JULY 2017

ESTIMATING THE VALUE OF NEW GENERATION INTERNET BASED APPLICATIONS IN INDIA

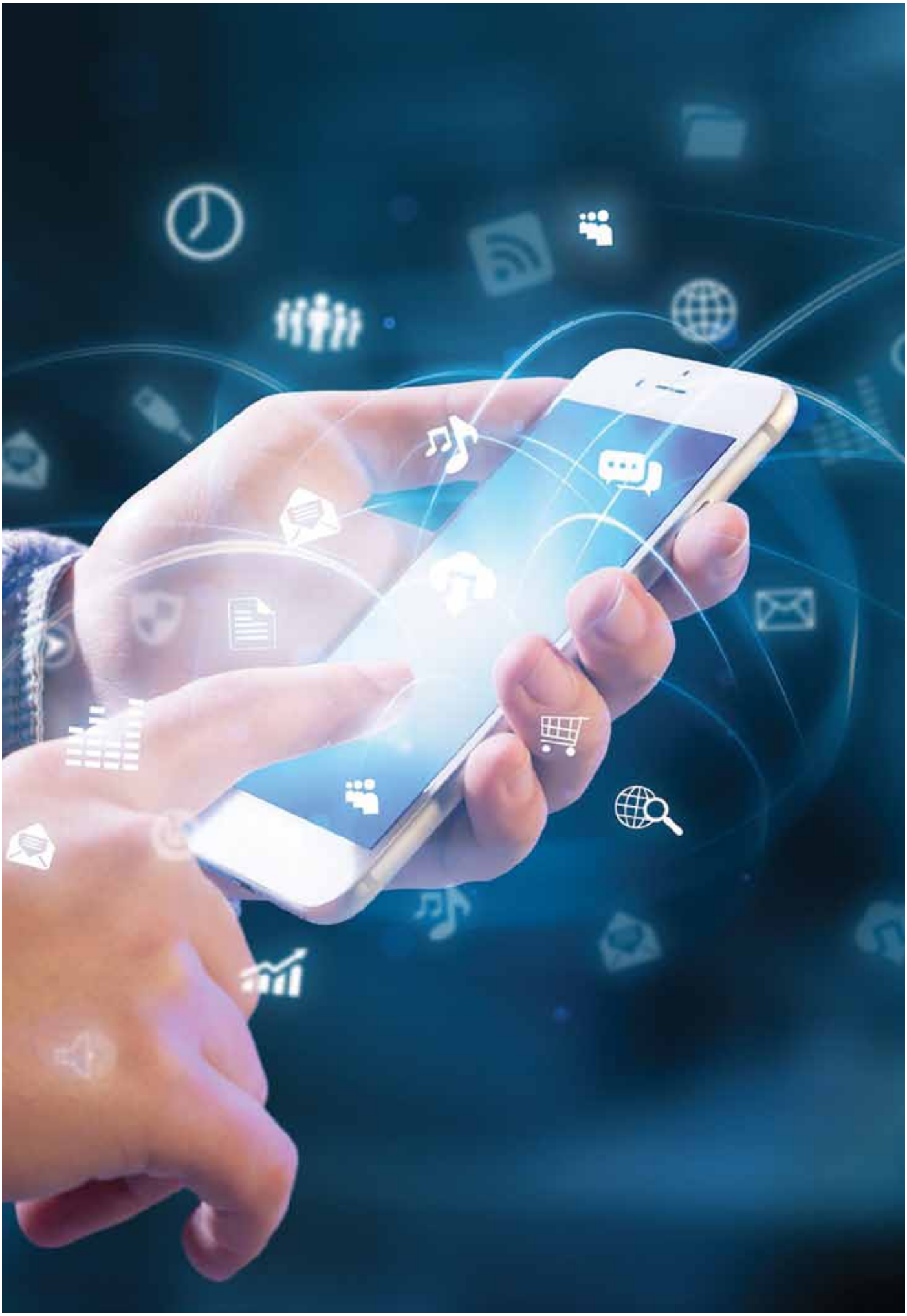
Rajat Kathuria | Mansi Kedia | Gangesh Sreekumar Varma | Kaushambi Bagchi

Broadband India Forum
BIF
enhance, expand & unleash the true value of broadband

CONTENTS

LIST OF FIGURES

LIST OF TABLES



Acknowledgements

We gratefully acknowledge the contribution of Broadband India Forum (BIF) and its members in facilitating this research. We humbly recognise the co-operation of T V Ramachandran, Sandhya Balasubrahmanyam, and Garima Kapoor from BIF without whose constant support and diligence the report would not have been possible. We would also like to thank Vivan Sharan from Koan Advisory for taking out the time to help us connect with app based service companies. The richness of the case studies has added immense value to the study and the insights of willing representatives from the content creators featured in this report have been fundamental. We are grateful for their profound interest in our study and for making the time to engage with the research team. We would also like to thank Usha Andra from CISCO VNI who promptly agreed to share invaluable data and helped with decoding it. Our diligent interns Saumitra Khullar, Tanya Vaidya and Manvi Puri have been nothing short of a blessing, always standing by to rescue us from difficult situations. We are also grateful to all our colleagues at ICRIER for providing a stimulating environment that makes such research possible. All errors are our own.

Broadband India Forum

BIF

enhance, expand & unleash the true value of broadband

Executive Summary

The growth of the app economy is nothing short of extraordinary in India. App Annie recently ranked India as the fourth largest app economy in the world. With over 94 percent subscribers connecting to the Internet on their mobile phone, it is no surprise that India is leading the global *phablet* revolution. India now tops the chart in Google Play downloads when compared to Indonesia, Russia, Brazil and USA.

Internet and Internet based applications have drastically and quickly transformed the architecture of economic activity. Their evolution has sent regulators of legacy services such as telecommunications, cable and broadcast, commercial public transport etc. scrambling to manage disruption. Other stakeholders involved in related industries such as advertising have also had to adapt to this new revolution.

The academic economic literature has captured the impact of this phenomenon. Several global growth impact studies are available and for India ICRIER first estimated the growth impact of the Internet in 2012. The estimates have been periodically updated. The most recent estimate shows that 10% increase in internet penetration results in a 2.4% increase in the growth of state per capita GDP.

The current study is a departure from previous research, as it attempts to measure growth elasticity based on Internet usage and not Internet penetration. We feel this is a refinement in the approach to measure impacts given that subscriptions sometimes do not translate into usage. Thus usage elasticity is conceptually a more accurate estimate of the growth dividend, although it also requires more precise data on usage patterns. In this study, we measure Internet usage elasticity for India using an instrumental variable regression on a panel data set of 19 Indian states. We also do a similar exercise for 23 countries in order to draw international comparisons with the Indian estimates. The growth coefficients of usage, a first for India, are a starting point to understand the magnitude of the growth impact of app-based usage.

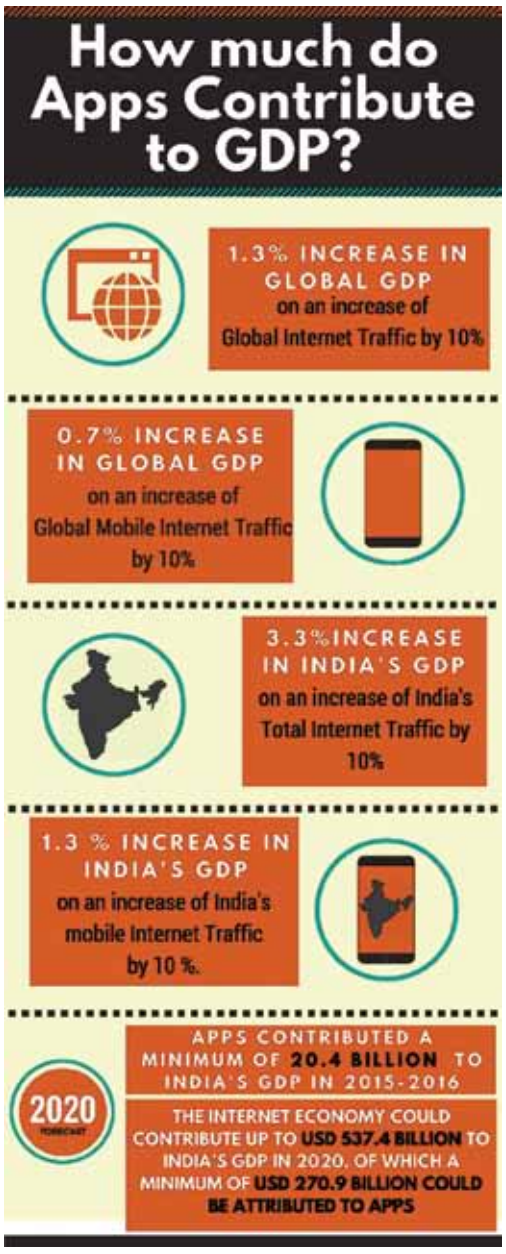
Since not all Internet usage is app based, we moderate the estimate using assumptions on contribution of apps to the Internet Economy in India. We measure Internet usage with CISCO VNI data on total Internet traffic in petabytes per month and mobile Internet traffic in petabytes per month.

The results from the econometric estimations are fortified by case study illustrations of impact generated at the micro-level using a carefully selected collection of 16 apps. The sample of featured apps are chosen to represent the app

KEY RESULTS FROM THE ECONOMETRIC ESTIMATION ARE:

› **10% INCREASE** in global Internet traffic, delivers on average a 1.3% increase in global GDP and a 10% increase in global mobile Internet traffic, delivers on average a 0.7% increase in global GDP

› **10% INCREASE** in India's total Internet traffic, delivers on average a 3.3% increase in India's GDP, and a 10% increase in India's mobile Internet traffic, delivers on average a 1.3% increase in India's GDP



› *Figure 1: Estimates for impact of apps on the global economy and India's economy*

› **17% INCREASE** in India's Internet traffic during the period 2015-2016, resulted in an absolute increase of USD 103.9 billion (Rs. 6,926.5 billion) in India's GDP during the year. An equivalent increase in India's mobile internet traffic during the period 2015-16, would result in an absolute increase of USD 41.4 billion (Rs. 2759.9 billion) in India's GDP during the year

› **APPS CONTRIBUTED** a minimum of USD 20.4 billion (Rs. 1357.6 billion) in the year 2015-16 to India's GDP

› **THE INTERNET ECONOMY** could contribute up to USD 537.4 billion to India's GDP in 2020, of which a minimum of USD 270.9 billion (Rs.18275.9 billion) could be attributed to apps

economy in its entirety - across sectors, the traditional and the modern, across urban and rural areas and the established along with those that are new and upcoming.

Each selected app, other than those falling in the e-governance category, address a unique market need, either left unresolved by the market and/ or government intervention. E-governance apps capture the increased transparency and efficiency of bringing citizen related information and services online. While most apps cater to the entire population, we have selected a few that focus only on urban or only on rural users, and some others that are limited to a specific locality. The case study discussions measure the magnitude of impact created, and also identify challenges to their growth. These challenges feed into our policy discussion.

The broad socio-economic impacts captured by the case studies are summarized below. It is notable how one single app delivers multiple impacts - a combination of economic and social development and on occasions, different aspects of economic growth or social upliftment. The impacts arising out of apps discussed in this report are:

› **Potential for increased income:** *Urbanclap* – Income for service providers within some categories increased by upto 4 times

› **Access to information and reduced asymmetry:** *Practo*- Created a fresh database of verified doctors based on specialization and patient feedback

› **Impact on the social perception and self image of the differently-abled:** *Inclov*- Facilitated matchmaking for the differently-abled and transformed physical spaces into accessible areas for the differently-abled

› **Job Creation:** *Inclov*- Partnered with hotels to create employment for the differently-abled, Direct employment by each of these apps including *PayTM* and *MMT* which work with a team of over 1000 employees each

› **Efficiency in Service Delivery (One stop shop for multiple services):** *MP mobile and Umang* - Integrated multiple government services under a single platform

› **Providing smaller businesses/individuals a platform to market their product/service:** *MMT*-Certification program enabled budget hotels to generate business through the MMT platform

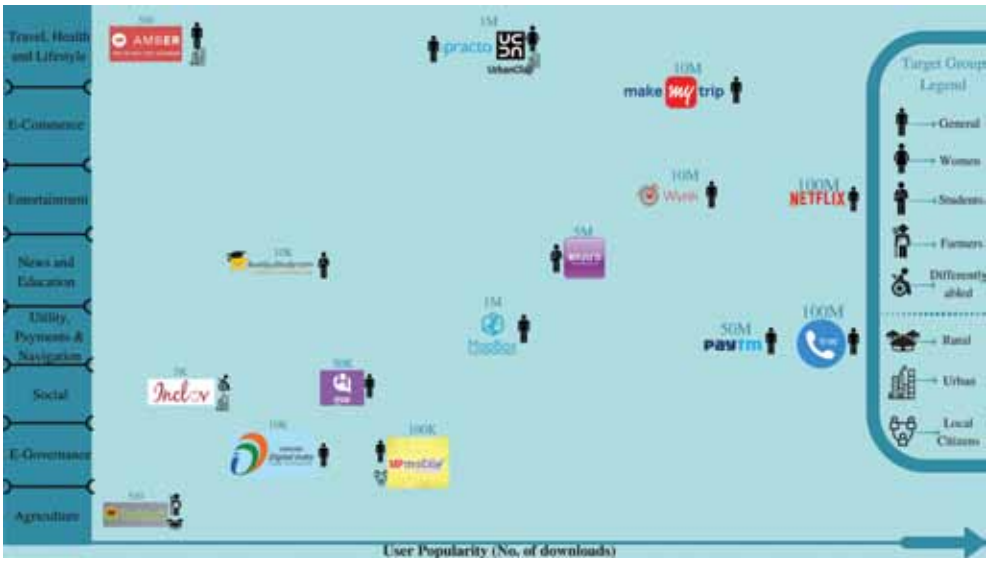
› **Encouraging disintermediation and lowering cost to buyers and sellers:** *farMart* - Platform enabled demand-supply match lowered cost of equipment leasing by upto 20%

› **Popularising use of vernacular languages:** *Mooshak*-Changing social perceptions on the use of local languages within a society where use of English is more fashionable

› **Enabling women safety:** *Truecaller* – Caller identification has helped women manage and block calls from unwanted numbers/ people

For apps to thrive, it is necessary that we address the many challenges that might limit their growth in the future. The policy challenges exist both on the demand and supply sides.

On the supply side, most apps are affected by the limited availability of network infrastructure or Internet connectivity in the areas they opt to serve. Moreover, app design must be improved to operate in light versions that function even where network connectivity is weak and on lower cost smartphones. Demand side challenges are largely associated with availability of content in regional languages. With a huge non-English speaking user base, even for e-governance apps such as MP Mobile the dominance of English is restricting the use of apps by people in semi-urban and rural areas. App development and app design must also address the rising need for increased data security, especially in case of digital payment apps.



› *Figure 2: Framework for Selection of Case Studies*

Apps have facilitated the creation of business models, which require regulators to think beyond the comfort of traditional businesses that operate in physical spaces and require physical movement of goods and services. The emergence of digital media, e-pharmacies, etc. falls outside the regulations within which each of these sectors currently operates. Services delivered through the digital platform sometimes constrained by the absence of clarity on regulations. As apps become core to many businesses, sectoral policies must also align themselves to allow smooth functioning and integration of apps into the economy.

Policy challenges arise in the natural course of innovation and disruption. Apps too have stirred policy debates involving regulation of Over-the-Top (OTT) services, which broadly refer to services that are delivered using existing Internet infrastructure and connectivity provided by a third party. This study is focused primarily on estimating the economic impact of apps. A study of the regulatory environment in which apps operate calls for an independent and explicit assessment that takes in account global experience, the innovation character of apps and an analysis of the instruments, both formal and informal, that could be used for regulation.

APP DESIGN MUST BE IMPROVED TO OPERATE IN LIGHT VERSIONS THAT FUNCTION EVEN WHERE NETWORK CONNECTIVITY IS WEAK AND ON LOWER COST SMARTPHONES.

The discourse on policies towards OTTs and apps is far from settled. However, it may be considered that in the case of new generation internet based application services that have significant socio-economic impact, – it would be premature to pass hard rules. Careful and planned approaches to soft law can be attempted and later developed into more firm rules as the sector matures. The benefits and impacts of the app economy are extensively discussed, and reiterated by the findings in this study. All that is left to be done now is to nurture growth in the fertile app market that can also serve as a catalyst for digital India.

› *Figure 3:* Recommendations

1. Introduction

Mobile phones have become ubiquitous among Indians, with over a billion connections today.[1] In 2016, India grew to become the second largest market of mobile phones in the world, with about half of its population having a mobile phone. In the same year, India also became the second largest smart phone market in the world. While the smart phone market continues to grow, its penetration currently represents about 30% of the country's population[2]. This growth also represents a significant change in its utility from being merely a communication device using voice telephony to a consumption device with numerous offerings ranging from entertainment to e-governance services.

Numerous schemes and initiatives of the government drive India's development agenda. Many of these rely on digitization, access to mobile, and access to Internet. Starting in 2015, the Digital India initiative consolidated efforts of the government in digitization of government services under a single umbrella. This flagship programme of the government envisioned the transformation of India into a digitally empowered society and knowledge economy beginning with the provision of digital infrastructure as a core utility to every citizen. Similarly, JAM (Jan-Dhan, Aadhaar, and Mobile) proposed linking Jan-Dhan accounts, mobile numbers and Aadhaar cards to avoid leakages in subsidy programmes. The recent demonetization drive of the government resulted in a significant push towards digital payments. The Smart Cities Project is also expected to further the need for connectivity infrastructure.

India has often been referred to as a 'mobile first'[3] nation. As noted above, the government has been leveraging the penetration of and access to mobile phones. Over 94% internet connections in India are wireless[4]. Additionally, a recent survey suggest as much as 58% consumers accessed the Internet *only* through their mobile phones. Consequently, content and service providers are increasingly focusing on mobile first strategies[5]. The Indian consumer's appetite for data has only been growing. The volume of wireless broadband data consumed by Indians has risen sharply, from less than 200 million gigabytes (GB) a month in June 2016, to around 1.3 billion GB a month in March 2017. This growth includes the disruptive entry of Reliance Jio, which started operations in September 2016. Data prices per GB have fallen from around $3.5 to $1.8 in the same period[6]. With smartphone penetration set to double by 2022, the increase in data traffic per smartphone is expected to grow by more than double, from 4 GB per month in 2016 to 11 GB per month in 2022[7].

Rise of Apps

At the heart of the smart phone revolution is the 'app'. The term app is an abbreviated form of 'application' and is essentially a software application on a mobile device. The early apps on mobile devices were often termed as 'features' and were pre-loaded on the device. Alarm clocks and, calculators etc. were some of the simplest and earliest apps that were featured on mobile phones. The iconic 'snake' game on mobile phones was also an app. The fundamental nature of the app took a turn with the availability of email on mobile devices. Among the pioneers that popularized this were Blackberry and Palm OS devices.

> **"SMART PHONE MARKET CONTINUES TO GROW, ITS PENETRATION CURRENTLY REPRESENTS ABOUT 30% OF THE COUNTRY'S POPULATION.**

With the launch of Apple's iPhone in 2007, the world of apps transformed forever. Soon after the iPhone, the App Store was launched. Interestingly, the initial proposition did not truly envisage third party app development. At first, Apple offered developers the opportunity to build web-based apps, but it wasn't until a few months later in October 2007 that they announced Software Development Kits (SDKs) for third party app development[8]. The new business model

1. *GSMA Intelligence 2017. The number of unique subscribers in India were 616 million as on June 2016*
2. *https://www.statista.com/statistics/257048/smartphone-user-penetration-in-india/*
3. *The 'mobile first' paradigm refers to the use of mobile technology as top priority in a country's development agenda*
4. *TRAI Performance Indicators Report, December 2016*
5. *Zinnov (2016), India as a Mobile First Nation: Opportunities and Challenges; See also https://www.appannie.com/en/insights/mobile-now-first-screen/*
6. *Internet Trends 2017, Kleiner Perkins Caufield Byer (KPCB)*
7. *Ericsson (2017) Mobility Report. Available at https://www.ericsson.com/assets/local/mobility-report/documents/2017/ericsson-mobility-report-june-2017-rina.pdf*
8. *https://www.forbes.com/sites/markrogowsky/2014/07/11/app-store-at-6-how-steve-jobs-biggest-blunder-became-one-of-apples-greatest-strengths/#6a0c77644652*

broke the 'walled garden' through which network operators controlled the mobile ecosystem. This idea was not easy to execute and posed significant challenges – the most crucial being the balance between providing "an advanced and open platform to developers" and "to protect iPhone users from viruses, malware, privacy attacks, etc"[9]. It wasn't until July, 2008 that the App Store was launched, and its success was evident with 100 million downloads by November 2008. Meanwhile in October 2008, Google launched its Play Store for the Android OS.

In many ways, the fertile ground provided by the mobile OS platforms for third party app development aided the proliferation of this new generation of Internet based mobile apps.

Emergence of the App Economy

Apps have evolved from being offline, and locked-in to devices, to being connected online and available across different operating system platforms. This disruptive innovation resulted in what is commonly referred to as the 'app economy'. Apps have time and again challenged existing technology and

INDIA NOW TOPS THE CHART IN GOOGLE PLAY DOWNLOADS WHEN COMPARED TO INDONESIA, RUSSIA, BRAZIL AND USA.

services. Right from desktop/laptop based email services, retail shopping, taxi services, to voice telephony – all of these have had to adapt or compete with new generation Internet based apps. According to a recent report from Flurry Analytics, Asia and India are leading the *phablet*[10] revolution. India now tops the chart in Google Play downloads when compared to Indonesia, Russia, Brazil and USA[11]. The top downloaded apps from Google's Playstore by Indian users are Whatsapp and Facebook Messenger. Indigenous entertainment apps such as Hotstar and Jio TV have also climbed the charts as popular apps among Indians. According to a recent estimate on the economic impacts of Whatsapp, discretionary consumer spending associated with communication on Whatsapp amounted to between $9.6 and $18.0 billion[12] in India in 2015. In fact government apps such as Bharat Interface for Money (BHIM), Umang, MyGov, Incredible India, etc. are also helping ease accessibility to government related information and services by bringing them online.

The evolution of apps had regulators of legacy services such as telecommunications, cable and broadcast, commercial public transport among others scrambling to manage the disruption. Other stakeholders participating in related industries such as advertising have also had to adapt to this new revolution. In this background the study seeks to estimate the economic and social impact of new generation internet based apps and explore the channels via which such impacts are created. Understanding the impact will allow regulators to take decisions based on systematic evidence rather than hastily responding to groundbreaking innovations.

The main objective of the study is to measure and demonstrate the impact of apps on GDP. We approach the study using two distinct methodologies. The first part of the study is a quantitative estimation of the impact of apps on GDP using econometric methods applied to quantitative models. These models are reduced forms of a set of structural equations that are grounded in economic theory. To reinforce the macro-economic results, the second part fortifies these findings though a set of case studies, which examine apps across various sectors and trace the channels through which economic and social impact are generated. Sections 2 and 3 of the paper focus on the impact assessments, followed by the concluding Section 4 that also reflects on the implications for policy as a result of the disruptions sparked by app based platforms in the service economy.

