.82%
18	2017	Madhya Pradesh	14.39%	$19.28	$16.64	0.24%

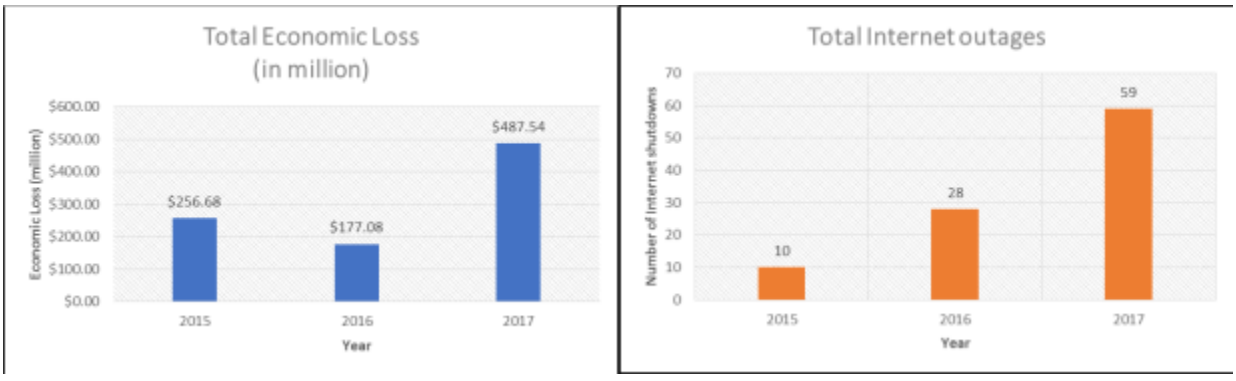

Figure 2: Experiment Results

Internet Outage Pattern Analysis

This section describes the probability computation of an Internet outage in a state, based on the analysis of previous major political episodes such as general election, political campaigns, communal riots, protests

and demonstrations. Not all states in a nation will have active Internet performance, so only states with adequate GDP contribution from Internet services, will be filtered out for further evaluation. Not all political episodes lead to Internet shutdowns, so the target is to identify the major political episodes in which Internet outages are imposed and patterns will be identified to derive the probability factor for predicting an outage during future political incidents.

As an experiment, one particular state-Haryana is considered here. Though there are many political incidents in the state, a few remained as major prolonged episodes, which are listed in Table 4.

No	Major Incidents	Internet Shutdown	Protests	Police Forces Involved	Paramilitary Army Involved
1	Jat Agitation - Caste reservation demands	Yes	Yes	Yes	Yes
2	Dera Headquarters-Charging Religious leader	Yes	Yes	Yes	Yes
3	Haryana Farmers-Remunerative Crop prices	No	Yes	Yes	No

Table 4: Major political incidents in Haryana

Of the three episodes, Internet shutdowns were imposed only during the two which caused unmanageable public violence, leading to involvement of paramilitary forces. All the Internet shutdown events accounted during the period 2016-17 in the state, were only associated with these two political episodes.

It is noticed that, on commencement of each incident associated with the two political incidents, the Internet was banned as a precautionary measure. For example, during JAT agitation, the civil movement dragged out for more than a year finally until the Government and the JAT group arrived at a compromise. Up until that time Internet shutdowns were imposed during each incident as shown in the timeline illustrated in Figure: 3.

Figure 3: Timeline of JAT Agitation and occurrence pattern of internet outage

From the timeline it is clear that the Internet was banned during situations like civil protests, potential violence and public marches against the government. The authorities are imposing Internet shutdown as a preventive or controlling measure during the entire episode of JAT agitation.

The next prolonged political incident 'Dera Violence', which was a religious violence against authorities, also led to Internet shutdowns at the onset of any associated incident as shown in timeline Figure 4.

Figure 4: Timeline of Dera Violence and occurrence pattern of internet outage

A prediction of Internet outages in the state of Haryana may be possible by analyzing other latent features associated with these events and by analyzing similar historical trends. Whenever a prolonged civil movement against government authorities occur in this state and when paramilitary forces are involved against rampage, then for each associated event, Internet bans are highly susceptible.

