WIK • Report

THE ECONOMIC AND SOCIETAL VALUE OF RICH INTERACTION APPLICATIONS IN INDIA

Bad Honnef, November 2017

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

Authors:
Dr. René Arnold, Christian Hildebrandt, Peter Kroon, Serpil Taş


Main menu
12:45
Tue 27 July
Chat
Storage
Maps
Music
Files
Calendar
Notes
Shop
Mail
12:45

TABLE OF CONTENTS

FIGURES

TABLES

Acknowledgement

We gratefully acknowledge the contribution of Broadband India Forum (BIF) and its members in facilitating this research. We humbly recognise the co-operation of TV 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 Rosenthal Research who helped us with conducting the consumer research in India. We are also grateful to all our colleagues at WIK for providing a stimulating environment that makes such research possible. All errors are our own.

Executive Summary

India is on the fast track to digitization. Internet penetration has been growing exponentially: according to the Telecom Regulatory Authority of India (TRAI), the number of people with access to the internet had reached 422.19 million at the end of March 2017. At the same time, India's Gross Domestic Product (GDP) growth has outpaced the global average. However, subscription to an internet service alone does not result in any significant value for consumers. It is the applications that they can access and use frequently that creates or supports the added value for them and hence for the economy. Today, India is considered to be the third largest app economy after the US and China with about 6.5 billion app downloads in 2016.

The present study is the first to focus directly on the value added for consumers in India by Rich Interaction Applications (RIAs), such as Google Hangouts, iMessage and WhatsApp, as well as India-based applications such as Hike Messenger, JioChat Messenger, Lookup, Flock and Nimbuzz, which have become increasingly popular means of personal and business interaction.

First, our study establishes that these applications play a disproportionately important role in India when compared to other Asia-Pacific (APAC) countries. In fact, a consistently larger share of internet subscribers in India than in any other APAC country uses these applications. Our own representative survey of internet subscribers in India further confirms that RIA users typically utilize at least five out of six RIA functions.

The six core functions of RIAs analyzed in our survey are (1) ordinary calling, (2) video calling, (3) texting, (4) sending pictures, (5) sending videos, and (6) group chats. To understand the value added in detail, our study estimates the consumer surplus stemming from using these functions instead of traditional alternatives. The results of our consumer surplus survey and analysis show that RIA usage saves on average **803.9 minutes per week**. Based on the average annual income in India (INR94,130), this translates into an annual consumer surplus of **US$98** billion in 2017. Thus, each user of RIAs in India receives on average **US$249** of consumer surplus annually. Applied to the entire population—not just RIA users—this results in **US$74 per capita.**

Hike, an India-born 'unicorn', is part of this success story. The firm behind the popular RIA is providing many local jobs and is pushing innovation by engaging in local start-up financing. They have recently announced their acquisition of Creo, another innovative start-up founded by former Hike employees. Flock (focused on collaboration) and Lookup (an app giving small and medium-sized enterprises (SMEs) visibility for local consumers featuring various RIA functions) are further examples of the thriving and extremely innovative digital economy in India.

Furthermore, our study highlights significant social benefits created by RIA usage. Both specialized and general purpose RIAs can play an important role in education and knowledge transfer when direct face-to-face interaction is not possible. RIAs can bridge the digital divide by offering new options to individuals who otherwise have limited access to telecommunications services and little knowledge about more complex computers. Indeed, if used well, RIAs could be a critical tool to drive the Digital India Programme.

All of the benefits stemming from RIA usage are a result of the high levels of competitive innovation that has driven product and feature development and expansion among RIAs. The popularity and extensive use of RIAs in India indicate that consumers, who recognize the value that these services add to their lives, are the ultimate beneficiaries. In order to protect and sustain this consumer value, innovation and in particular innovation in the internet economy must remain a top priority for policy makers. Heavy-handed regulation may stifle innovation, and policy uncertainty could discourage investment.

1. Introduction

Internet adoption in India has expanded rapidly over the last few years, growing from 21.37% (267.39 million people) at the end of December 2014 to 32.86% (422.19 million people) at the end of March 2017, registering a quarterly growth rate of 6.54% (TRAI 2015, 2017). One of the most significant benefits for these internet users is the immediate, real-time interaction that it supports. Applications such as Flock, Google Hangouts, Hike, iMessage, JioChat, KakaoTalk, LINE, Lookup, Nimbuzz, Signal, Skype, Snapchat, Threema, Viber, WhatsApp and WeChat have become increasingly popular means of personal and business interaction.