9. https://smarthealthit.org/2009/09/open-and-safe-hit-platforms/
10. Phablets are devices with screens between 5" to 6.9"
11. Internet Trends 2017, KPCB
12. Rafert and Mate, 2017, "The Global and Country-level Economic Impacts of Whatsapp", Analysis Group

2. Measuring the Economic Impact

With close to three decades of empirical analysis, there is some consensus on the contribution of Information and Communication Technology (ICT) to economic growth. Theoretical research in this area was initiated by a series of studies that focused on measuring the impact of IT on aggregate productivity and output growth for individual countries, mostly the United States. The initial papers found little contribution of ICT to productivity[13]; Solow summarized these findings into his famous aphorism "you can see the computer age everywhere but in the productivity statistics". Several attempts were made to explain this *productivity paradox* in the research that followed. With improved data sets and growth accounting methodologies, studies in the new millennium began to show that investment in ICT did in fact impact economic growth significantly. Ever since, the literature on growth dividends of ICT has evolved into two distinct streams, one that captures the productivity impacts created by increased production and accumulation of IT capital; and the other that captures the general purpose technology (GPT) nature of ICT. The former, popularly referred to as the "*ICT-centered story*[14]" highlights the increase in productivity through direct total factor productivity (TFP) increase in ICT-producing sectors, and through capital deepening and labour productivity improvements in ICT-using sectors. These studies aggregate findings at the firm-level to make macro-economic generalizations. The latter is an "*ICT-related story*[15]", which captures structural shifts and creation of spill-over benefits at the macro-economic level. The pervasive use of computers and related equipments across sectors of the economy, allow ICT to be seen as a GPT. Moreover, technological innovation has facilitated new ways of running and organizing businesses. It is argued that benefits of a new GPT are realized only once adequate secondary innovations have occurred[16]. In the current era of the "gig" economy[17], we can be certain that some of these growth benefits have already kicked in. In comparison with electrification, the other important GPT era from 1894 to 1930, ICT has shown faster improvement and higher number of innovations, measured in terms of patents and trademarks issued[18].

The technological dynamism of the sector has also found expression in the empirical literature. Recent research uses two broad approaches – (i) input output method to estimate the impact of ICT infrastructure (telecom, internet and broadband) on economic growth and employment[19] (ii) Multivariate regression analysis to establish a causal link between ICT infrastructure and economic growth. A pioneering study in the latter genre by Roller and Waverman(2001)[20] was the first to address the two-way causality between GDP growth and telecommunications investments by building a structural model that endogenised the latter[21]. This simply means that the estimation technique recognizes that causality could also run from income level to telephone investment and ignoring this impact could exaggerate the results. Even after controlling for this effect, the results clearly showed a significant impact of telecommunications infrastructure and that it is not

13. *Roach (1987, 1989, 1991); Baily (1986b); Zachary (1991); Berndt and Morrison (1995), Jorgenson and Stiroh (1995)*
14. *Oliner et al, 2007, "Explaining a Productive Decade", Finance and Economics Discussion Series, Division of Research & Statistics and Monetary Affairs, Federal Reserve Board, Washington, D.C.*
15. *Op Cit*
16. *Helpman and Trajtenberg, 1994,*
17. *"Gig economy" is a reference to internet enabled labour markets characterized by short term contracts or freelance workers as opposed to permanent jobs*
18. *Jovanovic and Rousseau, 2005, "General Purpose Technologies" Chapter 18 Handbook of Economic Growth Volume 1 Part , Pages 1881 - 1224*
19. *Crandall (2003), Katz et al (2009), Katz et al (2008), Atkinson (2009), Libenau (2009)*
20. *Roller and Waverman, 2001, "Telecommunications Infrastructure and Economic Development: A Simultaneous Approach", American Economic Review, 91(4), pp. 909-23*
21. *The authors use a four-equation model with an aggregate production function, telecommunications demand and supply, and a telecommunications production function with data from 21 OECD and 14 developing countries.*

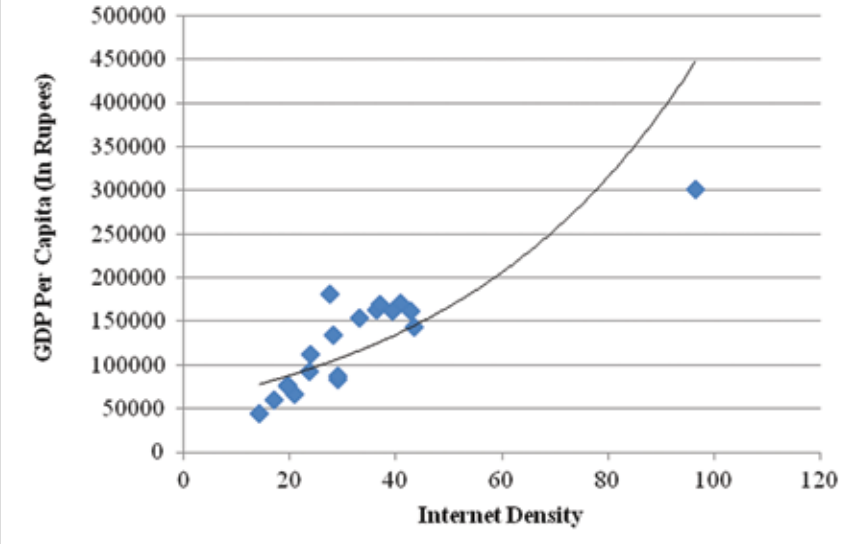
necessarily linear. Thus telecommunications investment creates network externalities that are an increasing function of the number of users. Roller and Waverman's method was adapted in several studies (both cross-country and sub-national) to estimate the impact of different ICT/ telecommunication measures (investment, subscribers, users, mobile, internet, broadband) on economic growth[22]. Other studies in this category have adopted Barro's (1991)[23] endogenous growth model, popularly used to unpick the growth impacts of telecommunication infrastructure[24]. The model is based on a static cross-country regression framework that estimates the causal effect of various policy/ environmental/infrastructure variables on growth.

India, like most emerging markets, has benefitted immensely from ICT diffusion. The studies undertaken at ICRIER, have estimated the growth impacts of both mobile and Internet on the Indian economy over time[25]. According to the most recent estimate a 10% increase in internet subscribers results in a 2.4% increase in the growth of state per capita GDP. The unprecedented increase in Internet subscribers over the last few years can help explain why this estimate is higher than the global average for developing countries[26]. While global Internet subscribers increased at an annual average rate of 8.5% during 2013-2016, the comparable increase in India was 24.2%, largely fueled by the rise of mobile Internet subscribers[27]. However, Internet usage in India has not increased commensurately, global Internet traffic in peta bytes per month increased at an annual average rate of about 30% while the comparable increase in India was 21.7%[28] during the same period. The cost of Internet data plans and smart phones have inhibited growth in data use, in a price sensitive market such as India. Other factors may include inadequate vernacular content, digital illiteracy, etc. These trends are gradually reversing with the lowering cost of technology and rising competition in the services market, jolted by Reliance Jio, the new Schumpeter in India's telecom market.

This study seeks to quantify the impact of Internet usage, and more importantly to isolate the impact of Internet based application services, more generally, India's app economy on GDP growth. In 2015, we estimated the impact of the app economy on job creation in India using the input-output model for India[29]. Our study found that under the business as usual scenario, one more person hired in the app economy would result in an increase of 1.2 persons in direct and indirect employment, and 2.9 in direct, indirect and induced employment[30].

> **10% INCREASE IN INTERNET SUBSCRIBERS RESULTS IN A 2.4% INCREASE IN THE GROWTH OF STATE PER CAPITA GDP.**

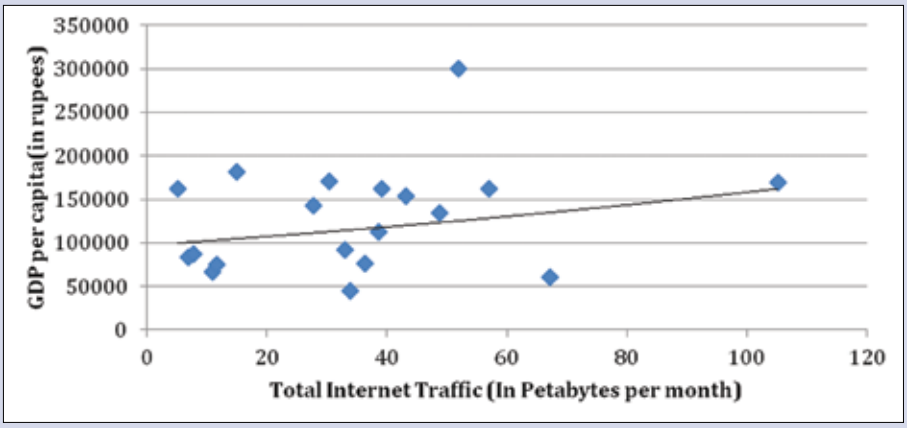
The growth of the app economy in India has been impressive. App Annie, an app-analytics company, recently ranked India as the fourth largest app economy in the world, with annual app downloads to touch 7.7 billion by the end of 2017. This growth is however, not uniform. India, often justifiably referred to as a subcontinent displays remarkable demographic variety across its 29 states and 7 union territories. This heterogeneity makes measurement of impacts possible at the sub-national level. Figure 1 shows the variance in Internet density and income levels across the states of India. For ease



Source: TRAI Performance Indicators Report and CSO

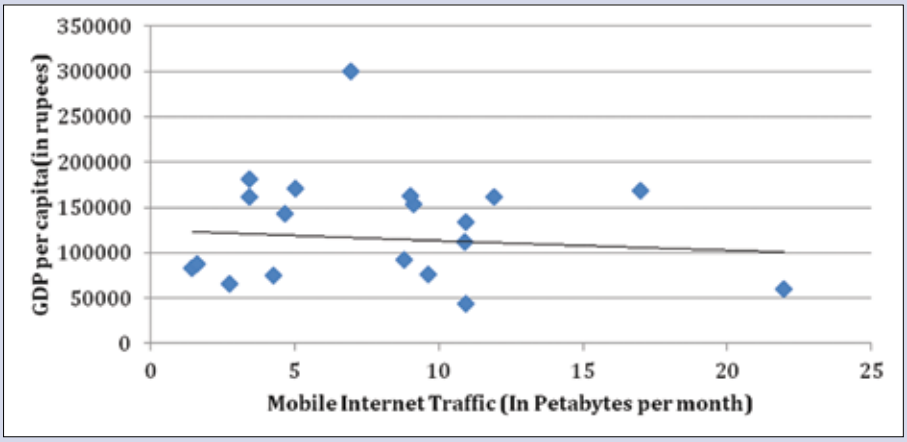
› *Figure 1: Scatter plot for GDP per capita and Internet Density across 19 states in India (2015-16)*

22. Sridhar and Sridhar (2004), Qiang et al (2009), Kathuria et al (2009), Koutrpompis (2009)
23. Barro, 1991, "Economic Growth in a Cross Section of Countries", Quarterly Journal of Economics, Vol 106, No. 2, pp. 407-443
24. Qiang et al (2009), Adrianaivo and Kpodar (2011), Vu (2011), Chavula (2012)
25. Kathuria et al 2009, Kathuria and Kedia (2012), Kathuria et al (2016)
26. According to a World Bank study, developing economies show a 10% increase in broadband penetration increase per capita GDP growth by 1.3%
27. Internet Live Stats, Accessible at http://www.internetlivestats.com/internet-users/, TRAI Performance Indicators Reports (2013, 2016)
28. CISCO Virtual Networking Index Forecasts
29. Kathuria et al, 2015, "An Inquiry into the Impact of India's App Economy", ICRIER
30. 1.2 and 2.9 are the Type I and Type II multipliers respectively



Source: Performance Indicators Report, CSO, CISCO VNI

› *Figure 2a: Scatter plot for GDP per capita and Total Internet Traffic across 19 states in India (2015-16)*



Source: TRAI Performance Indicators Report, CSO, CISCO VNI

› *Figure 2b: Scatter plot for GDP per capita and Mobile Internet Traffic across 19 states in India (2015-16)*

of measurement we use data on 19 telecom circles, which are almost contiguous with state boundaries[31]. The states lie on a smooth positively sloped exponential trend line, establishing a strong correlation between GDP per capita and Internet Density (correlation co-efficient is 0.9). Correlation however does not imply causation and neither does Internet subscriber density capture usage trends across demographics and states. To isolate the impact of Internet on GDP, usage is an improved indicator compared to density. In the absence of data on state-wise Internet traffic patterns, we assume uniform usage across subscribers and distribute total Internet traffic for India across states in the proportion of subscribers per state. Data on total Internet traffic in India was made available by CISCO from their estimates of the Virtual Networking Index (VNI). Figures 2a and 2b display the correlation between total Internet traffic and GDP, and mobile Internet traffic and GDP respectively for 19 states in India. We use estimated values of total Internet traffic and mobile Internet traffic for the econometric estimation in the next section.

Econometric Model

Internet and Internet based applications have drastically transformed the architecture of economic activity. The ubiquity of the Internet makes it impossible to delineate the digital economy from other components of the traditional economy. Brynjolfsson and Joo Hee Oh[32] have commented on how traditional methods that rely on direct expenditures and money spent fail to capture the value of digital innovations. Leveraging the idea of the *Attention Economy*, the authors estimate how consumers value digital services and innovations based on the use of their time spent on the Internet. While data availability on Internet and Internet infrastructure has vastly improved over the last few years, there is substantial scope for progress in recording data on type and intensity of usage, at the individual, firm and macro level. In this study we employ usage as opposed to subscribers as a key driver of impacts since usage patterns in terms of time spent and traffic generated is a preferred metric for impact assessment. Using subscriber numbers as a proxy to measure value generated by Internet applications implicitly assumes that usage across subscribers is uniform and that traffic growth is proportional to subscriber growth. With Internet adoption approaching saturation in some countries,[33] an assumption of monotonic increase in value (i.e. usage) based on number of users might mistakenly overestimate the impact. Internet penetration elasticity is not the same as Internet usage elasticity. Global literature on Internet penetration or Internet user elasticity, finds that a 10% increase in broadband penetration can increase GDP growth by 0.9% to 1.5% on average[34]. The corresponding numbers for Internet usage elasticity are significantly lower. A recent study by Deloitte[35] reports that doubling of mobile data usage can have a positive impact on GDP per capita growth ranging between 0.03% to 1.42% over a year. Some research has also estimated the impact of increased broadband speeds on GDP growth, with elasticities ranging from 0.03% to 0.98%.[36]

31. The assumptions and data modifications are explained in Section 2.1
32. Brynjolfsson and JooHee Oh, 2012, "Measuring the Attention Economy" MIT Initiative on the Digital Economy
33. Internet penetration in United States South Korea, United Kingdom, Japan, Germany, France, Italy, etc. are all over 85%
34. Qiang et al (2009); Koutrompis (2009); McKinsey (2012)
35. Deloitte, 2012, "What is the impact of mobile telephony on economy growth?" A report for the GSM Association. Available at https://www.gsma.com/publicpolicy/wp-content/uploads/2012/11/gsma-deloitte-impact-mobile-telephony-economic-growth.pdf
36. Deloitte, 2016, "The economic impact of disruptions to Internet connectivity" A report for Facebook. Available at http://globalnetworkinitiative.org/sites/default/files/The-Economic-Impact-of-Disruptions-to-Internet-Connectivity-Deloitte.pdf

In this study, we measure Internet usage elasticity for India using an instrumental variable regression on a panel data set of 19 Indian states. We also do a similar exercise for 23 countries in order to draw international comparisons with the Indian estimates. This is the first time that Internet usage elasticity is calculated for India and it is a starting point to unpick the magnitude of impact of app-based usage. Since not all Internet usage is app based, we need to moderate the estimate using assumptions on contribution of apps to the Internet Economy in India to arrive at an accurate estimate.

The model specifications for the Global and India estimations are discussed in Box 1 and Box 2 respectively.[37] We measure Internet usage with data on total Internet traffic in petabytes per month and mobile Internet traffic in petabytes per month as well. Missing values for annual investment in telecom have been either extrapolated or interpolated. In either case we assume linearity. The logarithmic value of the number of secure Internet servers per 1 million is treated as the instrumental variable. Data on secure Internet servers for each country has been extracted from the ITU database.

Table 1 below, provides the descriptive statistics for equations 1 and 2. The range and standard deviation for both dependent and independent variables in the *cross-country regressions* is relatively large when compared to the descriptive statistics for the models using data on India.

› **Table 1:** *Descriptive Statistics for cross-country regression (Equations 1 and 2)*

	GDP (PPP in USD billion)	Total Internet Traffic (in petabyte per month)	Mobile Internet Traffic (in petabyte per month)	Capital/ Labour[38]
Mean	3,410	1195	52	1.15
Standard Deviation	4,450	2081	83	3.09
Minimum	144	43	0.49	0.005
Maximum	19,800	14667	504	13.4

For the India estimation, the logarithmic value of the number of Base Transceiver Stations (BTSs) is used as an instrument. Data on number of BTSs has been extracted from Lok Sabha starred questions.[39]

› **Box 1: Global**: *Model Specification, Assumptions, Data Sources and Descriptive Statistics*

Log GDPit = α + ßLog (K/L)it + νLog (TotalInternetTraffic)it + Di +ε.....(1)

Log GDPit = α + ßLog (K/L)it + νLog (MobileInternetTraffic)it + Di + ε.....(2)

Where i goes across 23 countries and t runs from 2011 to 2015

In equation 1,

Log GDPit is the logarithmic value of PPP adjusted nominal GDP in USD for the ith country in year t. Data for this variable has been extracted from World Bank's database

Log (K/L)it is the logarithmic value of capital intensity as measured by Purchasing Power Parity (PPP) adjusted Net Investments (Net of investments in telecommunication) in the ith country in year t divided by Total Labour Force in the ith country in year t. Data on Net Investments has been estimated by subtracting investments in telecom from total gross capital formation. Data on PPP adjusted total Gross Fixed Capital Formation (GFCF) is extracted from World Bank and that for investments in telecommunication is extracted from ITU. Data on total labour force is also extracted from World Bank's database

Log (TotalInternetTraffic)it is the logarithmic value of total Internet traffic in petabytes per month for the ith country in year t. Data on total Internet traffic was made available by CISCO's VNI database.

Di are 23 country dummies

α and ß are the Constant and Error terms respectively

In equation 2,

All variables remain the same, except Log (MobileInternetTraffic)it which is the logarithmic value

37. Since all models use a logarithmic transformation for dependent and independent variables, the coefficients are all elasticities
38. PPP adjusted Net Investments (Net of Investments in Telecom) in USD million divided by total labour force
39. The data for 2013 and 2014 are March figures, however for 2015 and 2016 they are September 2015 and January 2016 respectively. We work with these numbers as the change in BTSs is not very dynamic during a year.

Log GDPit = α + ßLog (K/L)it + vLog (TotalInternetTraffic)it + Di + Ɛ………………….…(3)

Log GDPit = α + ßLog (K/L)it + vLog (MobileInternetTraffic)it + Di + Ɛ……………………(4)

Where i goes across 19 states[1] of India and t runs from 2013 to 2016[2]

In equation 3,

Log GDPit is the logarithmic value of nominal state domestic product in rupees lakhs (using the 2011-12 base) for the ith state in year t. Data for this variable has been extracted from the State Series data of the National Accounts (CSO)[3].

Log (K/L)it is the logarithmic value of capital intensity as measured by Net Investments (Net of investments in telecommunication) in rupees lakhs for the ith state in year t divided by Total Persons Engaged in the ith state in year t. Data on Net Investments has been estimated by subtracting investments in telecom from total gross capital formation in the country and distributed across states using the proportion of factories as distributed across states. Data on Net Investments is extracted from the National Accounts Statistics (CSO), on number of factories and total persons engaged from the Annual Survey of Industries[4].

Log (TotalInternetTraffic)it is the logarithmic value of total Internet traffic in petabytes per month for the ith state in year t. In the absence of state level data, total Internet traffic has been distributed using the proportion of number of Internet subscribers in each state. CISCO VNI made data on total Internet traffic in India available and data on Internet users was extracted from TRAI Performance Indicators Report.

Di are 19 state dummies

α and Ɛ are the Constant and Error terms respectively

In equation 4,

All variables remain the same, except Log (MobileInternetTraffic)it which is the logarithmic value of mobile internet traffic in petabytes per month for the ith state in year t. In the absence of state level data, mobile Internet traffic has been distributed using the proportion of number of mobile subscribers in each state. CISCO VNI made data on mobile Internet traffic in India available and data on mobile users was extracted from TRAI Performance Indicators Report..

1 The 19 states include Andhra Pradesh, Assam, Bihar, Delhi, Gujarat Haryana, Himachal Pradesh, Jammu and Kashmir, Karnataka, Kerala, Madhya Pradesh, North East, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal. For ease of measurement and concordance with telecom administrative circles North East includes Arunachal Pradesh, Tripura, Mizoram, Meghalaya, Nagaland and Manipur, Uttar Pradesh includes Uttar Pradesh and Uttarakhand, Madhya Pradesh includes Madhya Pradesh and Chattisgarh, Maharashtra includes Maharashtra and Goa, Bihar includes Bihar and Jharkhand, Tamil Nadu includes Tamil Nadu and Puducherry, West Bengal includes West Bengal, Andaman and Nicobar islands and Sikkim, Punjab includes Punjab and Chandigarh, Andhra Pradesh includes Andhra Pradesh and Telengana

2 In 2012, definitions for wireless Internet subscribers was revised by TRAI; comparable numbers on Internet usage are therefore available only from March 2013. Data on Internet and mobile traffic, made available by CISCO VNI have been extrapolated for 2016, using data for years 2011 to 2015

3 Data on State Domestic Product for the modified states has been estimated by aggregating the individual state estimates

4 Data on number of factories and total persons engaged for the modified states has been estimated by aggregating the individual state estimates

Descriptive statistics for the India model are presented in Table 2. Besides statistics for the sample as a whole, we also report statistics for developed and developing states, categorized on the basis of a threshold state per capita domestic product. The category of developing states include Jammu & Kashmir, Assam, Bihar, Uttar Pradesh, West Bengal, Madhya Pradesh, Rajasthan, North East, Odisha and Himachal Pradesh. We use the classification to identify difference in magnitude of impact across states in the next section.

Table 2: *Descriptive Statistics for Regression Models on India (Equations 3 and 4)*

		SDP (In rupees crore)	**Total Internet Traffic** (in petabyte per month)	**Mobile Internet Traffic** (in petabyte per month)	**Capital/ Labour[40]**
Developing	Mean	455000	35.02	4.69	0.74
	Standard Deviation	350000	28.79	4.73	0.16
	Minimum	8281978	5.06	0.38	0.45
	Maximum	134000000	125.81	21.97	1.04
Developed	Mean	81100000	57.18	5.74	0.91
	Standard Deviation	43700000	29.78	3.72	0.31
	Minimum	31900000	14.92	0.93	0.45
	Maximum	202000000	145.59	16.99	1.7
Total	Mean	62400000	45.52	5.19	0.82
	Standard Deviation	**43000000**	**31.13**	**4.29**	**0.26**
	Minimum	**8281978**	**5.1**	**0.38**	**0.45**
	Maximum	**202000000**	**145.59**	**21.97**	**1.7**

40. Net Investments (Net of telecommunication investments) in rupees lakhs divided by total persons engaged

The key results of the estimation are:

The coefficients for total Internet traffic and mobile Internet traffic in the cross-country regressions are both positive and significant[41] ***and imply that a 10% increase in global Internet traffic, delivers on average a 1.3% increase in global GDP and a 10% increase in global mobile Internet traffic, delivers on average a 0.7% increase in global GDP.***

The comparable coefficients for total Internet traffic and mobile Internet traffic in India, both positive and significant[42], ***imply that a 10% increase in India's total Internet traffic, delivers on average a 3.3% increase in India's GDP, and a 10% increase in India's mobile Internet traffic, delivers on average a 1.3% increase in India's GDP.***

Table 3 compares the growth elasticity estimate across the four models.