Similar studies on other major states reveals patterns, enabling the forecast of upcoming Internet outage events such as the wide-spread use of circumventing methods during a particular episode.

Conclusion

With the GDP associated measurement of Internet shutdowns and the analysis of censorship patterns, this research may help promote Internet freedom by raising awareness on the economic impacts by Internet shutdowns. Unlike the majority of Internet censorship research that focuses on detection and circumvention tools, this study aims to promote further research for measuring the aftermath caused by the Internet bans. The two major objectives of this research include: (1) using a GDP based approach to measure the economic impacts of Internet shutdown events and (2) evaluating Internet shutdown patterns to foster research investigations into a predictive model to forecast future Internet shutdown events. Results provide a quantitative representation of Internet outage impacts that may shed light on the implementation of effective Internet governance policies by authorities and promote research for circumvention technologies that help citizens overcome the impact of Internet shutdowns. The analysis in this paper highlights the areas in India under the increasing practice of Internet bans and its substantial impact on National GDP. Future research will expands on the data collection at a multi-national scope that enables work on Global GDP distribution and the impact of Internet outages on the world economy. These results will aid in the development of a cost-benefit analysis model that may help to reveal underlying Internet policies toward online censorship

Acknowledgements

The work is supported by the National Science Foundation under Grant No.: 1704113, Division of Computer and Networked Systems, Secure & Trustworthy Cyberspace (SaTC).

References

Dainotti, A., Squarcella, C., Aben, E., Claffy, K. C., Chiesa, M., Russo, M., & Pescapé, A. (2011). Analysis of Country-wide Internet Outages Caused by Censorship. *IMC'11*. Berlin.

Bernadette, S. H. (2014). *Internet Censorship:A Reference Handbook*. California: ABC-CLIO, LLC.

Chaabane, A., Chen, T., Cunche, M., Cristofaro, E., Friedman, A., & Kaafar, M. A. (2014). Censorship in the Wild: Analyzing Internet Filtering in Syria. *IMC '14* (pp. 285-298). Vancouver, BC: ACM.

Dossani, R., & Nathan, D. (2007). The Internet's Role in Offshored Services: A Case Study of India. New York: ACM Transactions on Internet Technology.

Gill, P., Crete-Nishihata, M., Dalek, J., Goldberg, S., Senft, A., & Wiseman, G. (2015). Characterizing Web Censorship Worldwide: Another Look at the OpenNet Initiative Data. *9*(1).

Jaidka, K., & Ahmed, S. (2014). The 2014 Indian General Election on Twitter:An analysis of changing political traditions. *ICTD '15*. Singapore: ACM.

McCulla, S. H., & Smith, S. (2007). Measuring the Economy: A primer on GDP and the National Income and Product Accounts. *Bureau of Economic Analysis, US Department of Commerce*.

Nicole Lupien, Plotnick, L., Grandhi, S. A., & Roxanne, G. H. (2017). An Exploratory Study of the Perceived Impact of Internet Outage. *CSCW'17 Companion*, (p. 4). Portland.

Olukotun, D. B. (2016, December 12). Internet shutdowns – an explainer. *MediaDev*.

Pandey, N. (2017). Internet Governance Maturity Model: Assessing India's Maturity. *ICEGOV '17* (p. 608). New Delhi: ACM.

Rajat, K., Mansi, K., Vatsala, S., & Parnil, U. (2016). *Quantifying the Value of an Open Internet for India*. India: ICRIER.

Roberts, H., Zuckerman , E., & Palfrey , J. (2011). *2011 Circumvention Tool Evaluation* . Harvard: The Berkman Center for Internet & Society Research Publications.

Subramanian, R. (2011). The Growth of Global Internet Censorship and Circumvention: A Survey. (S. Altschuller, Ed.) *Communications of the IIMA, 11*(2), 10-11.

Tomlinson, B. R. (2013). In B. R. Tomlinson, *Economy of Modern India*. Cambridge: Cambridge University Press.

West, D. M. (2016). *Internet shutdowns cost countries $2.4 billion last year*. Washington D.C: Brookings publication.