Overall, India's app economy is considered one of the largest in the world. According to App Annie (2017), almost 6.5 billion apps were downloaded in India in 2016. This number is expected to rise to nearly 23 billion in 2021, growing annually by almost 28%. Simultaneously, consumer spending on apps is going to increase. App store spending amounted to almost US$100 million in 2016. In 2021 the amount will be US$2.1 billion. However, despite the growing popularity of RIAs, there is comparatively little systematic knowledge about their socioeconomic impact. The present study builds on the insights gathered by Arnold et al. (2017)[1] to explore the socioeconomic impact of apps in India.

For the purpose of this study, we collectively refer to these applications using the term Rich Int-eraction Applications (RIAs) as they enable consumers to interact in ways not possible through traditional communications channels, using features such as group chat and high-definition photo and video sharing. Moreover, as providers of such applications have competed with each other by innovating and rapidly adding new functionalities, the range of features developed and offered has grown to include nearly the full range of common internet activities, including integration with services such as advertising and payment.[2]

The Digital India Programme launched by the government of India in July 2015 aims to transform India into a digitally empowered society.[3] While availability of broadband (fixed and mobile) is essential to this aim, it is in fact the applications that people can use on the internet that create additional value. As the present study will show, RIAs play a significant role in creating added value through enhanced connectivity.

1.1 Summary of the global study on RIAs

RIAs are sometimes mischaracterized as a "free calling application" or "improved SMS", but this does not reflect the fundamental nature and evolution of these

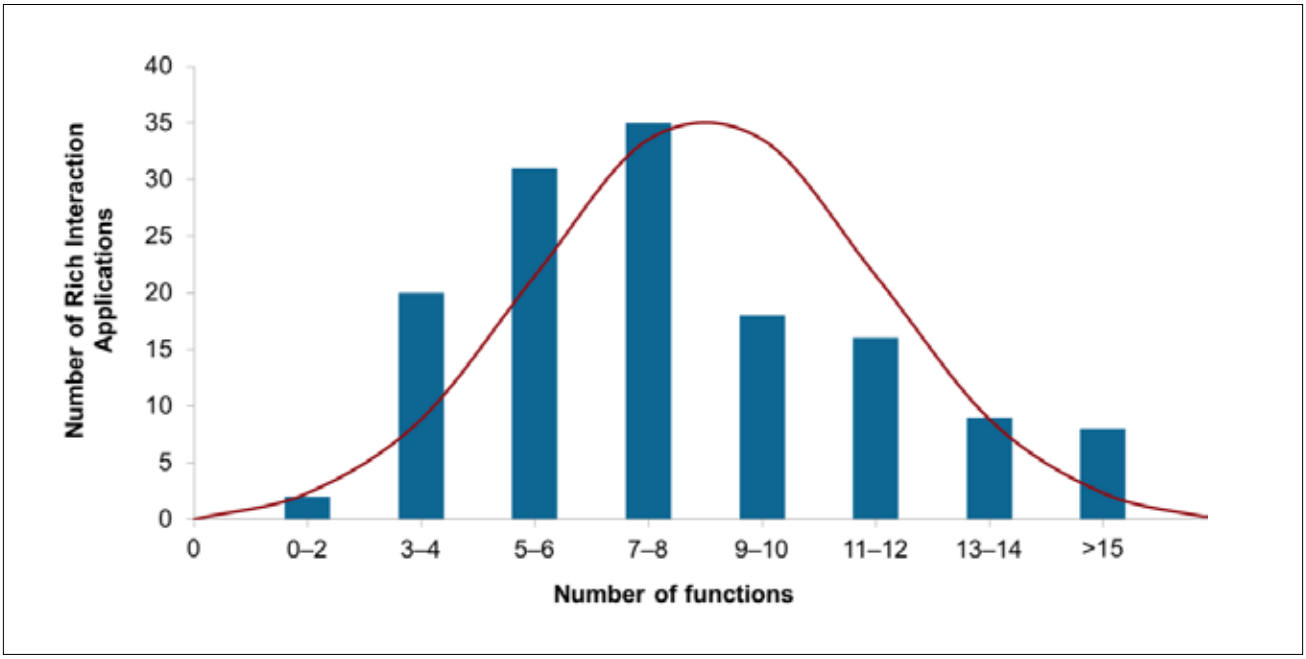
Overall, India's app economy is considered one of the largest in the world. According to App Annie (2017), almost 6.5 billion apps were downloaded in India in 2016.