› *Table 3: Comparison of estimated growth elasticitiesStatistics for cross-country regression (Equations 1 and 2)*

	India		Global	
	Total Internet Traffic	*Mobile Internet Traffic*	*Total Internet Traffic*	*Mobile Internet Traffic*
Growth Elasticity	*0.33 (6.83)*	*0.13(5.96)*	*0.13 (16.45)*	*0.07 (15.96)*

The numbers in parentheses are t-values

We split the India sample into developed and developing states using a threshold level of per capita income (average across 4 years of data) and find that the growth dividend for the developed category of states is higher. The possibility of Indian states not having reached critical mass values of Internet usage could be the reason why developed states show higher growth impacts.

The magnitude of impact can be translated into in an absolute amount by multiplying the actual increase in total Internet and mobile Internet traffic with the elasticity estimate, and the GDP of the base year. For example, using the growth elasticity estimate of 0.33 for India, *a 17% increase*[43] *in total Internet traffic during the period 2015-2016, resulted in an absolute increase of USD 103.9 billion*[44] *in* GDP. This includes direct expenditure on the Internet as well as spillovers into the other sectors of the economy and accounted for about 5% of Nominal GDP in 2016. The estimate compares favorably with BCG's estimate of 2012 that projected the Internet Economy to account for 5.6% of GDP in India by 2016[45]. For mobile internet, *an estimated increase of 8% in traffic during the year 2015-16, resulted in an absolute increase of USD 19.6 billion in India's GDP in 2016.* Of course this is a subset of the total value created by the Internet.

The global elasticity estimates are much lower compared to those for India. The set of 23 countries used in the estimation include only 2 countries that fall within the low or lower middle-income category of the World Bank[46]. As a result the estimate is more likely to reflect that of developed countries, which as empirical literature suggests, is lower than that for developing countries[47]. It is argued that telecommunications compensate for infrastructure and service deficits in developing countries that are well provided for in developed countries.

Apps versus Browser and the impact on GDP in India

The complex interconnectivity in operation and usage, make it hard to delineate the value generated by apps from that of the total Internet. Moreover, the recent debates on consumer preferences for app-based versus browser-based content[48], especially on mobile phones, adds another dimension to the problem. User behaviour suggests that both apps and web serve a purpose, and are likely to co-exist. Studies conducted by Flurry, Venturebeat and ComScore in 2015, primarily on US consumers; suggest that apps contribute to about 80 percent of total time spent on mobile. With over 90 percent subscribers accessing the Internet on mobile,

INDIA'S INTERNET TRAFFIC FROM NON-PC DEVICES WAS 28% OF TOTAL INTERNET TRAFFIC IN 2015.

41. Detailed results for co-efficients and significance are provided in Appendix I. The models address the problem of endogeneity using instrumentation and are run under assumptions of homoskedasticity using robust standard errors. The values for Variance Inflation Factor (VIF) , reported in the appendix, testify the absence of multi-collinearity

42. Detailed results for co-efficients and significance are provided in Appendix II. The models address the problem of endogeneity using instrumentation and are run under assumptions of homoskedasticity using robust standard errors. The values for Variance Inflation Factor (VIF) , reported in the appendix, testify the absence of multi-collinearity

43. 17% increase in Internet traffic in India is based on linear extrapolation for values between 2011 and 2015 made available by CISCO VNI data

*44. This value is given by 0.17 (growth in Internet traffic)*0.33 (growth elasticity) *USD 1,873 billion (Nominal GDP in 2015)*

45. According to the same report, for the group of G-20 countries, internet contributed 5.3% of their collective GDP in 2016 "The Internet Economy in the G-20", 2012, The Boston Consulting Group. Available at https://www.bcg.com/documents/file100409.pdf

46. Reference to World Bank classification of countries by income. Available at https://datahelpdesk.worldbank.org/knowledgebase/articles/906519

47. Qiang 2009

48. https://www.business.com/articles/mobile-apps-vs-mobile-web-do-you-have-to-choose/

India could fall in the same category. In a comparison of mobile and desktop, time spent on mobile Internet exceeds desktop Internet, by close to double in some countries[49]. Though Internet use on mobile has increased dramatically in the last few years, according to Cisco data, it continues to contribute less than 10% to global Internet traffic[50]. This could also mean that users are viewing Internet content on a mobile device but using a fixed line connection. The proportion of mobile Internet traffic to total Internet traffic in India is much higher than the global average, estimated at 15.8% in 2015[51]. However, traffic cannot be proportionately attributed to time spent. For example, video traffic, which contributed to more than 50% of total Internet traffic, is primarily consumed using fixed line Internet, even if viewed on a mobile device. From a CISCO estimate, India's Internet traffic from non-PC devices was 28% of total Internet traffic in 2015[52]. According to experts, 70% of mobile or non-PC traffic could be attributable to apps implying that apps *contributed a minimum of USD 20.4 billion to India's economy in the year 2015-16*[53]. Thus the absolute impact of apps on the Indian economy in 2015-16 is estimated in the range of USD 20.4 to USD 103.9, the latter an upper bound in case all internet traffic is assumed to be driven by apps. These estimates do not include non-internet based IP traffic generated by apps and to that extent may undervalue the contribution of apps to the economy.

Forecasts for 2020

We use our elasticity estimates to project the contribution of the Internet economy and apps in the future. According to CISCO VNI's forecast for India, Internet traffic in India is likely to increase by close to 4.4 times between 2015 and 2020. During this time, the distribution of traffic is also projected to move in favour of non-PC devices from 28 percent to 72 percent. As a whole the Internet economy will be worth USD 537.4 billion in 2020 of which USD 270.9 billion is the estimated lower bound for the app economy[54]. The ten-fold increase in the contribution of the app economy from our 2016 estimate is driven by not only the increase in total Internet traffic but also the significant change in access using mobile devices. The forecast relies on the assumption that the Internet economy model of today will continue to be representative of the Internet economy in 2020. Any disruption in terms of technological breakthroughs or development of killer applications could render the model outdated and the current estimates inaccurate.

IN CONCLUSION, OUR TOP-LINE RESULTS ARE:

- **10% INCREASE** in global Internet traffic, delivers on average a 1.3% increase in global GDP and a 10% increase in global mobile Internet traffic, delivers on average a 0.7% increase in global GDP
- **10% INCREASE** in India's total Internet traffic, delivers on average a 3.3% increase in India's GDP, and a 10% increase in India's mobile Internet traffic, delivers on average a 1.3% increase in India's GDP
- **17% INCREASE** in India's Internet traffic during the period 2015-2016, resulted in an absolute increase of USD 103.9 billion (Rs. 6,926.5 billion) in India's GDP during the year. An equivalent increase in India's mobile internet traffic during the period 2015-16, would result in an absolute increase of USD 41.4 billion (Rs. 2759.9 billion) in India's GDP during the year
- **APPS CONTRIBUTED** a **minimum** of USD 20.4 billion (Rs. 1357.6 billion) in the year 2015-16 to India's GDP
- **THE INTERNET** economy could contribute upto USD 537.4 billion to India's GDP in 2020, of which a **minimum** of USD 270.9 billion (Rs.18275.9 billion) could be attributed to apps

In any case, we can be sure that the Internet economy will magnify to at least 15% by 2020, with apps contributing at a minimum half of the value.

The growth impacts are better understood in conjunction with the case studies illustrated in the following section. These case studies help explain the mechanisms by which impact at the micro-level translates into growth at the macro level. It also helps to understand the sectoral configuration of the apps and their associated growth potential in India.

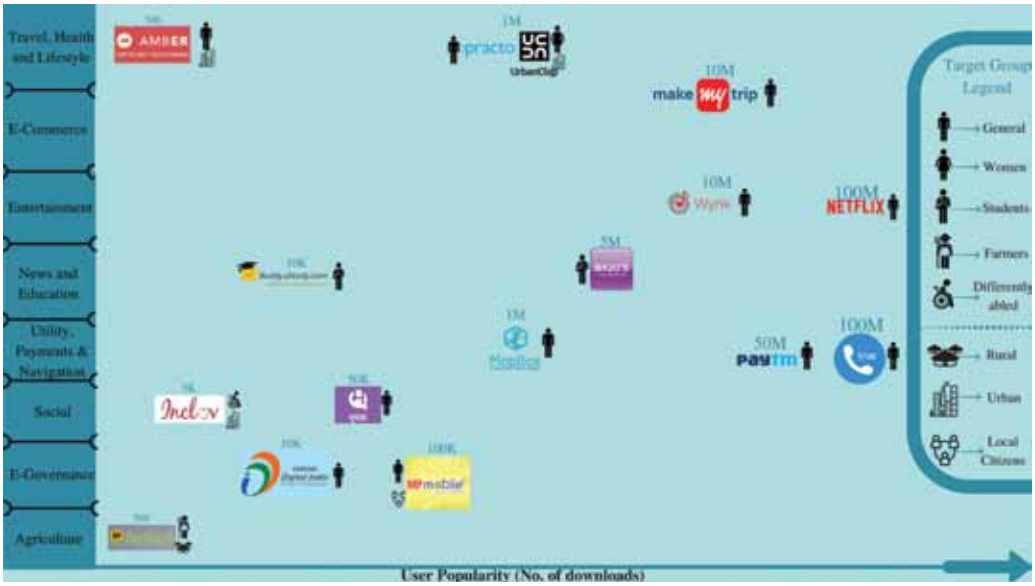
49. https://digiday.com/media/mobile-overtaking-desktops-around-world-5-charts/
50. CISCO VNI data 2015
51. Ibid
52. CISCO VNI Complete Forecast Highlights for India
53. Using growth elasticity of 0.33 estimated above, 28% of traffic generated from non-PC devices deliver about USD 29.1 billion; 70% of this value is attributed to apps.
54. Between 2015 and 2020 GDP is forecast to increase by X% while Internet traffic is set to grow by 440 percent implying a cumulative increase of USD 2.7 trillion over the 5 year period in the internet economy. 72% of total Internet traffic is non-PC devices, of which we continue to assume 70% is through apps even in 2020.

3. Impact Illustration using Case Studies

Internet has transformed the way we interact in the social, political and economic environments. With its increased penetration, especially in the multi-layered emerging market economies, it has led to a surge in entrepreneurial activity that generates economic value, besides also empowering civil society in several ways that impact daily lives. The driving force behind widespread internet adoption, in emerging markets like India has been the rise of affordable smartphones and tablets that have allowed for wider adoption of apps. Data from India show that entrepreneurship is synonymous with technology start-ups and app based solutions and services[55]. Apps have become a popular medium to reach out to target audiences for both businesses and social initiatives. It improves access, creates efficiencies and generates impacts that are simultaneously palpable and intangible. Case studies have served as a powerful tool of analysis in social science research, especially when the response to a research question cannot be fully captured by quantitative methods alone. For this study, it is essential to acknowledge the vastness and the intrinsic heterogeneity of the app ecosystem that engenders impacts not always reflected in data, or translatable into a quantifiable estimate. This creates both a need and an opportunity to look beyond the absolute value created by the app economy. It is necessary to delve deeper into understanding these apps and the sectors they operate in - their underlying objectives, markets they seek to serve, factors that drive demand for their services, sections of society they impact, and the challenges that hinder their growth.

While most apps cater to the entire population, we have also selected a few that focus only on urban or only on rural users, and some others that are limited to a specific locality. In addition we have identified apps with special category users such as students, women and differently-abled. Apps are presented based on app-store definitions, although some categories have been aggregated for neater representation (Figure 3). For example we have clubbed Travel, Health and Lifestyle, News and Education and Utility, Finance and Navigation. The apps are mapped on a continuum of greater popularity from left to right. A legend identifies user types and

55. The Indian Institute of Technology is the fourth ranked educational institution in the world after Stanford, Harvard and University of California to churn out 13 Unicorn founders.



› *Figure 3: Framework for Selection of Case Studies*

also geographical reach. Apps that service the entire country do not have a separate geographical identifier. Our choice of apps skips the gaming category from our mini repository of cases, not by choice, but due to inability to gain access to an effective gaming app. However, the sixteen selected case studies are adequate to establish and reinforce the channels through which the socio-economic impacts are being created.

APPS HAVE ALSO HELPED THE GOVERNMENTS IMPROVE TRANSPARENCY AND EFFICIENCY IN ITS SERVICES.

Each selected app address a unique market need, either left unresolved by the market or being inimical to government intervention. For example, Truecaller is successfully tackling the market failure in containing the rise of spam calling by improved caller identification. It is an inconvenience and inefficiency that remained unaddressed despite TRAI's Do Not Disturb Regulations. Another example is that of farMart, an agricultural equipment aggregator that has adopted the shared economy model to optimize use of equipment. With a trend of declining land holdings and underused equipment, it is among the best available solutions for farmers to ensure maintenance and income from their investments in equipment. Apps have also helped the Governments improve transparency and efficiency in its services by bringing citizen related information and services online. Some of these efforts are at the state-level while others are integrated under the Digital India programme.

Through the case studies, we attempt to quantify the economic impact of apps, and where possible highlight the social impact. In case of relatively new apps with a small cohort of users we have not been able to quantify the economic impact. We do however contextualize and explain the potential of such apps. For example, apps such as Mooshak and Amber, do not provide immediate opportunities to measure employment or additional income generated, but are socially relevant in the objectives they have set out to achieve. Each of the 16 apps has been tabulated below (Table 4) to illustrate functionality, impact and challenges to growth. The table allows for a quick reference to the scope and magnitude of impact created by different apps and also compares across app types. For details on each of the case studies, please refer to Appendix III of the report.

› *Table 4: Description, Impact and Challenges for Selected Apps*

Name of Application	Problem Addressed	Impact	Challenges
Amber (the app operations have been suspended temporarily by the company due to reconsiderations in the business model)	• *Lack of a well-functioning on-call ambulance service* • *Lack of a protocol driven approach to medical emergencies in India.*	• *Integrated services, including co-ordination with hospital emergency rooms and record keeping of patient history allows for quick and seamless medical aid to patients in times of emergency.* • *Proxy feature allows a user to operate the app on behalf of anyone remotely. This is especially useful for the elderly, who are not very adept with technology, more so in case of emergencies*	• *Creating quality assurance requires better training of paramedics in India Ambulances with high quality of services are hard to find* • *Re-establishing faith in the quality of ambulance services among urban users who do not trust existing citizen services.*

Buddy4Study	• *Huge information asymmetry in the market for scholarships. A large number of meritorious students are unaware of the available scholarships. Funds allocated for scholarships often go unrewarded because of poor response.*	• *Over 20000 students have received scholarships worth more than INR 24 crores through the platform* • *Has helped increase outreach of scholarship programmes by partnering with 40 newspapers that carry this information at minimal cost. This is in sharp contrast to the huge marketing budget of scholarship programs, often more than the value of the scholarship itself.* • *Scholarship Tracking System assures appropriate use of funds, bringing more transparency to the system.* • *Helped students from underprivileged backgrounds (from smaller cities) secure scholarships and pursue higher education.*	• *Poor Internet connection in smaller cities limits the circulation of information on scholarships, especially among those who are likely to benefit more from them.* • *Inability to collaborate with Government on a very large number of scholarships offered by various departments, leaving out a big chunk of the available scholarships in the market*
BYJU's	• *A need to improve the understanding of fundamental concepts among young students in their formative years, especially in smaller cities that do not provide quality education infrastructure.*	• *Most of BYJU's students come from outside the top ten cities. The app enables students to track their learning curve.* • *Developing world class content in education by collaborating with child psychologists and graphic designers.*	• *Parents' perception that education tools on smartphones, especially at an early age, is not useful, and might in fact harm the child's physical development.* • *The inability to price the service lower, impacts the uptake in smaller cities.*
Chennai Flood map	• *Problems of navigating a city or locality in times of natural disasters or emergency. This web app helped people navigate through Chennai during the days of flooding and facilitated transportation of relief measures*	• *Over 1 million views in a two week period and showed about 1515 inundated roads within 24 hours of its operations[56].* • *Its crowd-sourcing feature helped in gathering information about inundated areas across the city.* • *Several NGOs were able to identify high-risk areas, coordinate relief supplies and deliver them to those in need.*	• *Uncertainty around the Geospatial Information Regulation Bill, 2016, which aims to license the production and restrict dissemination of geospatial data[57].* • *People not knowing how to use maps limits the scope of this app, as most of it is based on crowd-sourced information.*
farMart	• *The market for renting farm machinery is unorganized. Farmers are often unable to find the required equipment, which affects their output[58].* • *Farmers with under-utilized machinery are not able to monetise investments given their inability to identify farmers who need such machinery.*	• *109 daily active users, 300-350 missed calls and 40-50 orders received per day.* • *Reduction in cost of renting equipment between 10%-20% in some villages.* • *Planning in advance allows machinery bookings to be aggregated within a single location, optimizing logistics and reducing fuel costs.* • *A formal framework enables farmers to opt out of informal borrowing at exorbitant rates of interest. It offers users 15 day loans at a 1% rate of interest.* • *Sharing model generates a return of 16%-17% for machinery suppliers.*	• *Poor internet connectivity impacts digital payments and GPS tracking of leased out equipment, especially tractors.* • *Lack of digital options makes collection and handling of cash inefficient and costly.*

56. Pyne, S 2015, 'This ingenious Chennai Map shows which areas are currently flooded #ChennaiRains', Business Insider 2 December. Available from: http://www.businessinsider.in/This-ingenious-Chennai-Map-shows-which-areasare-currently-flooded-ChennaiRains/articleshow/50008460.cms (12 June, 2017).

57. Srivas, A 2017, 'How the Controversial Geospatial Bill Snowballed – And Was Then Shoved Into Cold Storage', The Wire 7 March. Available from: https://thewire.in/114584/controversial-geospatial-bill-snowballed-shoved-cold-storage/ (12 June, 2017).

58. Dias, C 2016, 'farMart: The Rental Marketplace for Farm Equipment', Networked India 15 July. Available from: http://www.networkedindia.com/2016/07/15/farmart-the-rental-marketplace-for-farm-equipment/ (12 June, 2017).

Inclov	• *The social taboo associated with dating and matchmaking among the differently abled. Most existing dating apps are either inaccessible, non-inclusive or do not have a high success rate for people with disabilities*	• *Over 3000 matches on the app so far. Some couples who met on the app, also eventually got married.* • *20 meet ups in 10 cities under the Social Spaces initiative, encouraging the disabled to step out of home.* • *They have also facilitated accessibility to physical spaces such as Kara Café and promoted inclusive yoga in partnership with Zorba.* • *Helped in employment generation of the disabled by partnering with large employers such as Lemon Tree Hotels.*	• *Poor response of female users who are more affected by social pressures. The ratio of male to female users on the app is terribly skewed in favour of men (80:20).* • *The current version does not support local language features.*
Make my Trip	• *To address the lack of familiarity and distrust among Indian users, especially from smaller cities while booking tickets online*	• *In 2016, online bookings accounted for $13 billion in a $47 billion market, driven by apps that allow flexibility to make bookings on-the-go as well as make spontaneous travel plans.* • *Number of transactions made by app users is twice that of non-app users.* • *145% rise in domestic hotel transactions along with a 59% increase in international hotel bookings in 2016.* • *It is driving the Middle India agenda by building reach and penetration beyond metro towns* • *Facility of Assured Hotels' using which hotels, cabs, buses etc are categorized and certified to address customer's concern on quality and simultaneously provide opportunity for smaller businesses to grow*	• *Existence of fundamental trust deficit, inherent in the Indian traveler's psyche.* • *The lack of Information and booking options in vernacular languages.* • *Poor infrastructure, especially mobile Internet access, since apps are driving growth of the online travel industry*[59].
Mooshak	• *Absence of social media platforms that exclusively promote exchange in local languages*[60].	• *It is a portal that appeals more to users in tier-2 and tier-3 cities as compared to the ultra-urban social media apps. For many users, Mooshak serves as their first social media experience.* • *Users are dominated by students and retired professionals/ businessmen over the age of 65 years, which is in contrast to other popular networks like Facebook and Twitter that are dominated by young adults and the middle-aged.* • *Facilitating the creation of a more language inclusive internet ecosystem.*	• *Current design of the app, does not allow smooth functioning on slower networks like 2G* • *The need to change social perceptions surrounding use of vernacular languages when communicating in English is perceived as more fashionable*

59. India's Internet Opportunity, 2013. Available from: http://www.mckinsey.com/industries/high-tech/our-insights/indias-internet-opportunity (12 June, 2017).

60. Gupta, K 2016, 'Importance of local language in Indian context and social media', Thinking Aloud 13 April. Available from: http://www.thinkingaloud.in/home/importance-of-local-language-in-indian-context-and-social-media (12 June, 2017).

MP Mobile	• *Absence of an integrated platform for government services that increase inconvenience and costs for citizens who make multiple trips to different government offices.* • *The massive misutilisation of government manpower to deliver government services*	• *Massive improvement in access to information. MP Mobile has integrated services from 12 government departments, all under a single platform.* • *Over 59000 citizens benefited from access to board exam results and over 200000 students took online counseling for engineering on MP Mobile. 1361 citizens have benefited from the online electricity bill payment system.* • *Leveraged the CSC model to boost entrepreneurship in the state.* • *Apps enable better penetration in rural areas, as mobile phones are far more ubiquitous than computers.*	• *General lack of awareness among citizens about e-governance apps and other digital initiatives of the government creates a demand side problem* • *Lack of language options hinders access in rural areas.*
Netflix	• *The inability to produce an on-demand platform under the classical cable TV system; an affordable and personalized experience that also seeks to curb piracy in distribution of content*	• *Reduction in piracy in countries where Netflix started operations. Download of torrent websites declined by approximately 30%.* • *Through their 'Open Connect Program', Netflix invests in its own Content Delivery Network (CDN) which enhances user experience* • *Providing worldwide exposure to national talent (examples – Vir Das and Aditi Mittal).* • *Aims to strike a balance between local and mainstream content, star-driven and independent films.*	• *Lack of fast networks – an inadequacy in most emerging markets. High data costs and caps on data affect their business.* • *Consumers face technical issues while paying the subscription fees online because of patchy infrastructure.*
Paytm	• *Lack of digitization in payment processing and the hassle of making payments using the credit/debit card in case of non-cash transactions.*	• *Paytm has scaled to over 220 Million registered users[61] .* • *Mom-and-Pop stores that cannot afford to accept card payments due to high costs of purchasing machines and associated items can easily accept online payments via Paytm. This was especially true for protecting sales of kirana stores in the post-demonetisation period.* • *Reduces cost of carrying cash and increases convenience of transacting and even transferring money.*	• *While use of smartphones has increased, internet penetration remains low.* • *Lack of financial literacy and reluctance to adapt to new technologies[62].* • *Concerns have been raised regarding data security pertaining to the mobile number based money transfer system.*
Practo	• *Information asymmetry in the health care industry, especially related to quality of doctors in different localities.*	• *Nearly 200,000 registered doctors on its database.* • *Nearly 25% of its traffic is from tier-2 and tier-3 cities illustrating improved access to medical facilities in smaller towns.* • *The feedback and rating system has created more transparency in identification of doctors and the follow on consultations* • *The online consultation feature enables doctors to see more patients in a day, and also enabled patients to consult doctors with ease for minor ailments. Increasing the efficiency of health care services in a country that suffers from limited health care facilities*	• *The verification of doctors and their qualifications can be tedious and often tricky* • *Lack of clarity on government policy related e-prescriptions, and telemedicine limits the growth of some of their businesses, especially e-pharmacy.*

61. https://paytm.com/about-us/ (July 3, 2017)
62. article-digital-payment-firms-cash-in-on-demonetisation-but-can-it-last-1631471 (July 3, 2017).

		• *The app has promoted Medical Tourism in an unprecedented way, with citizens of other countries using Practo to book appointments with Indian doctors.*	
Truecaller	• *The inconvenience associated with not knowing the identity of callers and answering unwanted calls.*	• *More than 450 million spam calls have been identified in India. About 70% of spam calls are captured by Truecaller's automatic spam filter[63]. There are country based spammer lists that are regularly updated[64].* • *Truecaller Priority has benefited over 20 companies by ensuring frictionless communication with their e-commerce customers.* • *Provision for improving women's safety as it helps identify and block unwanted callers.*	• *Data privacy became a major concern after the app was hacked in 2013[65].* • *Voice over IP and integration of technology might warrant fresh investments from Truecaller to upgrade its caller identification system which currently runs on a network that dominated by traditional voice calling.*
UMANG (in its beta-testing phase)	• *Lack of a unified platform using which citizens can access all services provided by different government departments*	• *The app has had 10000 downloads. It provides 18 services presently and aims to provide 200 services by December 2019.* • *Mitigates the information asymmetry regarding government services in tier-2 and tier-3 cities, semi-urban and rural areas, where people may not be aware of these services.* • *By providing their services through UMANG, departments will no longer have to undertake tendering processes for individual applications and will be integrated with Aadhar, DigiLocker, Payment Gateways and RAS at no cost.*	• *Low rate of Internet penetration may act as an impediment in the wide adoption of the app.* • *Since the app is an integrator of services, there is a risk that the size of the app may become too large to function smoothly.*
Urban Clap	• *The demand supply mismatch in provision of utility services such as beauty, plumbing, electrical repairing, etc in urban areas, especially in case of families that move to a new city or a new locality within the same city*	• *Partnership with 65000 professionals across 8 cities and served over 1.5 million customers in the last two years.* • *There are 800 empanelled beauticians across 8 cities. There has been a 2-4 fold increase in their earnings as beauticians retain 80% of their earnings unlike the 20% they retained while working at beauty parlours.* • *Standardization in pricing and service experience enabled by training that provides quality assurance* • *Facilitated the elimination of middlemen, helped professionals market their skills and created a network of micro-entrepreneurs.*	• *The inability to verify background of all service providers who register on the app in which case the liability of poor service falls on Urban Clap* • *The mindset of consumers on reliability of portals like Urbanclap to train and empanel quality service providers*
Wynk	• *The need to spur growth in digital distribution of music and simultaneously curb music piracy that has proliferated the industry*	• *According to Wynk, Piracy in music has been curbed by 30%-35%.* • *The number of songs played online rose from 40,000 to 4 Million from 2014 to 2015 and 20% of this growth can be attributed to Wynk.* • *About 75%-80% of Wynk's users belong to the non-English speaking, semi-literate category.*	• *No legal framework for distribution of content on an online platform* • *Monetisation is a challenge as users are not willing to pay a fee for access* • *Limited collection of regional music, as urban users dominate the current mix and have a preference for Bollywood music*

63. https://blog.truecaller.com/2016/05/18/trueinsights-new-spam-filters-from-us-less-spam-for-you/ (12 June, 2017).
64. https://blog.truecaller.com/2017/02/22/truecaller-spam-call-research/ (12 June, 2017).
65. D'Monte, L 2014, 'Truecaller's biggest challenge lies in scaling up hiring: CEO Alan Mamedi', Livemint 7 April. Available from: http://www.livemint.com/Companies/TkgFNLe6saq403IzHX788I/Truecallers-biggest-challenge-lies-in-scaling-up-hiring-CE.html (12 June, 2017).

The case studies provide evidence of technology led remedy to a problem where previous attempts whether by the market or the government were inadequate or even ineffective. Not all apps are successful, but the ones that are, show an improvement in quality and efficiency of an existing market-based and/or government service. For example, Amber provides an integrated medical emergency response platform that includes existing citizen services (helpline numbers 102 and 108). The impacts from app-based services are manifold - users find means of livelihood, higher income, improved standard of living and access to quality services at lower costs especially in sectors such as health and education, which are fraught with information asymmetries. Buddy4Study and Practo are illustrative examples of how apps are assimilating and organizing information for better consumer access. Moreover, some apps lower cost of data collection by facilitating crowd-sourced information. In the case of Chennai Flood Maps, crowd sourced information from the network of users created an invaluable resource that helped immensely in a situation of emergency and natural disaster. Delivery of government services has also become efficient through e-governance apps. Many states are providing an integrated platform for delivery of services online; we cover just one, MP Mobile, of the many examples in our study. The broad socio-economic impacts captured by the case studies are summarized below- notable is the fact that one single app can deliver multiple impacts across economic and social dimensions.

- **Potential for increased income:** *Urbanclap* – Income for service providers within some categories increased by upto 4 times, *farMart* – Income for equipment owners increased with the use of the platform that brought demand to farmers with underutilized machinery
- **Access to information and reduced asymmetry:** *Practo*- Created a fresh database of verified doctors based on specialization and patient feedback, *Buddy4Study*- Created a database of scholarships programme, *Umang*- Integration of all e-government services that minimizes cost and time invested by citizens on government services

MANY STATES ARE PROVIDING AN INTEGRATED PLATFORM FOR DELIVERY OF SERVICES ONLINE.

- **Impact on the social perception and self-image of the differently-abled:** *Inclov* - Facilitated matchmaking for the differently-abled and transformed physical spaces into accessible areas for the differently-abled
- **Job Creation:** *Inclov* - Partnered with hotels to create employment for the differently-abled, Direct employment by each of these apps including *PayTM* and *MMT* which work with a team of over 1000 employees each
- **Efficiency in Service Delivery (One stop shop for multiple services):** *MP mobile* and *Umang* - Integrated multiple government services under a single platform
- **Providing smaller businesses/ individuals a platform to market their product/ service:**

MMT - Certification program enabled budget hotels to generate business through the MMT platform, *Netflix* - Encouraging local media productions and promotion of local artistes (such as Vir Das) to an international audience

- **Encouraging disintermediation and lowering cost to buyers and sellers:** *Urban Clap* - Eliminated the role of intermediaries by creating its own network of micro-entrepreneurs. *farMart* - Platform enabled demand - supply match lowered cost of equipment leasing by upto 20%
- **Popularising use of vernacular languages:** *Mooshak* - Changing social perceptions on the use of local languages within a society where use of English is more fashionable
- **Enabling women safety:** *Truecaller* – Caller identification has helped women manage and block calls from unwanted numbers/ people

Besides the case studies covered in this report, there is a host of other evidence, not all anecdotal that illustrates how apps improve access to services, especially in tier 2 and tier 3 cities, which function on limited internet resources compared to metropolitan cities. For apps to thrive, it is necessary that we address the many challenges that might limit their growth in the future. The policy challenges exist both on the demand and supply sides. On the supply side, most apps are affected by the limited availability of network infrastructure or Internet connectivity in the areas they opt to serve. Some app companies highlighted that the recent decline in data prices, fuelled by Jio have encouraged app downloads and app usage. Government initiatives such as the National Optical Fibre Network (Bharat Net) must therefore be implemented speedily. Moreover, app design must be improved to operate in light versions that function even where network connectivity is weak and on lower cost smartphones. Demand side challenges are largely associated with availability of content in regional languages. With a huge non-English speaking user base, even for e-governance apps such as MP Mobile, the dominance of English is restricting the use of apps in semi-urban and rural areas. Data privacy is another concern among app users. To the extent possible, app development and app design must address this rising need especially in case of digital payment apps. At Mapbox, worry surrounds the Geospatial Information Regulation Bill, 2016 that could potentially limit the use of crowd-sourced data in citizen mapping. As apps become core to many businesses, sectoral policies must also align themselves to allow smooth functioning and integration of apps into the economy. The rest will of course be tackled through appropriate regulation and enforcement. The policy discussion in the next section reiterates the need for some of these changes.

> **DATA PRIVACY IS ANOTHER CONCERN AMONG APP USERS.**

4. In lieu of a Conclusion

Apps are at the heart of the smart phone revolution that is fuelling the vision of Digital India. This implies not only a huge consumption market, but also significant scope for a developer market in India. According to App Annie's Report for 2016, emerging markets like India and Indonesia still continue to see exponential growth in app downloads while mature markets have shifted focus from download growth to usage and revenue growth. As per this understanding, India is clearly a fertile ground for the further growth of the app economy, especially considering there is still significant scope for increase in India's smart phone penetration.

The macro-economic estimations suggest that a 10% increase in global Internet traffic, delivers on average a 1.3% increase in global GDP and a 10% increase in global mobile Internet traffic, delivers on average a 0.7% increase in global GDP. Corresponding estimates for India show that a 10% increase in India's total Internet traffic, delivers on average a 3.3% increase in India's GDP, and a 10% increase in India's mobile Internet traffic, delivers on average a 1.3% increase in India's GDP.

In absolute numbers, a 17% increase in India's Internet traffic during the period 2015-2016, resulted in an increase of USD 103.9 billion (Rs. 6926.5 billion) in India's GDP during the year. An equivalent increase in India's mobile internet traffic during the period 2015-16, would result in an absolute increase of USD 41.4 billion (Rs.2759.9 billion) in India's GDP during the year. Using estimates on device related traffic, apps contributed a minimum of USD 20.4 billion (Rs. 1357.6 billion) in the year 2015-16 to India's GDP. Using the same elasticity estimates, the app economy in India could potentially contribute a minimum of 270.9 billion (Rs. 18275.9 billion) to India's GDP in 2020.

> **"THERE IS AN APP FOR THAT."**

The estimates must be seen in light of data gaps. In the absence of state-wise data on Internet traffic, we have used the number of Internet and mobile subscribers per state to distribute traffic data. Availability of actual state level usage data will of course be the best time to revisit the estimates in this study. Until then we feel this study provides the first carefully crafted measure of the impact of Internet, including app-based usage on GDP.

The macroeconomic estimations only a part of the impact story of apps. The case studies featured in this report also analyze and trace mechanisms through which impacts are generated and translated into overall growth and social development. Apps across sectors reflect the wide range of such impacts on income and employment and on standard of living. In addition, they help address information asymmetries, enable disintermediation, battle age-old social perceptions and in general create hope for a prosperous and safe future. Needless to say, apps have the potential to become synonymous with daily life, though their growth is not without risks of abuse and exploitation. Improved privacy and data protection by app companies will provide users the much-desired comfort in sharing their personal details, especially on digital payments apps.

Besides the case studies covered in this report, there is a host of other evidence, not all anecdotal that illustrates how apps improve access to services, especially in tier 2 and tier 3 cities, which function on limited internet resources compared to metropolitan cities. For example, a recent study by Zinnov on online resellers, estimated 2 million homemakers across the country to generate $9 billion gross sales by reselling apparels and lifestyle products[66].

66. https://inc42.com/buzz/homemaker-resellers-zinnov-ecommerce/

It is a foregone conclusion that apps have facilitated the creation of new business models. At the same time increasing demand for apps has also created a new focus on data in the telecom sector. Most recently, the launch of Reliance Jio has significantly driven down data prices, encouraging the use of data and thereby app based services. The emergence of new models of business that supplant or extend traditional businesses that operate in physical spaces and require physical movement of goods and services obliges a fresh look at the oversight framework. The emergence of digital media and e-pharmacies to name just two fall outside the regulations within which each of these sectors currently operate. Services delivered through the digital platform sometimes constrained by the absence of clarity on regulations. As apps become core to many businesses, sectoral policies must also align themselves to allow smooth functioning and integration of apps into the economy.

The magnitude and extent of impact that apps generate requires governments to favour policy that creates an enabling environment for growth and innovation in the sector. The rapid proliferation of apps and the disruption to traditional businesses have prompted many policy debates. These debates are not limited to challenges that face a displaced incumbent, but how apps that gain enough traction run the risk of compromising consumer rights such as privacy, national security and environmental protection.

In the app ecosystem, the first stage of policy debates begins with a form of self-regulation, where platforms prescribe guidelines for app developers. For example both Apple's App Store and Google's Play Store, review all apps that wish to be on their platform, and developers have to comply with certain guidelines that are prescribed. Failure to meet these standards can result in the app being rejected or taken down. The categories of App Store guidelines prescribed by Apple's App Store[67] and Google's Play Store[68] are provided in Table 5.

› **Table 5:** *Categories of App Store guidelines*

Apple App Store	Google Play Store
• Safety • Performance • Business • Design • Legal	• Restricted Content • Intellectual Property • Deception & Spam • Privacy and Security • Monetization and Ads • Store Listing and Promotion • Families and Children's Online Privacy Protection Act • Enforcement

Source: Compiled by Authors from guidelines listed on the Apple App Store and Google Play Store (Refer footnote 67 and 68)

Each of these categories enumerates standards and rules that developers have to comply with for their apps to be accepted. It may be noted that while the classifications seem to differ, some categories of guidelines are nested under broader titles. For example, Apple's App Store legal guidelines address both privacy and intellectual property whereas these are under separate categories in Google's Play Store guidelines. The importance of these guidelines can be seen from the recent furor surrounding Uber's violation of Apple's App Store policy that almost resulted in the app being taken down from the store[69]. Similarly Google's Play Store also revised its User Data Policy that required all app developers to provide a valid privacy policy if and when their apps requested for sensitive user data[70].

Beyond self-regulation is regulation by government fiat. Apps too have stirred policy debates involving regulation of Over-the-Top (OTT) services, which broadly refer to services that are delivered using existing Internet infrastructure and connectivity provided by a third party. Although this study is focused primarily on estimating the economic impact of apps, the regulatory environment in which apps operate and create the much-celebrated impacts is a critical input for the outcome documented in this report. Accordingly, it calls for an independent and explicit assessment that takes in account global experience, the innovation character of apps and an analysis of the instruments, both formal and informal, that could be used for regulation. In India, both the Telecom Regulatory Authority of India (TRAI) and the Department of Telecommunications (DOT) have touched upon this discussion in two separate processes[71],[72]. The discourse on policies towards OTTs and apps is far from settled. However, it may be considered that in the case of new generation Internet based application services that have significant socio-economic impact, it would be premature to pass hard rules. Careful and planned approaches to soft law could be considered to start with.

In this context it is important to keep in mind some considerations while deliberating the app economy and ways to support its growth.

67. https://developer.apple.com/app-store/review/guidelines/
68. https://play.google.com/about/developer-content-policy/
69. ISAAC, M. (2017) "When Uber was nearly kicked out of Apple's App Store" The Economic Times, http://economictimes.indiatimes.com/small-biz/startups/when-uber-was-nearly-kicked-out-of-apples-app-store/articleshow/58335159.cms . See Also https://techcrunch.com/2017/04/23/uber-responds-to-report-that-it-tracked-users-who-deleted-its-app/
70. Clark B (2017) Millions of apps could soon be purged from Google Play Store, available at https://thenextweb.com/google/2017/02/08/millions-apps-soon-purged-google-play-store/#.tnw_wJcHEj0Z
71. https://www.mygov.in/sites/default/files/master_image/Net_Neutrality_Committee_report.pdf
72. TRAI (2015), Consultation Paper on Regulatory Framework for Over-the-top services

First, the idea of blanket regulations on OTTs and apps would be a regulatory nightmare given the wide range of sectors that apps and OTTs impact. Consequently, such regulations would create a compliance burden and form barriers to entry, affecting market efficiency and competition. It is also important to note that depending on the function and nature of the app, other regulations may be applicable as well, that increase the regulatory web within which apps would be required to operate. For example, provisions of the Information Technology Act, 2000 and IT (Amendment) Act, 2008 are applicable to certain apps; regulations by RBI on digital payments are applicable to Fin-tech apps, etc.

> **THE GOVERNMENT'S BHIM PLATFORM WAS ALREADY SUPPORTING 1.94 MILLION TRANSACTIONS WORTH RS. 631 CRORE PER MONTH.**

Second, sector specific regulators have to carefully examine the changes brought about by use of technology through apps. Understanding these changes contributes towards understanding the changes in market structures. The ideal balance sought would be between promoting innovation, fostering competition, securing investments and protecting consumer interest. In a dynamic sector such as this, it is important to invest in studying technology-enabled changes and their implications on the market, before attempting to regulate it. Further, regulation must be careful not to merely protect a status quo; it should facilitate growth, promote innovation and improve market efficiency.

Third, recognizing that the app economy and government initiatives in India have a symbiotic relationship and leveraging this opportunity to fuel growth. For example, government promotion of digital payments and development of supporting infrastructure has immensely helped the app economy. This is not restricted to payments and fin-tech apps, but the scope for other apps to use such platforms and conduct business. In February 2017, the government's BHIM platform was already supporting 1.94 million transactions worth Rs. 631 crore per month[73]. E-commerce companies, especially, have benefitted from clarity in regulations regarding digital payments. Moreover, e-governance apps have created a platform for better outreach to citizens and improved government–citizen engagement. State IT cells are championing this initiative of bringing government services on to integrated IT platforms[74].

The ability of an app to provide localized solutions to market needs, in an accessible fashion, reducing search and transaction costs for a consumer, makes it desirable as a driver of growth and development in the economy. The benefits and impacts of the app economy are extensively discussed, and now reiterated by the findings in this study, all that is left to be done is nurture growth in fertile markets of the app economy in India.

Recommendations

1. **Address lack of digital infrastructure:** The growth of the app economy as highlighted in most case studies is constrained by the lack of digital infrastructure especially in semi-urban and rural areas. It is necessary for the government to fast track progress of Bharat Net and create a digital backbone that the country necessarily needs for the app economy to thrive in.

2. **Invest in India's e-governance app ecosystem:** India is heavily invested in its vision of Digital India, and the numerous welfare measures that rely on convenient and affordable access to technology enabled services. India

73. https://www.linkedin.com/pulse/statistics-digital-india-bhim-dont-lie-bishnu-das
74. Refer case study on MP Mobile

SEVERAL APPS COLLECT PRIVATE INDIVIDUAL DATA, WHICH MUST BE WELL PROTECTED TO MINIMIZE ECONOMIC LOSS IN INSTANCES OF CYBER ATTACKS.

must invest in the e-governance app ecosystem, a huge network within the app economy that has the potential to provide the necessary *big-push* to this sector.

3. **Encourage development of vernacular content:** The use of several apps in India is limited by the absence of content in regional languages. India's huge non-English speaking community is yet to discover the magic of the Internet in the absence of enough vernacular content. Even e-governance apps are predominantly available only in English.

4. **Use the Start-Up India program to accelerate growth in the sector:** The status report of the Start-Up India Program shows spectacular success in the last year. It is a great platform to incubate app-based ideas and train entrepreneurs for successful businesses in the future.

5. **Up-skilling of app developers:** Several apps highlighted the need for light and efficient versions of their app to function well on poor quality network, as is often the case with several locations in India. Feedback from industry suggests the need for high-quality app developers who trouble shoot efficiently and also enhance user interface of such apps. Government or private sector enabled training, perhaps under the Skill India program or independently will help contribute towards the growth of this sector.

6. **Promote government and private sector collaboration:** From the case studies we know that apps developed by the private sector have helped address market needs, despite government intervention. Some successful examples are Truecaller and farMart. Some of these apps could work better with improved government support. Amber and Buddy4Study are examples where promoters have expressed interest in collaborating with the government to increase outreach and impact of their apps.

7. **Strengthen cyber-security infrastructure:** The rising instances of security breaches and cyber attacks have raised an alarm on the counterproductive impacts of the growing app economy. Several apps collect private individual data, which must be well protected to minimize economic loss in instances of cyber attacks. Building a secure infrastructure will also address the trust deficit hindering widespread adoption within certain app categories, especially those related to digital payments.

8. **Change Perceptions and Build Awareness among Consumers:** The use of apps is driven by a massive transformation in lifestyle and patterns of consumption. In order for app promoters to build a significant user base, it is important to demonstrate the impact from use of such apps. Very often poor services, security breaches, etc, creates a trust deficit that discourages users from going back to the app. In many cases this could be on account of users not using their apps well or not being aware of provisions for quality check, data protection, etc. It is important for the government and the private sector to jointly develop an awareness and communication program to help consumers use their apps better, perhaps safely.

9. **Disentangle Regulatory Needs:** There is significant conflation and bundling of regulatory debates surrounding apps. These may range from net neutrality to national security. It is important to untangle matted regulatory approaches to apps and the app economy to be able to clearly understand the market structures, technology, and regulatory needs.

   Also, the case studies provide examples from healthcare, media distribution and geo-spatial mapping, where the lack of regulatory clarity related to the use of technology in delivery of some services hinder investment and growth of an app. It is important to address these concerns, for growth to pick up, as has been in the case of digital payment apps after clarity provided by RBI on specific regulations.

10. **Develop a systematic approach to regulations:** Given the disruptive changes, and highly dynamic nature of the app ecosystem, it is important to review and understand regulations governing legacy services and also those that impact apps. Having bottom-up consultations with all stakeholders (an existing practice in the sector) enables well-informed understanding of the market, its structures and the opportunities and challenges therein. It is also important within dynamic ecosystems, to allow for a flexible regulatory approach that can adapt to function-based evolution. The discussion on informal tools in the policy section is worth experimenting with. The most crucial, however is to minimise regulatory burden on businesses and maintain a light-touch rule-by-rule approach.

Appendix

Appendix I: Regression Results for cross-country models

	Model 1	Model 2
K/L	.04 (1.07)	.04 (0.97)
mobile traffic		0.07 (15.96)
internet traffic	0.13 (16.45)	
Constant	28.798 (63.43)	29.67 (72.12)
(Numbers in parentheses are t-statistics, denoting significance of over 95% for each variable)		
Fixed effects	**Yes**	**Yes**
R-squared	0.999	0.999
Number of observation	115	115
VIF	3.44	7.36
Heteroskedasticity	No	No

Appendix II: Regression Results for India models

	Model 1	Model 2
K/L	.63 (5.64)	.64 (5.87)
mobile traffic		.13 (5.96)
internet traffic	0.33 (6.83)	
Constant	17.62 (67.48)	17.53 (171.01)
(Numbers in parentheses are t-statistics, denoting significance of over 95% for each variable)		
Fixed effects	**yes (State dummies)**	**yes (State dummies)**
R-squared	0.999	0.999
Number of observation	76	76
VIF	3.19	2.08
Heteroskedasticity	No	No

Appendix III: Detailed Illustration of Case Studies

I. AMBER

1. **Background:** Health infrastructure is a major indicator of the state of public welfare. In India, health indicators are gradually improving, with a rise in average life expectancy by four years, from 64.4 years in 2005 to 68.3 years in 2015. The government has also cleared the National Health Policy 2017, which promises to increase public health spending to 2.5% of GDP in a time-bound manner. It also promises healthcare services to all Indian citizens, particularly the underprivileged[75]. Initiatives from both private and public sectors have helped in achieving positive outcomes, however, there are some basic areas where there is still much to be done, ambulance services being one of those.

2. **Addressing the Market Need:** India does not have a functional on-call ambulance line. The primary market need being addressed by Amber is the lack of a protocol driven approach in India to address medical emergencies. Amber's objective is to provide swift and efficient emergency care within the first 90 minutes of any medical trauma. This is known as the 'golden hour' during which providing effective treatment might help prevent irreversible damage and optimize survival chances of the patient[76]. Most people in India rush to hospitals without an ambulance, thus denying patients the care crucial during the 'golden hour'. The founders, with the help of existing technology sought to bring to people a service that integrated both the hospital emergency and ambulance services.

3. **Business Model:**

   a. ***Functionality:*** The Amber app was first launched in 2016. Though not presently functional owing to strategic developments in their business, they had integrated a multitude of features. The app allows the user to share her/his geo-location and medical records with the responder, on a single cloud platform. Family members are also pre-alerted. Users get a call back from their chosen hospital and doctors or para-medical staff can speak to either the patient or the person accompanying the patient.

   b. ***Revenue:*** Though, Amber does not charge users in emergency cases, there is an annual subscription model in place, where users have to sign up for a year by paying an annual subscription fee to access the services. They also charge hospitals for offering fleet management services, which is their secondary source of revenue. Apart from this, they also offer services such as ordering and delivery of medicines.

   c. ***Growth:*** The app, when it was functional had a B2C model in place. Amber is trying to refine it further and the app operations have been put on hold in order to explore partnerships with insurance companies. The app is live with hospitals like Apollo Hospitals, Max Hospitals, AIIMS (both trauma centre and main hospital), Paras Hospitals etc. It

75. *Special Correspondent 2017, 'Health spending to be 2.5% of GDP', The Hindu, 17 March. Available from: http://www.thehindu.com/news/national/centre-cleared-the-long-awaited-national-health-policy-2017/article17487845.ece*
76. *Subramanian, N 2016, 'Soon, Uber-like app to bring emergency care to your phone', Business Standard, 5 March. Available from: http://www.business-standard.com/article/companies/soon-uber-like-app-to-bring-emergency-care-to-your-phone-116030500726_1.html*

is however, not live with hospitals in South India. Their objective is to keep the primary functions and features the same, but routing it via insurance companies. Due to the better connectivity of insurance companies with hospitals, it would help Amber create a better distribution model.

4. **Impact:**

- Amber is trying to mend the broken system of addressing medical emergencies. Though there are service helplines in India such as 108 and 102, their limited reach to all sections of the population, and inability to assimilate medical information and location of the patient swiftly often render them redundant.
- Amber's target audience is the smartphone owning urban population. The app's target population as of now is people in urban cities. Their focus is on capturing the urban market first and then moving to rural.
- When people rush to hospitals without an ambulance, time is lost out because the medical staff is unaware of the patient's medical history, which they have to find out before they can begin treating the problem at hand. With the feature of recording a patient's medical history, Amber helps in saving time and making the treatment procedure swifter.
- Integrating ambulance services with hospital emergency rooms streamlines the transfer of patients to a hospital of their choice as well as assurance of quality ambulance services.
- Amber's proxy feature allows a user to operate the app on behalf of anyone from anywhere in the world. This feature is most useful to the elderly, who are extremely vulnerable during medical emergencies. There is also a panic button, which when used enables the app to operate on its own, thus coming to the aid of someone who is either not in the condition to operate the app or does not know how to do it.
- Amber also trains hospitals and ambulance personnel on how to use the app. One of the most crucial things in emergency wards is fleet management, services for which are offered by the app company, thus helping hospitals take a more methodical approach to dealing with emergency cases.

5. **Challenges:** The major challenge to Amber and to the medical emergency market as a whole, lies in the fact that not enough resources are spent on delivering quality emergency services. In a comparison to cities like New York City in the United States, where ambulances are strategically located in places that are more vulnerable, such services in Indian cities are grossly inadequate. In countries like the US and UK, para-medical staff is trained enough to handle emergency cases. This is however, not the case for India where there is a lack of quality training for para-medics and they cannot administer cases without doctors. There is a problem of availability of ambulances with high quality of services. It is difficult to trust local people owning ambulances as there is no guarantee for the services offered. Another crucial aspect is addressing the trust deficit of the collective mindset. People would much rather drive to a hospital themselves than rely or wait for an ambulance. Especially with technology intervention in this space being a fairly new initiative, gaining people's trust and recording a considerable uptake will happen only in due course of time.

II. BUDDY4STUDY

1. **Background:** Every year in India, educational scholarships worth more than INR 16000 crores are made available for various underprivileged sections of society like Scheduled Castes, Scheduled Tribes and Other Backward Classes. Scholarships have also been instituted for funding education for girl children, such as 'Pragati' which is a Government of India initiative to encourage and support girl children to pursue technical education. However, a large number of meritorious students still drop out of school, especially in the last mile. According to a report by Montreal based UNESCO Institute for Statistics and Global Education Monitoring, India has 47 million youth of secondary and higher secondary school-going age dropping out of school[77].

2. **Addressing the Market Need:** Despite the availability of a large number of scholarships, instituted both by governmental and non-governmental bodies, millions of meritorious students, especially those belonging to poor socio-economic backgrounds, lose out on opportunities to pursue higher and even basic education owing not only to financial constraints, but also due to lack of information about availability of scholarships. Most of these scholarships remain undisbursed due to lack of applicants. Therefore, the market need that Buddy4Study seeks to address is two-fold – firstly, it attempts to bridge the information asymmetry regarding scholarships and uses technology to transmit information to as wide an audience as

77. IANS 2016, 'UNESCO: 47 million youth in India drop out of school by 10th standard', Firstpost, 17 August. Available at: http://www.firstpost.com/india/unesco-47-million-youth-in-india-drop-out-of-school-by-10th-standard-2961334.html

possible; secondly, by designing a formal application mechanism with continuous check points and tracking, it helps students submit completed applications as well as helps funding organizations track their funds, thus attempting to eliminate any misappropriation there in.

3. **Business Model:**

   a. ***Functionality:*** Buddy4Study has both a web and an app version. Once a student's profile is created, the online platform uses data science and artificial intelligence to match the credentials of students with relevant scholarships and also sends regular alerts and updates. The app is available only for android users.

   b. ***Revenue:*** Most of their revenues come from their paid subscription model students can sign up, create their profiles and receive scholarship alerts via SMS and e-mails for a rupee a day. The other channel for revenues is through their B2B model, where corporate houses are charged for scholarship management services offered to them by Buddy4Study, which include launch, promotion, and selection of scholars. Buddy4Study charges 8% to 15% of scholarship fund as technology and processing fee.

   c. ***Growth:*** Buddy4Study as a scholarship portal was conceptualized in August 2010 and began its services in October 2011. Their first few years were driven by research and the primary challenge faced was that of aggregation of information. Initially there were 700 registered students and 65 scholarship schemes on the portal, however, major growth has taken place in the last year and a half. 65% of their user traffic comes from the app. There have been 18000 downloads within a span of 22 months without any paid promotions.

4. **Impact:**

- Through Buddy4Study, over 20000 students have received scholarships worth more than INR 24 crores. Out of the total number of students benefited, 40% students were from poor families, 25% students from the SC/ ST community, 10%-15% students were girls & approximately 20% students were from the unreserved category.
- 75% of their user traffic comes from underprivileged students.
- Of all the states in India where scholarships have been successfully awarded, Karnataka, Andhra Pradesh and West Bengal are the top three states securing 22.27%, 11.36% and 10% respectively, of the total scholarships disbursed.
- Of the students receiving scholarships, in 90% of the cases, it was the first time that the student was hearing of scholarships.
- Buddy4Study is helping students, especially from low income backgrounds gain information about scholarships and complete their applications online. The 'Scholarship Tracking System' tracks every scholar's performance over the scholarship period. This helps in ensuring that the money reaches the student and is utilized properly, thus addressing the issue of misappropriation of funds.
- To spread information in areas where there is no Internet connectivity, Buddy4Study has partnered with 40 newspapers in India in which a column containing scholarship information curated by Buddy4Study is printed. They also plan to upgrade their app to provide access to information in vernacular languages since one of the major barriers to scholarship access is the low level of English literacy among students from underprivileged backgrounds. As per Buddy4Study's estimates, approximately 95% of scholarship information is in English and the level of English literacy is a mere 12%. Many students therefore, cannot read or understand the information and application guidelines, which established the need for a multilingual platform.
- By digitizing scholarships and their application procedures suppliers of scholarship programs have reduced their costs and increased outreach. It has also facilitated one-on-one interactions of scholarship suppliers with students, thus making the system more transparent and efficient.
- On the supplier side, 'Bhimrao Ambedkar Essay Competition' is a special case where the prize money awarded was INR 5 lakhs, while INR 15 lakhs was being spent for promotional activity. However, with the help of Buddy4Study, they were able to reduce marketing expenses and increase their applications by approximately 6 times

STORIES FROM STUDENTS:

Ashutosh Padhy

For Ashutosh, a regular student of Delhi Public School in Kalinga, his passion for sports was what set him apart from the rest of his classmates. He excelled in Billiards and Snooker. His prolific inclination towards the game earned him the Indian Oil Sports Scholarship. He went

on to win several state and national level titles, thus setting the stage for an illustrious future for him.

Nandhini Bharthi

Nandhini's story exemplifies what strength and determination can do even in the face of adversities. In the early days of her education, Nandhini lost her father, which made the continuation of her studies difficult. However, after joining Buddy4Study, she was able to gain access to information and opportunities on scholarship programs. With the support of scholarships, she successfully completed her graduation and post-graduation. She went on to pursue Aerospace Engineering from NTU, Singapore and is now a researcher at the University of Florida.

The existence of such portals has incentivized corporate houses to invest a portion of their CSR funds into scholarships. Increased transparency and the comfort of knowing how and by whom the CSR fund is being utilized has encouraged many corporate houses to award scholarships that can be easily tracked.

5. **Challenges:** One of the primary challenges for portals like Buddy4Study is to reach out to students in areas without internet connection. For digitized portals like this to succeed, internet and smartphone penetration need to deepen in areas where the target population resides. The other challenge is to tap the supply side of this market completely. Finally, any change in government policies that divert funds away from educational scholarships, affects business for such portals.

III. BYJU'S

1. **Background:** Akin to various other areas, penetration of technology has also transformed the education sector in a big way, both in terms of access to abundant resources as well as innovations in pedagogical methods. Information on absolutely anything is merely a click away (albeit with questionable authenticity and accuracy). In the recent past, technology in internet has evolved to accommodate portals for free courses, video lectures, 3D imaging for teaching and has facilitated not only the availability of knowledge, but also the absorption of it. Platforms like edX, Coursera, Khan Academy etc. have brought access to the best courses from the topmost educational institutions to anyone and everyone willing and able to learn.

2. **Addressing the Market Need:** BYJU is trying to achieve two broad objectives – first is the eradication of rote learning and second is helping children learn better in their formative years. These stem from the problem that the founder of the platform Byju Raveendran encountered back in 2007 when he would travel across the country to train students for various entrance exams like the Common Admission Test (CAT), which is taken each year by hundreds of thousands of candidates aspiring to study management. He identified that across the board, a fear of entrance exams prevailed which was possibly a consequence of inefficient training in crucial subjects like mathematics at the school level. This drove him to make an attempt to solve the problem at the root with innovations in content and teaching methods which would help students strengthen their fundamental knowledge of subjects.

3. **Business Model:**

   a. ***Functionality:*** The app, BYJU's was launched in August 2015. Initially learning programs were offered from classes 8 to 12, but were later extended to include classes 6 and 7 as well. There is also a separate app called BYJU's – Math App which offers Math programs for classes 4 and 5. Their features include specially designed video lectures, complete coverage of syllabi, separate modules and mock tests for CAT aspirants and detailed analysis of progress and performance of students to aid in their improvement. The app provides free access to study material for 15 days after which subscribers have to pay an annual fee of Rs. 10,000 for continued access.

   b. ***Revenue:*** Their primary sources of revenue are the annual subscription fee of Rs. 10,000 and external funding. Presently, they have approximately 4 lakh annual subscriptions. Additionally, Byju continues to have physical classrooms that incorporate online learning and contribute about 10% to revenue[78]. Some of their investors include the Chan Zuckerberg Initiative, International Finance Corp., Sequoia Capital and the latest being a funding of USD 30 million from Brussels based family office, Verlinvest[79].

   c. ***Growth:*** From its inception in August 2015, to today, there have been 8 million downloads and 4 lakh annual subscriptions. The average time spent on the app is 40 minutes and the renewal rate of annual subscriptions stands at an incredible 90%. As per BYJU's internal analysis, most of their students come from outside the top 10 cities. All of their activities, from app development to the background music played in the app are an in-house affair. Their revenues stood at Rs 120 crore

78. Shree, S 2016, 'How Byju's fills the biggest gap in Indian education', Forbes India, 9 September. Available at: http://www.forbesindia.com/article/hidden-gems-2016/how-byjus-fills-the-biggest-gap-in-indian-education/44247/1

79. Chakraborty, S 2017, 'Byju's raises $30 million from Verlinvest', LiveMint, 29 March. Available at: http://www.livemint.com/Companies/8V9ZIlo1QsdlkWK2MnI57O/Edutech-startup-Byjus-raises-30-million-from-Verlinvest.html

for FY16, and Rs 76 crore in the April-June quarter of FY17, displaying significant average quarterly growth, and a profit of Rs 15 crore.

4. **Impact:**

- BYJU's is a completely app based education service with most of their students coming from outside the top ten cities.
- The impact of BYJU's is mostly in terms of their innovative learning techniques. Their video lectures are designed in a way that breaks down complex concepts into simpler issues and explained. The videos also have children of similar age groups explain certain concepts, which help students identify with what is being taught and increases the acceptability of the content.
- Their empanelled teachers interact closely with child psychologists and graphic designers to create a visual impact.
- Intervention in the approach to learning during formative years and the scope for personalization facilitated by the use of technology is often unavailable in schools and traditional coaching centres and tuition classes. It helps students learn and understand concepts at their own pace and potentially helps them overcome pressure from fast learners
- Apart from their innovative teaching techniques, BYJU's offers small tests after coaching on each concept. The tests facilitate instant evaluation and feedback on students' performance. Each student can track her/his learning journey.
- BYJU's does not work on a one-size-fits-all approach. The student to teacher ratio in India is 1:35 (as opposed to 1:14 in the developed world)[80]. An improved ratio might be difficult in terms of developing physical infrastructure, but technology solves that problem by providing the same content to a vast number of students, which they can use to learn at their own pace.
- On the supply side, teachers empanelled with BYJU's are usually from premier institutes like IITs and NITs.
- BYJU's, with its innovations, is trying to change the way students in India learn, by encouraging them to question and find problems rather than just solve pre-defined problems.

5. **Challenges:** The primary challenge for BYJU's lies in the apparent perception problem. Intervention in technology is a relatively new concept in India, and a successful uptake would require people to invest their trust in the effectiveness of such platforms as they believe in the age old exam-based learning pattern. Parents also do not want such early and continued exposure to smartphones and internet for their children due to its possible harms, including eyesight problems etc. Especially due to the subscription fee, a potential challenge for their uptake in lesser developed cities might be the affordability of the course modules, coupled with the risk associated with such an investment, stemming out of trust deficit.

IV. CHENNAI FLOOD MAP

1. **Background:** Navigation and transportation apps have changed the way people travel and explore. Booking a cab to your doorstep, sending locations in emergency situations or geo-tagging posts on social media are all examples of how digital navigation has become ubiquitous.

2. **Addressing the Market Need:** Chennai Flood Map was developed by Mapbox Bangalore, in two days, as a part of the company's monthly Hackathon. It coincided with the torrential downpour in the Indian city of Chennai, flooding many parts of the city and causing excessive damage. The web app developed using an open source mapping tool called Open Street Map allowed crowd-sourcing of information on inundated areas, condition of roads and other flooding alerts. This helped people navigate through Chennai during the days of flooding and facilitate transportation of relief measures.

3. **Business Model:**

   a. ***Functionality:*** Chennai Flood Map, was launched as a customizable tool and within 48 hours of going live, 420 inundated roads were marked on it. It allowed users to zoom into a locality, visualize the streets reported as flooded and mark inundated areas. It also highlighted locations of flood relief centres.

   b. ***Revenue:*** The development of Chennai Flood Map did not involve a revenue generation objective. However, parent organization Mapbox, which is a mapping platform for developers, survives on external investments and fee charged for its services. While the app per say, did not

80. Raveendran, B 2016, 'Smartphone as Learning Tool Can Reach Millions', BusinessWorld, 23 August. Available at: http://businessworld.in/article/-Smartphone-As-Learning-Tool-Can-Reach-Millions-/23-08-2016-104697/

earn revenue, the company has a sustainable business model.[81]

c. ***Growth:*** Mapbox is a mapping platform for developers. Their tools make it easy to integrate location and street maps into any mobile or online application[82]. The data is based on crowd sourced information provided by users. The Open Street Map (OSM) technology is completely free for any individual to use[83]. It allows the software to be altered, updated and user fact checked on the go, for greater speed, convenience and customization[84]. Some of the companies that use Mapbox are Foursquare, Evernote, Financial Times, GitHub, National Geographic, Pinterest, The Guardian, The Wall Street Journal, The Washington Post, among many others[85]. A flood map also exists for the city of Cuddalore in Tamil Nadu. The map has also been used by people in Africa in 2016, for data around flooded roads. Chennai Flood Map got over 1 million views in a two week period. 65% of the traffic was from India, out of which 40% was driven by mobile, mostly android phones. The success of a one-time app, led the team at Mapbox to be recognized by universities, researchers and technologists from around the world who wished to develop similar apps.

4. **Impact[86]:**

- Chennai Flood Map got over 1 million views in a two week period.
- The map showed around 1515 inundated roads within 24 hours of its operations[87].
- After the map went viral on social media, at peak load, they received 1500 requests per second[88].
- A crowd sourced website called chennairains.org became the epicenter for all information and relief activities, including adding requests for rescue, offers for shelter, food etc. Other Indian internet firms Practo, Zomato, Paytm and Ola pooled together relief measures[89].
- While each citizen was aware of the situation in his/her own locality, the crowd-sourcing feature of the map helped in gathering information about inundated areas across the city.
- Using the map, several NGOs were able to identify high-risk areas, coordinate relief supplies and deliver them to those in need. It gave volunteering groups and NGOs real insights into the affected areas.
- Chennai Flood Map exemplifies the use of open source mapping as a facilitator of civic participation on a massive scale and community action during natural disasters.

5. **Challenges:** One of the major challenges facing companies like Mapbox, in India, is the Geospatial Information Regulation Bill, 2016. Some of the contentious aspects of the bill include stiff-lines and jail-time for individuals and companies that depicted India's map incorrectly, licensing of production and restrictions in dissemination of geospatial data, thus making the policies around citizen mapping rigid and affecting maps that use crowd-sourced data[90]. There is no recent update on the implementation of this bill. The other challenge lies on the demand side, since the success of the product depends on crowd sourced information, people not knowing how to use maps limits the externalities that usage can create.

V. FARMART

1. **Background:** Increased farm mechanization is one of the proposed solutions to improving productivity and efficiency in the agricultural sector. Agriculture is grappling with challenges of a large share of small and marginal farmers, declining land holding sizes, high cost of farm machinery and equipment, complex operations, underdeveloped markets etc. Farm

81. *Clancy, H 2015, 'Meet the startup drawing maps for Foursquare, Pinterest and (soon) MapQuest', Fortune 18 June. Available from: http://fortune.com/2015/06/18/mapbox-smarter-maps/ (12 June, 2017).*
83. *https://www.mapbox.com/about/ (12 June, 2017).*
82. *Venkatraman, D 2016, 'The city's flood map goes global', The Hindu 31 October. Available from: http://www.thehindu.com/sci-tech/technology/The-city's-flood-map-goes-global/article15879880.ece (12 June, 2017).*
84. *Widder, B 2013, 'Roll Your Own Maps: Mapbox Wants To Become the Wikipedia of Cartography', Digital Trends 3 May. Available from: https://www.digitaltrends.com/computing/roll-your-own-maps-mapbox-wants-to-become-the-wikipedia-of-cartography/ (12 June, 2017).*
85. *https://www.featuredcustomers.com/vendor/mapbox/customers (12 June, 2017)*
86. *Venkatraman, The city's flood map goes global, 2016.*
87. *Pyne, S 2015, 'This ingenious Chennai Map shows which areas are currently flooded #ChennaiRains', Business Insider 2 December. Available from: http://www.businessinsider.in/This-ingenious-Chennai-Map-shows-which-areasare-currently-flooded-ChennaiRains/articleshow/50008460.cms (12 June, 2017).*
88. *Venkatraman, The city's flood map goes global, 2016.*
89. *Krishnamurthy, K & Vignesh, J 2015, 'Chennai Rains: Indian Startups like Zomato, Paytm and Ola kickstart relief measures for those stuck', The Economic Times 3 December. Available from: http://economictimes.indiatimes.com/small-biz/startups/chennai-rains-indian-startups-like-zomato-paytm-and-ola-kickstart-relief-measures-for-those-stuck/articleshow/50013020.cms (12 June, 2017).*
90. *Srivas, A 2017, 'How the Controversial Geospatial Bill Snowballed – And Was Then Shoved Into Cold Storage', The Wire 7 March. Available from: https://thewire.in/114584/controversial-geospatial-bill-snowballed-shoved-cold-storage/ (12 June, 2017).*

mechanization in particular is driven by land size, cropping pattern, market price of crops including Minimum Support Price, availability and cost of labour[91]. As land holdings continue to become smaller, cost of owning agricultural machinery becomes higher, thus disincentivising farm mechanization. According to the Agricultural Census of 2011, the average land holding size was an estimated 1.15 hectare[92]. Almost 85% of total land holdings are small[93].

2. **Addressing the Market Need:** Market research by founders Alekh, Mehtab and Lokesh revealed that there existed farmers with under utilised machinery which could be potentially leased out when not in use. The functional market for renting farm machinery is quite unorganized and very often farmers are unable to find the required equipment. This impacts their output, leading to lower yields and crop loss[94]. farMart founded in 2015 addressed this demand supply mismatch by creating a platform for renting of agricultural equipment at affordable prices.

3. **Business Model:**

   a. ***Functionality:*** farMart has both an app and a missed call based request system. When users open the app, they can view pictures of equipments and make selections. On the other hand, the supplier app has features like order management, order routing with GPS enabled directions and provisions to measure land holding/farm size. Once a supplier and user have been matched, farMart ensures that service is well provided and that the machinery is in good condition. There are multiple check points for suppliers and their equipment, such as registration of tractor with RTO, validity of tractor-driver's license, checking the overall condition of equipment, etc. There is an embedded feedback mechanism for users of rented equipment and penalties are applicable to suppliers for poor service. After the lease period is over, farMart collects the payment from the user and credits it to the supplier's bank account. In case of a long lease the rent is credited twice every week.

   b. ***Revenue:*** farMat earns commission based revenue. Commission is charged from the equipment owner at the rate of 5%-15% on each lease transaction. The rent charged varies with the region and type of equipment. For example, a harrow/tiller is rented for 600 rupees in Behat, while the rent is 720 rupees in Nakur (rural regions of Uttar Pradesh). For rotavators, the rent in Behat is 1200 rupees per acre while in Nakur it is 1400 rupees in Nakur. According to FarMart's surveys, the rates are much higher in Punjab and Haryana for both machines. The founders are exploring other revenue opportunities and have recently closed a round of seed funding from IAN.

   c. ***Growth:*** The company was incorporated in December 2015. Starting January 2016, the company ran a year-long pilot in 5-8 villages in the district of Saharanpur. It is currently functional in the tehsils of Behat and Nakur in Saharanpur, in the state of Uttar Pradesh and covers approximately 60 villages in each of the tehsils. Door-to-door surveys were conducted to identify farmers and equipment owners with spare capacity. There is also a referral program that incentivizes machinery owners to refer other machinery owners to farMart. Currently, 28 machinery owners are registered with farMart, and 20 applications are pending. 84% of customers are small and marginal farmers and 16% are medium farmers. Due to heavy demand of machinery in the post-harvest season, some large farmers also register on farMart as customers.

4. **Impact:**

   - There are about 109 daily active users. farMart receive about 300-350 missed calls and 40-50 orders per day. A handful of farmers, about 20, have shifted from missed calls to using the app, with Jio's entry into the market and access to cheap data plans. This has brought down the number of people using the missed call service, although it continues to remain the popular service choice for farMart users.
   - farMart has been able to improve the demand supply mismatch in some villages. The cost of renting equipment has also reduced between 10%-20% as a result.
   - Planning in advance allows machinery bookings to be aggregated within a single location, optimizing logistics and reducing fuel costs. This has helped bring machinery to small and marginal farmers who would otherwise be denied access to machinery because of small orders that are unprofitable for suppliers.

91. Food and Agri Strategic Advisory and Research (FASAR), YES BANK, German Agribusiness Alliance at OAV – German Asia-Pacific Business Association (GAA) 2016, Farm Mechanization in India: The Custom Hiring Perspective, p. 18. Available from: https://www.yesbank.in/pdf/farm_mechanization_in_india_%E2%80%93_the_custom_hiring_perspective.pdf (12 June, 2017)

92. Press Information Bureau, Ministry of Agriculture 2011, Highlights of Agriculture Census 2010-11, Government of India. Available from: http://pib.nic.in/newsite/PrintRelease.aspx?relid=132799 (12 June, 2017).

93. Ibid.

94. Dias, C 2016, 'farMart: The Rental Marketplace for Farm Equipment', Networked India 15 July. Available from: http://www.networkedindia.com/2016/07/15/farmart-the-rental-marketplace-for-farm-equipment/ (12 June, 2017).

- The lack of reliable financing options for small farmers hinders them from hiring machinery. In the absence of a formal sources, they resort to informal borrowing at exorbitant rates of interest that result in vicious debt traps. farMart attempts to solve this by offering a 'Pay Now' or 'Pay Later' option. Under the latter, the user can take a 15 day loan at an interest rate of 1%. They have not seen any defaults over the past 1.5 years, and whatever payment is not made in the first transaction, is automatically added to the next transaction amount. They are also looking to partner with an NBFC and facilitate a shift from informal to formal lending.

USER TESTIMONIALS:

Nathiram (Village: Mustapur) – "Earlier it was very difficult to find agri-machinery. Although I would have the contact numbers of a few machinery owners from my village, but they were not reachable most of the time. Sometimes even after accepting a booking they would either make me wait at my farm for 1-2 hours or not show up at all. I have now used farMart multiple times for booking my agri-machinery. I no longer have to run after machinery owners. farMart always ensure that the machinery reaches on time and keeps me updated."

SUPPLIER TESTIMONIALS:

Vikas (Village: Malayan) – "I purchased a tractor worth INR 8 lac on loan and joined a contractor for transporting cement and bricks. Since the contractor changed, my tractor was lying idle and not generating any income for the past 11 months. When I heard of farMart, I walked up to their regional office and requested to join their platform. The customer representative suggested I also purchase a rotavator. It has been a year since I joined farMart and I have not only recovered the cost of the equipment but also started making an alternate income."

Pankaj (Village: Manjhipur) – "I own two tractors and was earlier involved in renting my tractors to farmers around my villages. After joining farMart, my revenues have increased by 20%. The payments come on time. I am really glad that companies such as farMart exist."

5. **Challenges:** Among the challenges faced by farMart, the most significant ones are those of connection issues and lack of government support in facilitating digital payments in this area. Some pockets where farMart operates faces connectivity issues that hinders GPS tracking of equipment, especially tractors. Therefore, the option of placing orders using voice calls becomes the default. Even after demonetization, lack of digital options makes collection and handling of cash inefficient and costly. The company feels that from a policy perspective, subsidization of farm machinery is not an efficient solution, since the sharing model allows suppliers to earn a return of 16%-17% on the machinery they own.

VI. INCLOV

1. **Background:** According to the Census of 2011, 2.21% of the population in India is differently-abled, an increase from 2.13% in 2001[95]. Yet, our social spaces are mostly not accessible to this segment of the population. Lives of the differently abled in India are riddled with inaccessibility, both physical and social.

2. **Addressing the Market Need:** Co-founder of Inclov, Kalyani Khona, started her journey in 2014 with a matchmaking agency focusing on the disabled, called Wanted Umbrella. The inability to scale, paved into an idea of a matchmaking app, Inclov, which was conceptualized and launched in January 2016[96]. According to Khona and her co-founder Shankar Srinivasan, the differently abled are faced with challenges when finding dates and looking for life partners. Most existing dating apps are either inaccessible, non-inclusive or do not have a high success rate for people with disabilities. Inclov was conceptualized as an attempt to create an environment where finding companions for the differently abled was not awkward.

3. **Business Model:**

   a. ***Functionality:*** Inclov requires its users to build a profile and provide details of their disability, usage of assistive devices, medication and cure availability etc[97]. People are matched based on parameters of level of independence, employment, psychometric test results, instruments used and lifestyle choices. It is fully accessible to people with visual impairment through screen readers and talk back applications. Inclov was programmed by two part time developers, one of whom was visually impaired, which helped test the app right from the start. Moreover, functionalities and accessibility features were not imposed on the app (as in the case of many other apps), its fundamental design was to serve the differently abled. Users can view up to five profiles a

95. *Ministry of Statistics and Programme Implementation, 2016, Disabled Persons in India A Statistical Profile, Government of India. Available from: http://mospi.nic.in/sites/default/files/publication_reports/Disabled_persons_in_India_2016.pdf (12 June, 2017).*
96. *Rajendra, R 2017, 'Inclusive Love', The Hindu 20 May. Available from: http://www.thehindu.com/todays-paper/tp-features/tp-metroplus/inclusive-love/article18512858.ece (12 June, 2017).*
97. *Ibid.*

day and there is a chat feature available. Currently it is available for download only on android, however, efforts are on to launch it on iOS as well.

b. ***Revenue:*** Inclov does not accept endowments as its source of funding. The founders do not view it as a charitable endeavour, rather as a profitable opportunity in an underserved market. After some initial crowd-funding through Wishberry, Inclov subsequently secured funding from like minded investors who understood its vision, including investments from Network 18[98]. Other sources of revenue include offline services that are paid and meant for premium clients.

c. ***Growth:*** In 2014, when Wanted Umbrella was floated, within 7 months, it saw over 2000 sign ups[99]. It worked through a website where profiles were matched manually, either via Skype or telephone[100]. Inclov, developed after an in-depth survey of 300 people in 55 cities[101] attracted users very quickly. Presently, the 8000 app users are sprawled over 80 cities. About 50% of the app users are without any disability. Inclov also undertakes offline meet-up initiatives called Social Spaces, under their Plus model. They are normally sponsored by corporate houses and involve a ticketing system, prices of which vary from city to city. So far, they have covered 10 cities and held 20 such meet ups. In big cities like Delhi and Bangalore, a typical gathering is attended by 80 to 100 people. Inclov encourages its users to informally organize smaller gatherings without the active involvement of their team.

4. Impact:

- The first app in the world to focus on match making for the differently-abled. There have been over 3000 matches on the app so far.
- 20 meet ups in 10 cities conducted under the Social Spaces initiative, encouraging the differently-abled to step out of home.
- They have also helped transform physical spaces such as Kara Café to become accessible to the differently abled. These spaces are completely accessible through ramps at entry-exit doors, accessible washrooms and sign language interpreters.[102] They are also promoting inclusive yoga in partnership with Zorba.
- Inclov has also helped in employment generation of the differently-abled by partnering with large employers such as Lemon Tree Hotels. The exact number of differently abled employed through this channel is however not known.
- The Rights of Persons with Disabilities Act, 2016, has increased the number of recognized disabilities from 7 to 21, (though it's still short of UN's list of disabilities) and has broadened the mandate to accessibility in audio, electronic and printed content, in universal design of goods and equipment. Inclov is an active participant of the inclusiveness narrative within the Digital India realm.[103]

USER STORIES:

Anu Multani and Imran Garana, both in their early 30s and patients of polio, met on Inclov and got married in May 2016. Multani, also a Miss Wheelchair runner's up and a gold medalist in rifle shooting found her life partner through the app. Like Anu and Imran, there are several others who found companions, and some for a lifetime on Inclov.[104]

5. Challenges: One of the challenges that Inclov faces is to attract more female users. The ratio of male to female users on the app is terribly skewed in favour of men (80:20). The app, however hopes that with its stringent verification process and privacy protection measures like disabling screenshots will address at least, the safety concerns associated with online dating for women in India. For the convenience of non-English speaking users in India, they also hope to add local language features.

VII. MAKE MY TRIP

1. Background: The advent of internet and internet based apps has dramatically altered the dynamics India's travel and tourism industry.[105] There were two waves of information technology intervention that impacted the industry – first being the development of the direct reservation system and second being the development of an online sales channel via the internet.[106] A 2016

98. Zachariah, P 2016, 'Inclov, an inclusive matchmaking app', Livemint 3 December. Available from: http://www.livemint.com/Companies/XI8WztUbvUOmtBGpCJ9r5M/Inclov-an-inclusive-matchmaking-app.html (12 June, 2017).
99. Rajendra, Inclusive Love, 2017.
100. Ibid.
101. Ibid.
102. http://www.inclov.com/social_spaces.html (12 June, 2017).
103. Sharma, D 2017, 'Why Does Mainstream Indian Discourse on Digital Inclusion Leave Out Disability?', The Wire 9 May. Available from: https://thewire.in/133489/mainstream-indian-discourse-digital-inclusion-leave-disability/ (12 June, 2017).
104. Zachariah, Inclov, an inclusive matchmaking app, 2016.
105. May, K 2014, 'How 25 years of the Web inspired the travel revolution', The Guardian 12 March. Available from:https://www.theguardian.com/travel/2014/mar/12/how-25-years-of-the-web-inspired-travel-revolution (12 June, 2017).
106. Farrokh, M 2009, 'Impact of E-Commerce on Travel and Tourism: A Historical Analysis', International Journal of Management. Available from: https://www.questia.com/library/journal/1P3-1889954271/impact-of-e-commerce-on-travel-and-tourism-an-historical (12 June, 2017).

study by IAMAI and IMRB states that the online travel industry accounts for 61% of the Indian e-commerce industry with domestic air tickets and railway bookings dominating online travel spends.[107]

2. **Addressing the Market Need:** The Make My Trip (MMT, hereafter) website was launched in October 2000 under the name of International Web Travel. For the first five years it served only Non-Resident Indians (NRIs) travelling to India. Indian users were still unfamiliar and uncomfortable with online booking.[108] Roughly, 40% of travellers in India do not book in advance due to distrust in third parties. Among the bookings made online, 50%-55% are corporate bookings. It is this trust deficit that slows the market for online travel in India. Personalisation, curation and quality assurance are some services that MMT sought to deliver in order to overcome the trust deficit.

3. **Business Model:**

   a. ***Functionality:*** Bookings on MMT are made both through their website as well as their mobile application. All the features on the website are available on the app. Services available include booking air tickets, hotels, buses, IRCTC authorized railway tickets, cabs as well as holiday packages. Air tickets, hotels and holiday package bookings serve both domestic and international travel. Both the app and website personalize user interface by providing travel options/suggestions according to past searches and user behaviour.

   b. ***Revenue Model:*** The primary source of earning for MMT is through commissions. As low budget airlines came up, airline travel became cheaper over time, thus leaving very little margins for travel companies like MMT. In 2015-16, 50% of its revenue was earned from hotels and travel packages and the rest came from sale of air tickets.[109] Hotels and packages offer relatively higher margins as compared to air tickets. As of 2017, MMT has attained a leadership position in the Online Travel Agency segment in India.

   c. ***Growth:*** Deep Kalra's MakeMyTrip had a dream start with a funding of $2 million from eVentures in 2000. However, within a year of its operations, MMT was affected by the dotcom meltdown and the 9/11 attacks. However, it not only survived the crises, but got listed in the US.[110] Today, MMT dominates the market with 45% of the market share in the Online Travel Agency segment in India. In March 2017, the Competition Commission of India approved the merger between MMT and the Ibibo group to create a $2.2 billion valued entity under the common brand name of MMT.[111] This merger has been a great way for MMT to attract consumers for online hotel bookings. Goibibo, through their app had been able to get many young people to book hotels online. The GoCash feature on their app helped ensure consumer loyalty. The merger has created an entity that brings together leading consumer travel brands including MMT, Goibibo, RedBus, Ryde and Rightstay, which together processed 34.1 million transactions during fiscal year 2016.[112] The MMT app was launched in 2012, which has been a game changer for the business owing to the growth of internet and smartphone penetration in India. There are more than 10 million users on the app and 60%-65% of user traffic comes through the app. In order to enhance growth, several measures have been adopted by MMT which includes focus on quality of products, innovation via new platforms, effective Human Resource policies, customer friendly and partnerships for cashless transactions.[113]

4. **Impact[114]:**

   - Online bookings accounted for $3-$4 billion in a $33 billion market in 2010. In 2016, the comparable numbers were $13 billion in a $47 billion market. MMT is a leader of the growing online travel market in India.
   - For MMT there have been 39% more bookings by Indian travelers in April-July 2017 as compared to the same period in 2016.Mobile transactions at MMT grew 1.3 times in the period July – Dec 2016 versus same time in 2015 and constituted 57% of the total transactions versus 38% same time last year.
   - Mobiles have given customers the flexibility to make bookings on-the-go as well as make spontaneous travel plans. The mobile app accounts for 75% of the total International and Domestic Hotel transactions. App users are heavy bookers

107. Sharma, A2016, 'Online Travel Accounts for 61% of Indian ecommerce: IAMAI-IMRB study', Medianama 8 June. Available from: http://www.medianama.com/2016/06/223-iamai-ecommerce-study/ (12 June, 2017).
108. Verma, S 2015, 'MakeMyTrip's bootstrapping period was very educative: Deep Kalra', Livemint 20 July. Available from: http://www.livemint.com/Companies/xzaO12cmnfEWFgTuaiRbjK/Deep-Kalra--MakeMyTrips-bootstrapping-period-was-very-educ.html (12 June, 2017).
109. Ibid.
110. Ibid.
111. Ibid.
112. http://investors.makemytrip.com/phoenix.zhtml?c=238356&p=irol-newsArticle&ID=2240934 (12 June, 2017).
113. Kashyap, How A $2.2Billion Startup Snatched 45% of India's Online Travel Market, 2017.
114. Ibid.

and on an average, their number of transactions is twice that of non-app users. The number of repeat customers is twice as much for app users as compared to desktop users.

- MMT is also driving the Middle India agenda by building reach and penetration beyond metro towns. Transaction contribution of non-metro towns on apps is 11% more than transaction contribution of non-metro towns on desktop.
- Online travel bookings have also fuelled the growth of the hotel and hospitality industry in India. In 2016, there was 145% rise in domestic hotel transactions. Highest growth was observed in budget category hotels. The comparable numbers for international hotel bookings was 59%, In this case, highest growth observed in 3-star hotels.
- Considering that 70% of hotels in India are non-chain/budget hotels, guest houses and dharamshalas, the increase in domestic hotel bookings would have likely given a boost to these businesses, especially since this growth has been highest for budget category hotels. Addressing effectively the trust deficit which is the biggest hindrance in the sector, MMT has introduced a standardisation for hotels called 'Assured Hotels' where in hotels will be categorized and certified to address customer concerns while booking online. Hotels that secure more than 4 out of 5 stars would get listed on MMT, based on ratings and online reviews, clearly tagged locations, recent pictures to reinforce authenticity, and neighborhood guides[115].
- Many customers are now booking online as a result of reading online travel content. MMT, through its advertisement campaigns wishes to tell customers that their needs are being taken care of and through their various schemes aim to help consumers overcome barriers and make travel an easier experience.

5. **Challenges:** The major challenge in the online travel ecosystem continues to be that of a fundamental trust deficit, inherent in the Indian traveler's psyche. The other challenges lie in - enabling vernacular languages in the MMT app which would be the next step to trigger growth by drawing under the umbrella, a larger customer base from tier-2 and tier-3 cities. Finally, improving network infrastructure, especially mobile internet access is important, since smart phones are spearheading the shift from web to mobile within the online travel industry[116].

VIII. MOOSHAK

1. **Background:** India has over 125 million English speakers, which is second only to the United States[117], but just about 10% of its total population. In order to bring India's mass population online, more content and communication in local Indian languages needs to be encouraged. According to a recent study by KPMG India and Google, Indian language internet user base has increased at a CAGR of 41% between 2011 and 2016, to reach 234 million users at the end of 2016, thus surpassing English language internet users. One of the major drivers of this growth has been the increased adoption of local language enabled smartphones and keyboards. Indian language internet users are expected to account for 75% of India's internet user base by 2021[118].

2. **Addressing the Market Need:** Popular social media platforms like Facebook and Twitter have enabled sharing of content in local language. However, these forums are not unique to Indian languages and function within a widely accepted hegemony of English. Hindi content is a dismal 0.1% of the total content generated online[119]. Mooshak was conceptualized as a micro blog based social network, developed exclusively for local language content and communication. It is the first app to have their mobile and web user interfaces entirely in Devanagri.

3. **Business Model:**

   a. ***Functionality:*** The app features are similar to most micro blogging sites. All accounts are linked to phone numbers and verified by a One Time Pin (OTP). Each user is assigned a unique number by the system. Since user names can be in different languages, this number allows cross script/language communication. The app is currently operational in Hindi, however, Gujarati and Marathi will be added to the user interface later in 2017. The auto transliteration feature ensures that content typed in English is automatically converted to Hindi by the app. Users can type up to 500 characters. There are features for uploading images, audios and videos and hash tagging. Though the app does not have

115. Ibid.
116. India's Internet Opportunity, 2013. Available from: http://www.mckinsey.com/industries/high-tech/our-insights/indias-internet-opportunity (12 June, 2017).
117. Bhattacharya, A 2017, 'India's internet users have more faith in content that is not in English', Quartz 2 May. Available from: https://qz.com/972844/indias-internet-users-have-more-faith-in-content-thats-not-in-english-study-says/ (12 June, 2017).
118. KPMG in India and Google 2017, Indian Languages – Defining India's Internet,. Available from: https://assets.kpmg.com/content/dam/kpmg/in/pdf/2017/04/Indian-languages-Defining-Indias-Internet.pdf (12 June, 2017).
119. Gupta, K 2016, 'Importance of local language in Indian context and social media', Thinking Aloud 13 April. Available from: http://www.thinkingaloud.in/home/importance-of-local-language-in-indian-context-and-social-media (12 June, 2017).

a translation feature where one Indian language can be translated to another, content typed out in Devanagri can be viewed in other scripts like Odiya, Telugu etc. It is driven primarily by user based content, the spectrum of which ranges from light hearted banter to jokes and political memes.

b. ***Revenue:*** Funds remain one of the major constraints for Mooshak. The founders want to focus on revenue generation only once they have reached a minimum threshold of users. At present, their focus is on user acquisition. Some of the proposed revenue streams are in-app advertisements and selling of micro products such as skins, stickers etc. The app is currently being promoted only through their Facebook page.

c. ***Growth:*** The app was launched in Bhopal in September 2015, ahead of the World Hindi Conference that was being hosted in the capital city of Madhya Pradesh that year. Since then, there have been, roughly 92000 downloads. Maximum downloads are from Uttar Pradesh, Rajasthan, Madhya Pradesh, Bihar and Delhi. 90% of the user traffic comes from the app, while 10% comes from the website. The growth at Mooshak has been limited. They are looking to raise approximately 30 lakh rupees worth of funds in order to undertake promotional activities.

4. Impact:

- While the impact of Mooshak has not translated into significant revenue generation or employment creation, it is working towards a larger goal, which is to revive and encourage the use of local languages on the Internet. For many, Mooshak serves as their first social media experience.
- Mooshak is unique in terms of having been able to offer a service that appeals more to users in Tier2 and Tier3 cities as compared to the ultra-urban apps. Early adapters of the app are all from smaller towns and cities. Once Mooshak is made available in Gujarati, they hope to focus their efforts in replacing Twitter as a key influencer in the next Gujarat Assembly Elections.
- Mooshak users comprise an interesting demography. The predominant categories are students and retired professionals/businessmen over the age of 65 years. This is in contrast to other popular networks like Facebook and Twitter that are dominated by young adults and the middle-aged. The app is definitely bringing an unfamiliar demography on the Internet.
- Even though popular sites like Google, Facebook and Twitter are enabling local languages, the content ratio of English to vernacular is highly skewed. Platforms like Mooshak not only provide free space for the non-English speaking population to interact comfortably, it also facilitates the creation of a more language inclusive internet ecosystem.
- Other apps and platforms that are doing similar work include, Pratilipi, which is a self-publishing platform to read, write and download free stories, books, poems, etc. across eight Indian languages. Daily Hunt, a news aggregator platform, makes news, books and magazines available in 12 Indian languages.

5. Challenges: The major challenges for Mooshak lie in ensuring that the app runs faster on slower networks like 2G, especially since it is popular in small cities where high-speed connections are an issue. This would mean additional investments in developing a lighter app that consumes less data, and functions well on a slow speed connection. The other important challenge is to address social perceptions surrounding vernacular languages. The founders feel that communicating in English is considered more fashionable than communicating regional languages. By providing an internet enabled platform for interacting purely in Indian languages, Mooshak aspires to address the lack of social leadership in making Indians more comfortable in communicating in their own language.

IX. MP MOBILE

1. Background: The government has been increasingly directing its efforts towards digitization of governance and empowering citizens with the benefits of technology. Initiatives like Digital India have been major steps in that direction. Various services have been brought on digital platforms. With the increase in smartphone penetration in India, digital governance has definitely become more efficient and cost effective.

2. Addressing the Market Need: MP Mobile integrates government services in Madhya Pradesh into a single app. Bringing all governance related services on a digital platform bridges the information asymmetry by making accessible all directives and services on a single platform, saving citizens the hassle of multiple trips to government offices. It also helps the government redirect manpower and optimizes use of resources as processes become automated. It reduces costs for both parties, induces transparency and improves efficiency.

3. Business Model:

a. ***Functionality:*** MP Mobile is a platform that brings together various Governments to Citizen Services

offered by several government departments and public corporations, including those of the University of Madhya Pradesh on a single integrated and accessible platform. The app provides details on school and university level examination results, counseling sessions in colleges, scholarship details etc. As part of their transport department services, driving license downloads, registration certificate details etc. have benefited thousands of citizens. Services of MP Online have helped successfully conduct online semester exams in universities in the state.

b. ***Revenue:*** The app doesn't earn any revenue currently. Most services are free of cost and for transactions that take place through the app no separate commission is charged.

c. ***Growth:*** MP Mobile presently has a total of 2,13,563 downloads and 27,578 active users. It has benefited thousands of citizens in the state. The app was originally available only on Android but is now also available on Windows phones. MP Online Limited is the app's technology partner and is also co-promoted by Tata Consultancy Services (TCS). Kiosks in Madhya Pradesh are service delivery facilitation centres, where citizens can avail of the citizen centric services provided by MP Online. This is similar to the Common Service Centre model. There are 23608 such kiosks offering over 200 different services. The working language of the app is English, however, in case of certain services, results are also shown in Hindi.

4. Impact

- The kiosks styled on lines of CSCs are spread across urban and rural areas in MP. The potential for revenue generation from these kiosks is boosting entrepreneurship in the state. There are plans to expand the network of kiosks. Currently there are 13315 urban and 8404 rural kiosks. Improved operations and increased activity at kiosks would mean higher income for entrepreneurs running these kiosks and more employment to manage operations.
- Over 59000 citizens have benefited from service providing board exam results and over 200000 students have taken online counseling for engineering on MP Mobile. 1361 citizens have benefited from the online electricity bill payment system. Their web portal, MP Online has a presence in 51 districts and over 350 tehsils in Madhya Pradesh.
- Mobile based services enable inclusion of the rural population due to higher penetration of mobile phones in these areas as compared to computers. MP Mobile has the added advantage of a selection of services such as 'Know Your Exam Result (Madhya Pradesh Board of Secondary Education)', 'Verify Payment (Verification of transactional services which is done through MP Online) and 'Grievance Status (MP Online Grievance Status)' available on feature phones through USSD technology.
- Digital governance and integrated platforms like MP Mobile have created an integrated system involving both government and citizens that facilitates dialogue and participation of civil society in governance initiatives. The convenience factor helps in reducing barriers to public service operations, encouraging citizens or service providers to make use of technology.
- It also facilitates efficient and transparent service delivery by improving information accessibility to citizens. The app provides timely notifications on government initiatives and required citizen action.
- Operations on digital platforms help save resources (time, money and paper) for both citizens and the government.

5. Challenges: E-governance apps, in general face a demand side problem. There is a general lack of awareness among people about these apps and other digital initiatives of the government. Though, the apps are a way of bridging this gap, such applications can create tangible impact if they are marketed and promoted on a big scale. In case of MP Mobile, another potential challenge is the lack of language options. If the app aims to make governance more inclusive by reaching out to people in rural areas, the predominance of English might act as a major hindrance.

X. NETFLIX

1. Background: Internet has changed the way people view and consume music and video content. Smartphones and tablets are gradually replacing television, to become personal media devices that enable access to a wide variety of content. Easy accessibility empowers consumers to control their viewing experience. According to consulting firm, Ernst & Young, India had 160 million digital video viewers in the end of 2016[120]. With increased Internet and smart phone penetration, this number is only set to rise in the future.

120. Choudhary, V 2017, 'Hotstar top video streaming app in India: report', Livemint 25 January. Available from: http://www.livemint.com/Consumer/PyTKS6GVjiZTmYY9C46hzK/Hotstar-top-video-streaming-app-in-India-report.html (12 June, 2017).

2. **Addressing the Market Need:** The Internet has enabled a shift from the appointment based cable TV viewing to an on-demand platform.[121] Rapid innovations in digital media enable personalized experiences and create scope for constant quality improvements in video watching. Netflix provides consumers instant access to high quality storytelling and critically-acclaimed programs from around the world. Affordability, dissuades digital viewers from downloading pirated content. Personalised, instant and affordable video content, by platforms such as Netflix, is paving the way for a privacy free media industry and also one which encourages new comers.

3. **Business Model:**

   a. ***Functionality:*** Netflix membership gives users access to unlimited television shows and movies at a monthly price. A free trial is offered in the first month, after which it is chargeable. With the app, users can watch shows of their choice, anytime, anywhere and as many times as they want. Their personalization and discovery tools help consumers discover content, tailored to their unique tastes and preference, along with a parental control feature. There is a download feature on the app which enables users to download shows and watch them with poor or no connectivity. Netflix is fully amenable for use by the disabled.

   b. ***Revenue:*** Revenue is generated from the monthly subscription fee paid by users. One of Netflix's key strategies is production of original content that witness great uptake, and attract fresh subscriptions.

   c. ***Growth:*** Netflix had roughly 4.2 million active subscribers in March 2017[122]. For Indian consumers, mobile has been the preferred platform. The content varies from drama to comedy series, documentaries, stand up specials and films from all over the world. Netflix original productions like 'Stranger Things' and 'Orange is the New Black' to name a few, have been successful with Indian audiences, as with the rest of the world. According to data provided by Netflix, Indians devour a TV series over 3 days, which is higher than the global average of 4 days. This year, Netflix is looking to curate a compelling content library encompassing original and licensed titles. Partnerships have been forged with top industry players like Phantom Films, Red Chillies Entertainment and Viacom, as well as with stand-up comedians Vir Das and Aditi Mittal, in wake of the genre's rising popularity. Netflix also partners with operators and device manufacturers to provide better streaming experience, as well as with Smart TV manufacturers like LG who will include a Netflix button on their remotes for direct access. Netflix is now available in more than 1000 different internet-connected devices – from a mobile device to a tablet, to a Smart TV or a set-top box.

4. **Impact:**

   - Piracy has dropped in countries where Netflix started operations. Downloading of torrent websites declined by approximately 30%.
   - The rise of video services by platforms such as Netflix, contribute to the rapid increase in mobile video traffic in India, which is forecasted to grow 11.5 fold from 2016 to 2021, i.e. at a CAGR of 48%.
   - Through their 'Open Connect Program', Netflix invests in its own Content Delivery Network (CDN) which is a vehicle for delivering data to internet access networks for its transmission to end-user customers. This lowers costs and boosts efficiency for both Netflix and its ISP partners. The 'Open Connect Program' supports hundreds of large and small ISPs to directly interconnect with the Netflix network for free in regional locations rather than going through third party transit providers. Local delivery provides immediate financial savings for local ISPs.
   - Providing local performers a global platform: Vir Das is the biggest example of Indian talent getting worldwide exposure. He now has his own stand-up comedy series with Netflix and recently made his debut on American television. Netflix is also teaming up with other comedians like Aditi Mittal, as well as with independent filmmakers and artistes. 'Sacred Games' is their first announced Indian original series, in partnership with top studio Phantom Films. Other independent series like 'Brahman Naman' and 'Visaranai' which is India's entry to the Oscars this year and exclusive to Netflix, are set to be accessible to audiences worldwide, thus providing exposure and strengthening not only the mainstream film industry but also facilitating due recognition for smaller, independent artistes. Their aim is to strike a balance between local and mainstream content, star-driven and independent films. Users in India can view a wide variety of local language content including Gujarati (The Good Road), Marathi (Sairaat), Tamil (Interrogation), Punjabi (Anhey Ghorhey da Daan) and Assamese (Kothanodi).

121. Kohli, D 2017, 'The Rise of Online Content Consumption in India: Looking Beyond Metros', Inc42 23 March. Available from: https://inc42.com/resources/rise-online-content-consumption/ (12 June, 2017).

122. KPMG,' Media for the masses: the promise unfolds'. Available at: https://assets.kpmg.com/content/dam/kpmg/in/pdf/2017/04/FICCI-Frames-2017.pdf (12 June, 2017).

5. **Challenges:** One of the major challenges for Netflix lies in network speeds. This problem, however, is not unique to India but is faced by them across emerging markets. High data costs and caps on data affect their business. Jio's entry into the market has eased the connectivity problem in India. Consumers also face technical issues while paying the subscription fees online because of patchy infrastructure.

   Netflix is also closely following the net neutrality discussion in India that compares digital media and video on-demand to legacy cable and broadcasting services. The need for a level-playing field is the most debatable aspect of this policy.

XI. PAYTM

1. **Background:** A tremendous surge in digital payments took place in India after the government demonetized high value currency in November 2016. Digital payments recorded a 55% increase in FY 2016-17, thus validating observatory conclusions.[123] Not only in India, but globally, consumers and businesses have gradually transitioned from cash to plastic card payments to transactions and money transfers being made over digital channels, either from dematerialized cards held on digital wallets or in the cloud, or from new digital payment mechanisms[124].

2. **Addressing the market need**: At its core, Paytm addresses a payments problem. Carrying cash at all times for payments is inconvenient and payments through credit and debit cards are expensive for merchants for non-cash transactions. This necessitated a platform which was provided convenience of transacting without added expenditures, on both the consumer and producer sides. Paytm provided that platform where payments and transactions were being routed through the most widely adopted device – smartphones, thus enabling on-the-go transactions and transfer of money without the hassles of carrying money in the form of either cash or cards.

3. **Business Model:**

   a. ***Functionality:*** Paytm positions itself as a purely consumer app. It enables a user to get a mobile recharge, book airline tickets, pay electricity bills, and even transfer money to other Paytm users. The accounts are linked with mobile numbers and they have also introduced QR code scanning systems, where payments can be made a user by simply scanning the given code.

   b. ***Revenue:*** Paytm earns a commission of 2 to 3% per recharge. Paytm controls about 30% of the phone recharge market. They have also diversified their recharge services to television subscriptions, data-card, and metro card recharges. With over 1,000 brands in their e-commerce business, it has also become a major source of revenue. Paytm earns a percentage of every sale (made through the wallet), as a commission, which differs from category to category. Revenue is generated by holding promotions for sellers. It also charges a 4% fee if one deposits their money from Paytm wallet to a bank and also charges its sellers an annual subscription fee[125].

   c. ***Growth:*** In a short span of time Paytm has scaled to over 220 Million registered users[126]. Total payments through digital instruments are expected to reach $500 billion by 2020 in India, according to a study by Boston Consulting Group, with customer's payment to merchants driving this growth. It launched online train ticket bookings in partnership with IRCTC in October last year and is now targeting a three-fold growth this financial year. Currently, 90 per cent of the train ticket bookings on Paytm are done through the mobile platform. Paytm's traffic increased by 435%, app downloads grew 200%, and there was 250% rise in overall transactions and transaction value post demonetization.[127] It has also received Reserve Bank of India's payments bank license and the launch is due soon.

4. **Impact:**

   - Before demonetisation, 60% of Paytm's users came from the top 5 cities and 40% belonged to the rest of the 45 of top 50 cities. However, in the 8-9 months post demonetisation, the distribution changed, with 40% users coming from the top 5 cities, 45% coming from the next 45 cities and 15% of users coming from very small cities.

   - Due to Paytm, smaller shops witnessed a footfall of close to 1000 people per day (especially in the post-demonetisation period). On the merchant

123. *PTI 2017, 'Digital payments rise 55% in FY'17: Watal', The Economic Times 3 July. Available from: http://economictimes.indiatimes.com/news/economy/finance/digital-payments-rise-55-in-fy17-watal/articleshow/59423162.cms (6 July. 2017).*
124. *Accenture, 'Digital Payments Transformation From transactions to consumer interaction', p-4. Available from: https://www.accenture.com/t20150707T195226__w__/us-en/_acnmedia/Accenture/Conversion-Assets/DotCom/Documents/Global/PDF/Industries_5/Accenture-Digital-Payments-Transformation-From-Transaction-Interaction.pdf (6 July, 2017).*
125. *https://paytm.com/business/payments/pricing*
126. *https://paytm.com/about-us/*
127. *Sen, S 2017, 'Mobile wallets see a soaring growth post-demonetisation', Hindustan Times, 1 January. Available at:http://www.hindustantimes.com/business-news/mobile-wallets-see-a-soaring-growth-post-demonetisation/story-zwdBi3UGqG1qZD92AEF9GK.html*

side, over 6-7 million merchants have been added to the digital payments ecosystem.

- Paytm, being one of the first players in the digital payments market, has fostered an entire ecosystem of digitized transactions. Almost all apps, both online and offline portals, be it for ordering food and groceries or for finding a cab, allow for payments through Paytm. This saves both the consumer as well as the supplier from painful bargaining and haggling for change.
- The most notable impact of Paytm is perhaps, on MSMEs and mom-and-pop stores. One of the company's focus areas is on establishments that cannot afford point of sale swipe machines (which also require buying printing paper and ink). Paytm came as a blessing to such small businesses, especially after demonetization. Due to the massive cash crunch, digital transactions were the only way in which they could sustain their businesses.
- The new digital payment system has not only enabled transactions sans additional costs, but merchants are now also looking at business expansions. It has also helped them attract a new set of customers who prefer digital over non-digital payments.

5. **Challenges:** The primary challenge for Paytm and digital payments in general, is the aspect of consumer behaviour. Especially in the Indian context, people are habituated into cash based transactions. Lack of digital literacy among many, makes the operation of a smartphone difficult for them and with. While Demonetization acted as a shock to the economy and acted as a stimulus to online payment services and mobile wallets like Paytm, whether behavior patterns will change and lead to a sustained uptake of these services is yet to be seen. Another user concern is that of hidden charges on digital transactions. Paytm also depends on a network effect, where money transfers or transactions can happen only from one Paytm user to another. A comparison can be drawn here with apps like the government-created BHIM, which has been positioned as a public sector alternative to services like Paytm. Unlike Paytm however, BHIM requires a user to integrate their bank account with the app. BHIM also allows one to send money to a user who doesn't use the app by using their IFSC code, thus not relying as heavily on a 'network effect' for the adoption of the app. However, a number of concerns have been raised regarding the security and ease of use of the app. Privacy is also an issue with Paytm as the accounts function through mobile numbers and anybody who has access to another Paytm user's phone can log in and transfer money from one Paytm wallet to another. This risk prevents many from parking large amounts in their Paytm wallets in particular and other e-wallets in general.

XII. PRACTO

1. **Background:** The healthcare sector in India has been growing at a tremendous pace. It is expected to advance at a CAGR of 26.31 per cent during 2016–20 to reach USD280 billion by 2020. The large scope for improving healthcare services penetration in India presents further opportunities for development of the healthcare industry. Some of the factors that are likely to improve the growth of the sector are rising income levels, ageing population, growing health awareness & changing attitude towards preventive healthcare.[128] One of the key tools in enabling growth of the Indian healthcare sector is medical technology innovation, and this is not restricted to products but also services and innovation across the value chain including manufacturing, distribution, marketing etc[129].

2. **Addressing a Market Need:** Practo was founded in 2008 in response to a crisis, faced by the co-founder in sharing medical records with a doctor overseas for a second opinion. Practo started with the addressing the market need on the supply side, and made inroads into the medical practitioners, clinics, and hospitals with their practice management software called Practo Ray, that aided in digitization of medical records and data bases. On the demand side, it began the Practo platform for finding doctors in a particular area, with feedback from their patients and the ability to fix appointments on through the platform. Practo has also added a number of services such as home delivery of medicines, providing healthcare related content etc.

3. **Business Model:**

   a. ***Functionality:*** Practo provides two app platforms, one dedicated to doctors, and clinics known as Practo Pro, and a second focused on patients known simply as Practo. The Practo app provides a platform for discovering doctors, fix appointments, chat and consultations with doctor online, set reminders to take medicines, upload medical records, access healthcare articles etc. Practo Pro app houses many of the services that Practo offers for practice management known as Practo Ray, an online profile management service for the doctor/clinic known as

128. IBEF, 'Healthcare June 2017'. Available at: https://www.ibef.org/download/Healthcare-June-2017.pdf
129. Deloitte, 'Medical technology industry in India'. Available at: https://www2.deloitte.com/in/en/pages/life-sciences-and-healthcare/articles/medical-technology-industry-in-india.html

Practo Profile, an online service to improve visibility and outreach known as Practo Reach, and content publishing service that publishes and curates health articles called Practo Health Feed.

b. ***Revenue:*** Practo's revenue streams are mainly through hospitals or medical establishments advertising on the platform, software subscriptions by doctors, clinics and hospitals, and commission based revenue on online consultations, and delivery of medicines.

c. ***Growth:*** Practo has grown significantly in terms of customer base, geography and services provided. Over the last three years, it has created a database of 200,000 registered doctors, 5,000 diagnostic centres and 10,000 hospitals across 50 cities. It is now expanding across South East Asia, Latin America and the Middle East. It is currently fully operational in 35 cities in India. Practo is also operating in 18 other countries; it has begun providing practice management services in Singapore, Philippines, Indonesia, and Brazil, and in the remaining countries the patient-side services of doctor discovery, booking appointments etc. is available. Practo has also begun offering home delivery of medicines in certain cities.

4. Impact

- Practo has nearly 200,000 registered doctors on its database. Nearly 25% of its traffic from tier 2 and tier-3 is directed towards easier access to medical facilities in bigger cities with better medical facilities.
- The online consultation feature enables doctors to see more patients in a day, and also facilitates easier consultations for patients with qualified doctors for minor ailments.
- The app has provided doctors and medical practitioners greater visibility and access to a wider client base.
- The app now allows people outside India to book appointments with ease and has eased and promoted medical tourism in an unprecedented way.

5. Challenges: The verification of doctors and their qualifications has been a challenge, and required extensive effort on part of the Practo team to ensure that Doctors enlisted have the required qualifications and documents to support the same. However there are still cases of persons without qualifications registering on the platform with false documents etc. Another challenge that Practo faces is the lack of clarity on the government's policy on e-prescriptions, and telemedicine. This has hindered full-fledged expansion of Practo's new services such as home delivery of medicines. The rules and regulations have not been able to catch up with the innovation in delivery of healthcare services and this continues to pose a challenge to Practo, growth.

XIII. TRUECALLER

1. Background: The world is way past the days of phonebooks. In the digital era digitally fed contact lists are necessities. Bank accounts, e-commerce, feedback forms, everything is linked to phone numbers. This has helped create databases that are often misused in the form of spam calls to market/ promote products and services. A study has reported that spam calls could amount to 20 million working hours annually for small businesses, which is equivalent to $475 million each year[130].

2. Addressing the Market Need: Truecaller was born out of the need to address the uncertainty surrounding the identity of the person from whom a call was being received. India's calling habits were different from other countries. Mobile numbers are not treated as personal, and the liberty to call anyone at any time is exercised very liberally[131]. This also gives rise to the number of unwanted calls. The objective of the app is to identify the caller, create more transparency and block out spam and other unnecessary calls. Crowd sourced information helps a build a directory of spam callers, which can then by effectively avoided.

3. Business Model:

a. ***Functionality:*** Truecaller is an app to identify the identity of the caller. It is a free phone directory and caller identification app[132]. It serves as a global telephone directory and reverse directory that has caller ID, social media integration and call blocking facility[133]. With Truemessenger, users can

130. Don't Overlook the Hidden Costs of Spam, 2014. Available from: https://www.dialogtech.com/blog/call-routing/dont-overlook-hidden-costs-spam-calls (12 June, 2017).
131. Subramanyan, N 2016, 'Customer Delight Is Our No.1 Priority: Truecaller VP', CXOToday.com 1 August. Available from: http://www.cxotoday.com/story/improving-customer-experience-through-unique-innovations/ (12 June, 2017).
132. Truecaller launches its first brand campaign in India, 2015. Available from: http://www.business-standard.com/article/management/truecaller-launches-its-first-brand-campaign-in-india-115081900222_1.html (12 June, 2017).
133. https://en.wikipedia.org/wiki/Truecaller (12 June, 2017).

also identify and block spam messages. The app is available in over 40 languages worldwide, 7 of them being Indian languages. There is also a Hindi transliteration feature. Truecaller Priority services were launched in 2016 to help distinguish important calls made by companies from spam calls.

b. ***Revenue:*** Truecaller runs on external funding. It has raised $80 million so far, across four rounds from the likes of Atomico, Sequoia Capital and Kleiner Perkins, Caufield & Byers among others.[134] Their primary sources of revenue are advertisements and the Truecaller Pro subscriptions which is an ad-free version with additional features like Contact Request where a user can ask for the contact information of any other Truecaller user[135].

c. ***Growth:*** The Swedish company set up in 2009 was an effort by founders to find a better solution to look up phone numbers for the missed calls they received from family members living abroad.[136] Today, it has over 200 million subscribers, out of which approximately 130 million are from India, making the country, its top market[137]. Truecaller today is an integration of Truecaller, Truedialer and Truemessenger as well as its recent entry into digital payments and recharge. Turecaller users are spread across metropolitan, and tier 1 and 2 cities. The ratio of male to female users stands at 70:30.

4. Impact:

- More than 450 million spam calls have been identified in India. About 70% of spam calls are captured by Truecaller's automatic spam filter[138].
- Worldwide, 2.5 billion spam calls have been blocked using Truecaller over a span of one year. There are country based spammer lists that are regularly updated[139].
- The Callkit integration feature that came with iOS 10 allowed Truecaller to feature live spam identification. There was a 90% increase in spam coverage for iPhone users in certain countries. For India, the number rose from over 50% in the pre-iOS 10 stage to 80% in the post-iOS stage[140].
- Truecaller Priority has benefited over 20 companies by ensuring frictionless communication with their e-commerce customers.
- Partners of Truecaller have seen great impact through TrueSDK which is their tool for app developers who want to reduce the friction and complexities of getting new users on board[141]. For apps that are TrueSDK integrated, about one third of their sign-ups come via Truecaller. These include startups like Quikr, redBus, Goibibo, ShopClues, Naukri.com and OYO Rooms[142].
- User testimonials on social media platforms like Twitter show that people have been able to identify fake calls from banks and have avoided involvement in fraudulent activities.
- It has also been hailed as a go to app for women's safety as it helps identify and block unknown and unwanted callers (GSMA).

5. Challenges: One of the primary challenges faced by Truecaller was to convince its users of data privacy after the app was hacked in 2013 by a group called Syrian Electronic Army and released some user information on Twitter[143]. Truecaller has overcome this challenge by strengthening system security. In the days to come, voice over IP and integration of technology might warrant fresh investments from Truecaller to upgrade its caller identification system which currently runs on a network that continues to be dominated by traditional voice calling.

XIV. UMANG

1. Background: A primary objective of the Digital India campaign is to make government services more accessible to citizens electronically. E-governance initiatives strengthen the relationship between the citizen and the government. They increase awareness among citizens about government services and make governance more efficient, cost-effective and accessible.

134. Paul, S 2016, 'India is Truecaller's second home', Forbes 7 June. Available from: http://www.forbesindia.com/article/boardroom/india-is-truecallers-second-home/43393/1 (12 June, 2017).
135. Ibid.
136. https://www.truecaller.com/about (12 June, 2017).
137. Paul, India is Truecaller's second home, 2016.
138. https://blog.truecaller.com/2016/05/18/trueinsights-new-spam-filters-from-us-less-spam-for-you/ (12 June, 2017).
139. https://blog.truecaller.com/2017/02/22/truecaller-spam-call-research/ (12 June, 2017).
140. https://blog.truecaller.com/2017/02/22/truecaller-spam-call-research/ (12 June, 2017).
141. https://developer.truecaller.com/ (12 June, 2017).
142. Paul, India is Truecaller's second home, 2016.
143. D'Monte, L 2014, 'Truecaller's biggest challenge lies in scaling up hiring: CEO Alan Mamedi', Livemint 7 April. Available from: http://www.livemint.com/Companies/TkgFNLe6saq403IzHX788I/Truecallers-biggest-challenge-lies-in-scaling-up-hiring-CE.html (12 June, 2017).

With the increase in the use of smartphones and low data costs, the technological environment in India is promising for such initiatives.

2. **Addressing the Market Need:** The Unified Mobile Application for New Age Governance (UMANG) is a mobile application that acts as a single point of access for a citizen to avail government provided services. This initiative also makes it easier for government bodies to reach citizens and potentially lower costs of operation and increase efficiency.

3. **Business Model:**

   a. ***Functionality:*** The app acts as a platform for services provided by the Central Government, State Governments and local bodies as well as important utility services from corporates. While the app is available on popular platforms like the Play Store and the App Store, it can also be downloaded by scanning a QR Code, giving a 'missed call' to a designated phone number or a download link that is sent over SMS if one's phone number is submitted on the official website for the app[144].

   b. ***Revenue:*** The app can be downloaded for free. While the project to build UMANG is funded entirely by the government, the creation of the app was outsourced to a private firm through a thorough tendering process.

   c. ***Growth:*** UMANG currently integrates 18 services on the app. The application supports 12 Indian languages in additional to English[145] which will make adoption of the app much easier for citizens across the country. The app is also hosted on the cloud to improve scalability. While a formal launch is yet to be carried out for the app, a Beta release is currently available on all major application platforms. Thus, heavy promotions have not yet been undertaken by the government. There have been 10000 downloads of the app from Google Play Store since June 2017[146]. It aims to do increase the number of services to 200 by December 2019[147].

4. **Impact:**

- A myriad of government services are available as apps on various platforms. UMANG obviates the need to download each app separately and makes available multiple services on a single app. For example, a citizen who downloads UMANG to check CBSE results may also access services under the National Pension Scheme without downloading an additional app.
- It is easier for government bodies to provide their services electronically. By providing their services through UMANG, departments will no longer have to undertake tendering processes for individual applications and will be integrated with Aadhar, DigiLocker, Payment Gateways and RAS at no cost. This will also enable smaller government bodies and utility providers to reach citizens.
- The digitization of processes make it easier for citizens to avail government schemes. The DigiLocker feature that allows one to save documents potentially eliminates the need to create multiple copies of official documents and submit them in person. This is specially helpful for the elderly and the differently-abled.
- The app also helps in information dissemination and raising awareness among citizens about changes in policies, notifications which are receives on-the-go on their smartphones. It creates a platform for healthy dialogue between the government and its citizenry.

5. **Challenges:** Since the app uses an internet connection to load the various services the current low rate of internet penetration may act as an impediment in the adoption of the app. Since the nature of the app is that of an integrator of services, there is a risk that the size of the app may become too large to function smoothly.

XV. URBANCLAP

1. **Background:** Home services are the newest members to enter the camp of on-demand applications and are perhaps the next big market. There has been a surge in such applications over the past couple of years, the most prominent ones in India being UrbanClap, Housejoy and LocalOye. They offer a wide range of services, from salon services at home and providing carpenters, electricians and support staff for house cleaning to even hiring nutritionists and yoga instructors.

2. **Addressing the Market Need:** UrbanClap seeks to redefine the way local services and servicemen are hired. The founders identified fractures in the existing market where on the demand side, people had to depend on recommendations from friends and relatives to hire reliable people for delivering home based services and on the supply side, many talented professionals lacked the resources and the exposure

144. Ibid
145. https://web.umang.gov.in
146. Play Store Page
147. https://web.umang.gov.in

to capitalize on their expertise and had to rely on aggregators which exploited their potential for profits. Hence, UrbanClap sought to remove middlemen by shifting from an aggregator model to an individual model and organize the market by introducing service wise standardizations in pricing, service and experience and rating/feedback systems to create transparency in the system, thus addressing both the demand and supply side problems.[148]

3. Business Model:

a. ***Functionality***: UrbanClap is a one stop app for hiring professionals delivering a range of services in plumbing and electricity that are home based to beauty, photography and other lifestyle services. It partners with trusted service providers, empanelled after a proper screening procedure. Payments are based on pre-approved quotes and there are seamless payment options. Services can be booked at home by customers at their convenience.

b. ***Revenue:*** Their major source of revenue is from the commissions charged on the value of services provided by professionals empanelled with UrbanClap. It is a sliding commission and ranges from 5% to 25%. According to co-founder Varun Khaitan, UrbanClap is transacting a gross service value of Rs. 50 crore a month on average, and offers in excess of 100 services[149]. As of December 2016, it has raised USD 37 million from three rounds of funding, with the largest one worth USD 23 million, led by Bessemer Venture Partners[150].

c. ***Growth:*** Since its inception in 2014, UrbanClap has witnessed surging popularity. It is operational in Delhi – NCR, Mumbai, Bangalore, Pune, Hyderabad, Chennai, Ahmedabad and Kolkata, with the first three cities being its top markets. It currently lists about 107 services[151] and serves about 6000 customers every day[152]. Their revenues increased from Rs. 2 lakh in 2015 to a straight Rs. 2.8 crore in the year ending March 2016[153]. For their empanelled partners, UrbanClap provides training for skill enhancement. Every city has a trainer and training sessions have 9 day durations. Each selected partner is provided with a smartphone, data plan and other tools required for carrying out business on UrbanClap. Their marquee services include salon-at-home, EPC (Electrician, Plumber, and Carpenter), appliance repair, yoga-at-home and wedding services. Among long-tail services, there are physiotherapists, tutors, hobby/language classes etc.

4. Impact:

- UrbanClap has partnered with 65000 professionals across 8 cities and served over 1.5 million customers in the last two years.
- Its flagship service is salon-at-home. There are 800 empanelled beauticians across 8 cities. Their average earning is Rs. 40,000 per month, which is a significant improvement from Rs. 15,000 – Rs. 20,000 which was the range of their earnings before they partnered with UrbanClap.
- In a typical beauty parlour, the beautician gets 15%-20% of the earnings, while the parlour retains 80%[154]. However, with UrbanClap, this scheme is reversed and the beauticians retain 80% of their earnings, thus increasing their effective income by 2-4 times[155]. This model helps these beauticians unlock their full potential.
- UrbanClap has helped enhance businesses of over 60000 service professionals by moving away from the aggregator model to an individual model[156].
- UrbanClap has facilitated formalisation of the sector. By eliminating middlemen, it has led to the evolution of a value chain where service providers interact directly with their customers, leading to more transparency and better information sharing. UrbanClap, and similar other platforms have helped service professionals create micro brands of their own by listing and marketing their skills[157], thus facilitating the creation of a larger network of micro-entrepreneurs. On the demand

148. *Chopra, A 2017, 'How UrbanClap grew one on-demand service at a time', Live Mint, 20 March. Available at: http://www.livemint.com/Companies/ck6h9KKDL9Aw1SCgzvMLRM/The-building-of-UrbanClap-one-ondemand-service-at-a-time.html*
149. *Press Trust of India 2016, 'UrbanClap hopes to turn profitable in the next two years', Business Standard, 28 December. Available at: http://www.business-standard.com/article/companies/UrbanClap-hopes-to-turn-profitable-in-the-next-two-years-116122800830_1.html*
150. *Ibid.*
151. *Chopra, 'How UrbanClap grew one on-demand service at a time', 2017. Available at: http://www.livemint.com/Companies/ck6h9KKDL9Aw1SCgzvMLRM/The-building-of-UrbanClap-one-ondemand-service-at-a-time.html*
152. *Sharma, N 2016, 'It's A Long Road To Profitability For UrbanClap', Bloomberg Quint, 31 December. Available at: https://www.bloombergquint.com/business/2016/12/31/UrbanClaps-fy16-balancesheet-is-nothing-to-laud-about*
153. *Ibid.*
154. *Chopra, 'How UrbanClap grew one on-demand service at a time', 2017. Available at: http://www.livemint.com/Companies/ck6h9KKDL9Aw1SCgzvMLRM/The-building-of-UrbanClap-one-ondemand-service-at-a-time.html*
155. *Ibid.*
156. *Exhibit, 2017, 'Abhiraj Bhal – Founder, UrbanClap', TheTechy.com, 23 January. Available at: http://www.thetechy.com/abhiraj-bhal-co-founder-UrbanClap/*
157. *Agarwal, S 2016, 'Online home services start-ups create a new generation of entrepreneurs', Live Mint, 22 November. Available at: http://www.livemint.com/Companies/VznwzhTV9ZygmL9lpxkPnK/Online-home-services-startups-create-a-new-generation-of-en.html*

side, too, it reduces time costs of searching for services.

- Many of their empanelled service providers have not had access to even basic education. For them, to be able to handle a smartphone and even read messages and instructions is a challenge. By providing training sessions to them, UrbanClap ensures that they are equipped not only with the physical resources but also the knowledge to operate on a digitized platform. Their Electornics, Plumbing and Carpenter category of services, which possibly has a high percentage of servicemen without any formal education, receives the highest Net Promoter Scores, which also encourages them to perform better.
- UrbanClap has a unique target group of women in the age group of 25-40 years who are independent professionals as well as relocating residents. The convenience of booking from home at one's suitable time, without hassles of bargaining has been the key uptake factor. Even for those who migrate to new cities, a platform like this saves them the trouble of repeated trials and errors with unreliable service providers.

EMPLOYEE STORIES:

Naziya - Naziya, a beautician empanelled with UrbanClap, is a single mother with two children. Before joining Urban Clap in August 2015, she used to run her own parlour and had taken a loan for her daughter's marriage. Her earnings were hardly Rs. 20,000 a month. However, after joining UrbanClap, she started earning around Rs. 50,000 from the first month itself and not only cleared the loan but also bought a car for her son.

One of their other beauticians was in an abusive marriage when she joined UrbanClap. However, joining the platform gave her the financial independence and the courage to walk out of her marriage, illustrating how portals like UrbanClap have helped many women achieve financial independence accompanied with a sense of social empowerment.

UrbanClap's first beautician is now a proud owner of a flat in Gurugram.

5. **Challenges:** The fragmented nature of the local services market, especially in terms of quality makes it difficult to determine a single measure of standardisation, which further affects the way their pricing[158]. There are various levels of skill acquisition, which varies from person to person. Due to the unavailability of formal training institute for the EPC category, they suffer from lack of confidence in their ability to deliver services satisfactorily. The other challenge is the trust deficit in the collective mindset of consumers about the reliability of portals like UrbanClap. Though, every empanelled partner has to pass through stringent verification procedures, individual character traits can hardly be captured by any sort of method. This applies to both service providers as well as customers. There are also challenges related to identification and more importantly retention of professionals offering high quality services and ensuring the engagement of service providers by maintaining the demand supply balance.[159] This presents the need for UrbanClap and other similar platforms to stay true to their vision, refrain from quality compromises and build a robust service guarantee system along with suitable grievance redressal mechanisms.

XVI. WYNK

1. **Background:** The global music industry is booming. 2016 witnessed a 5.9% growth in global revenues, of which 50% was attributed to digital music. Digital revenue in itself, increased by 17.7%. With the advent of cheaper smartphones and internet enabled devices that, Internet is set to take over media and entertainment, and become a major driver of growth.

2. **Addressing the Market Need:** According to a 2016 report by KPMG, in India, only 1-2% of the music is legally purchased and the rest 99% is illegal or pirated. As much as internet and smartphone penetration has enabled access to digital content, it has also enabled internet browsing which allows for free download of music from certain websites, the most common of the lot being the erstwhile 'songs.pk' which, due to repeated blocking has changed its URL, but is not yet off the hook. Much like Netflix, the market need here is two-fold – one, is the clear objective of curbing piracy and the other is to facilitate digital consumption of music. Wynk came up as an innovation to drive digital consumption of music, becoming an important source of revenue for its parent company's Internet service provision business.

3. **Business Model**

   a. ***Functionality:*** Wynk was launched in late 2013. It is not very different from other competing music apps such as Gaana or Saavn. It has an additional mp3 format and can run on 2G and data

158. Prasad, P 2015, 'UrbanClap: Clap to get help', Business Standard, 10 August. Available at: http://www.business-standard.com/article/companies/UrbanClap-clap-to-get-help-115081000034_1.html

159. Kavlekar, P 2016, 'Responding to the Urban clap', TheSmartCEO.in, 1 February. Available at: http://www.thesmartceo.in/starting-up/responding-to-the-urban-clap.html

saver modes. Users can stream 2.6 million songs across Indian and International music. Playlists are curated by mood, genre etc. For users who do not know how to use the app, there is an auto-play feature which enables the app to play music automatically once installed. Paid subscribers can enjoy advertisement free music streaming and downloads. A user interface in English and Hindi allows non-English speaking users to comfortably navigate the app.

b. ***Revenue:*** Their main sources of revenue are advertising, subscriptions and B2B revenue. Owing to near decade long associations of music labels with Airtel, content curation was an easier task for Wynk. The music industry gets paid on the basis of per play and not per user or per download. The subscription fee on Wynk is 100-120 rupees which is standard across music apps. Subscription to Wynk comes free with certain Airtel data plans. Monetisation through advertisements has only started in April 2017.

c. ***Growth:*** Since its launch in 2013, Wynk has seen considerable growth. It is a third party OTT app and is accessible to non-Airtel users, which is its source of bulk growth. The app has about 50 million installs till date. According to data from app analytics firm App Annie, Wynk has been the largest OTT music app in the form of installs over the last 16 months, barring brief periods where it was overtaken by other music apps. The average Wynk user spends about 75 minutes per day on the app, which is the highest in the category. They also have the highest number of daily users.

4. Impact:

- Piracy in music has been curbed by 30%-35%. There are declining trends in free music download websites like songs.pk. In April 2015, approximately 4 million songs were being played per month on music apps, as opposed to 40000 songs in April 2014. 20% of this growth can be attributed to Wynk. As of April 2017, 12 million songs are being played per month on music apps.
- About 75%-80% of Wynk's users belong to the non-English speaking semi-literate category. 60% of the content on Wynk is Hindi/Bollywood.
- Music streaming apps like Wynk, allow new music to be discovered. Although YouTube is the most used music service, its usage is limited mostly to known music unlike the new age streaming apps that allow for music discovery[160]. It has helped regional content reach the masses.
- The consumer mindset in India is presently less of ownership and more of rental via streaming and subscriptions. Globally, streaming has helped in increasing the depth of content through partnerships with music labels/artistes. The Asia-Pacific music industry revenues are projected to reach beyond $2 billion by 2020, in which streaming revenues are expected to be the dominant component[161].

5. Challenges: One of the major challenges that hinder the growth of music streaming apps in India is bottlenecks surrounding piracy and licensing of content. For apps like Wynk, there is no legal framework for licensing content. Cases filed in courts against piracy take very long to get resolved and blocking of websites hosting pirated content is countered by the websites changing their URLs and functioning as usual. However, with an increasing number of consumers paying for licensed content, music labels are easing their licensing policies. Monetisation continues to challenge since the penetration of music subscriptions is still quite low and a major portion of revenues of the apps go to content labels and rights publishers. The other challenge is to penetrate deeper into the regional music industries, so as to also attract consumers beyond urban regions, which presently comprises nearly 60%-70% of Wynk's user base. Tamil, Telugu and Punjabi are presently the strongest regional languages in music, however, they lack of depth in content.

160. Ispos Connect & International Federation of the Phonographic Industry, 2016,Music Consumer Insight Report. Available from: http://www.ifpi.org/downloads/Music-Consumer-Insight-Report-2016.pdf (12 June, 2017).

161. Deloitte, n.d., Digital Media: Rise of On-Demand Content. Available from: https://www2.deloitte.com/content/dam/Deloitte/in/Documents/technology-media-telecommunications/in-tmt-rise-of-on-demand-content.pdf (12 June, 2017).w

Bibliography

Boston Consulting Group (2012), *"The Internet Economy in the G-20", March 2012*

Boyan Jovanovic and Peter L. Rousseau (2005) "General Purpose Technologies" Handbook of Economic Growth, Volume 1

Christine Zhen Wei Qiang, Carlo Rossotto and Kaoru Kimura (2009), "Economic impact of Broadband" Information and Communications for Development, World Bank

Dale W. Jorgenson and Kevin Stiroh (1995), "Computers and Growth", Economics of Innovation and New Technology, Volume 3, Issue 3-4

Deloitte (2012), "What is the impact of mobile telephony on economic growth?" A Report for the GSM Association, November 2012

Deloitte (2016), "The economic impact of disruptions to Internet connectivity" A Report for Facebook, October 2016

Ericsson (2017), "Ericsson Mobility Report"

Erik Brynjolfsson and Joo Hee Oh (2012), "Measuring the Attention Economy", MIT Initiative on the Digital Economy

Ernst R. Berndt and Catherine J. Morrison (1995), "High-tech capital formation and economic performance in U.S manufacturing industries An exploratory analysis", Journal of Econometrics, Volume 65, Issue 1, Pages 9-43

Food and Agri Strategic Advisory and Research (FASAR), YES BANK German Agribusiness Alliance at OAV - German Asia-Pacific Business Association (GAA) (2016), "Farm Mechanization in India: The Custom Hiring Perspective"

Kala Sridhar and Varadharajan Sridhar (2004), "Telecommunications Infrastructure and Economic Growth: Evidence from Developing Countries", National Institute of Public Finance and Policy, Working Paper 14

Kleiner Perkins Caufield Byer (KPCB) (2017), Internet Trends 2017

Lars-Hendrik Roller and Leonard Waverman (2001), "Telecommunications Infrastructure and Economic Development: A Simultaneous Approach", American Economic Review, Volume no. 91, No. 4, September 2001

Martin Neil Baily (1986), "What has happened to Productivity Growth?" Science, Volume 234, Issue 4775, Pages 443-451

Mihasonirina Andrianaivo and Kangni Kpodar (2011), "ICT, Financial Inclusion and Growth: Evidence from African Countries", IMF Working Paper, April 2011

Nathan Cortez (2014), "Regulating Disruptive Innovation", Berkeley Technology Law Journal, Volume 29, Issue 1 Spring, Article 5

Pantelis Koutrompis (2009), "The economic impact of broadband on growth: A simultaneous approach", Telecommunications Policy, Volume 33, Issue 9, Pages 471-485

Press Information Bureau, Ministry of Agriculture (2011), "Highlights of Agriculture Census 2010-11", Government of India

Rajat Kathuria and Mansi Kedia Jaju (2012), "India: The Impact of Internet", ICRIER

Rajat Kathuria et al (2009), "India: The Impact of Mobile Phones", ICRIER, Vodafone Policy Series No. 9, January 2009

Rajat Kathuria, Mansi Kedia, Vatsala Shreeti and Parnil Urdhwareshe (2016). "Quantifying the Value of an Open Internet for India", ICRIER

Rajat Kathuria, Sahana Roy Chowdhury, Mansi Kedia and Sugandha Srivastav (2015), "An Enquiry into the Impact of India's App Economy" ICRIER-IAMAI, July 2015

Raul Katz et al (2009) "Estimating broadband demand and its economic impact in Latin America"

Robert Barro (1991) "Economic Growth in a Cross Section of Countries", Quarterly Journal of Economics, May 1991

Rosie Mate and Greg Rafert (2017), "The Global and Country Level Economic Impacts of WhatsApp", Analysis Group

Stephen D. Oliner, Daniel E. Sichel and Kevin J. Stiroh (2007) "Explaining a Productive Decade", Finance and Economics Discussion Series, Division of Research & Statistics and Monetary Affairs, Federal Reserve Board, Washington, D.C.

Tim Wu (2011), "Agency Threats", Duke Law Journal, Volume 60

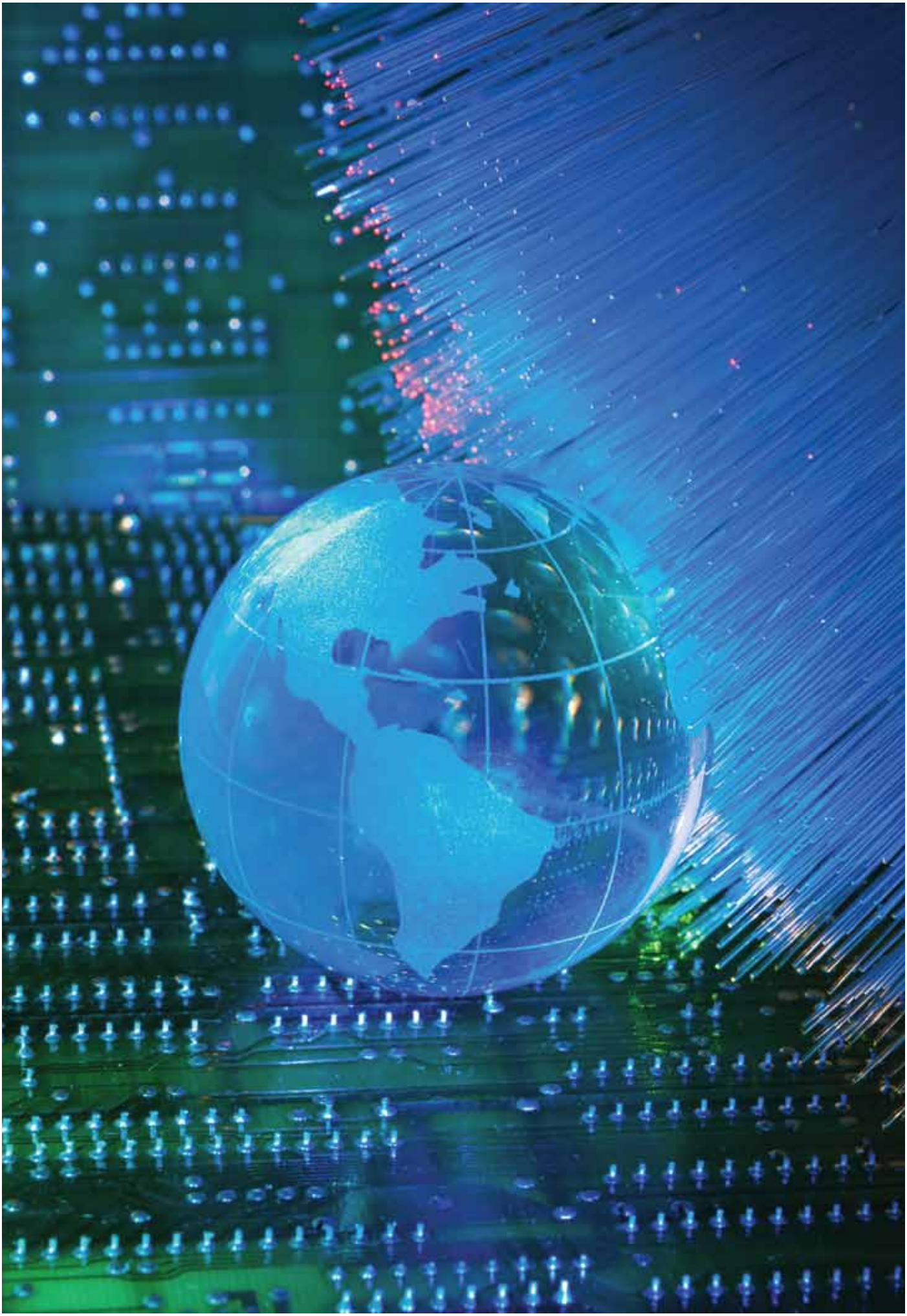
TRAI (2015), "Regulatory Framework for Over-the-top (OTT) services"

TRAI (2016), "The Indian Telecom Services Performance Indicators October – December 2016"

Zinnov (2016), "India as a Mobile First Nation: Opportunities and Challenges"

OTHER DATA SOURCES INCLUDE:

- ❑ ***TRAI Performance Indicator Reports***
- ❑ ***CISCO VNI Data***
- ❑ ***MOSPI***
- ❑ ***India Stat***
- ❑ ***World Bank***
- ❑ ***OECD***
- ❑ ***ITU***



Disclaimer

This report has been produced under one of ICRIER's eight thrust areas - "Infrastructure including Telecommunications, Transportation and Energy". This work adds to the considerable stock of carefully crafted empirical evidence generated by ICRIER under this theme and we hope it will add to the keen policy discourse on the Internet that is ongoing in India.

Opinions and recommendations in the report are exclusively of the authors and not of any other individual or institution including ICRIER. This report has been prepared in good faith on the basis of information available at the date of publication. All interactions and transactions with sponsors and their representatives have been transparent and conducted in an open, honest and independent manner as enshrined in the ICRIER Memorandum of Association. ICRIER does not accept any corporate funding that comes with a mandated research area which is not in line with ICRIER's research agenda. The corporate funding of an ICRIER activity does not, in any way, imply ICRIER's endorsement of the views of the sponsoring organization or its products or policies. ICRIER does not conduct research that is focused on any specific product or service provided by the corporate sponsor.

BIF Broadband India Forum

enhance, expand & unleash the true value of broadband