1. *For a detailed description see Section 2.3.*

2. *We have chosen this term deliberately as it is of greater use than the commonly used phrase "Over the Top" (OTT) services. The phrase OTT originates in the telecoms industry and simply describes any application or service traveling across telecoms infrastructure. That imprecise phrase therefore applies to any and all services running over the internet from banking to government services. RIAs correspond more accurately to the focus of the present study on applications that are used for a wide range of functions, allowing two or more parties to interact with each other in numerous ways. We delineate RIAs from other terms such as rich mobile applications, rich communications services and rich internet applications:*
https://en.wikipedia.org/wiki/Rich_mobile_application
https://en.wikipedia.org/wiki/Rich_Communication_Services
https://en.wikipedia.org/wiki/Rich_Internet_application

3. *See http://www.digitalindia.gov.in/content/vision-and-vision-areas.*

Figure 1-1: Number of functions of RIAs



Source: *Arnold et al. (2017).*

applications that enable a full suite of interactive options.[4] Indeed, consumer research indicates that the breadth of functions of RIAs plays an important role in their success (Arnold, Schneider, & Hildebrandt 2016). Even though RIAs offer text and calling functionalities, they are in fact not the same service and therefore are not a substitute for traditional telecommunications services, just as computers are not a direct substitute for typewriters.

Arnold et al. (2017) map the functions of 139 RIAs globally. What is immediately clear is the broad range of interactive options that RIAs can offer. The most comprehensive RIA in their sample (WeChat) features 23 functions. Figure 1-1 demonstrates that 30% of he RIAs studied feature ten or more functions, and the average RIA has almost nine functions.

Arguably, developers of RIAs create new features to keep up with or stay ahead of the competition, focusing on niche features when necessary. In fact, one may be reminded of a supply-side depiction of Rogers' seminal innovation curve (Rogers 1962); in this instance, the innovators are found at the right-hand side and laggards on the left-hand side of the curve.

The evolution of RIAs also means that they provide an increasingly full suite of common internet functions. Taking the UK Office of Communications' (Ofcom's) typology of internet use as an example, we see that profile pictures and timelines accord with personal use; rich messaging functions, photo and video sharing (including through group chats), and even translation services correspond to consumers' communication and social networking usage; payment and purchasing functions match transaction use (Ofcom 2015); integrated games offer entertainment use; and integration with news feeds reflect information and leisure-related usage.[5]

In addition to the organic expansion of functionality, RIAs are also beginning to integrate services provided by commercial partners, such as hailing an Uber taxi ride through Facebook Messenger or an Ola taxi ride through Hike.[6]

Given the competitive pressure originating from the multitude of actors in the market, as well as the demonstrated economic benefits of intermediaries (Hildebrandt & Nett 2016), it is likely that more and more creators of RIAs will look to integrate other services to enrich the consumer experience.

4. *The following section is mainly based on the findings from the global study of RIAs conducted by Arnold et al. (2017).*
5. *See also Helsper, Deursen, & Eynon (2016) and McKinsey & Company (2010). The following chapter gives more detail about the relevance of these uses and corresponding functions in consumer behavior.*
6. *Hike is a local RIA popular in India. Ola is the Indian equivalent of Uber.*

At the same time as the functionality of RIAs is expanding organically or through tighter integration with third-party applications, we also see that other online services, including games, e-commerce and content distribution, are incorporating rich interaction features to enhance the functionality (and consumer appeal) of their services. For instance, YouTube recently introduced a test phase for in-app messaging to enable consumers to interact with others about the content they are watching.[7]

The analysis conducted by Arnold et al. (2017) on the impact RIAs have on GDP rests on the finding that RIAs are developing to integrate almost all of the functionalities associated with a "full internet experience". In the study, in order to calculate the impact, an econometric model was applied on a panel of 164 countries over 16 consecutive years (2000 to 2015) featuring more than 2,600 observations in total. Since usage intensity of RIAs varies across countries, the analysis accounts for this by introducing a weighting factor based on the usage numbers presented in the GlobalWebIndex data.

This early 2017 study found that, on average, a 10% increase in the global usage of RIAs leads to an increase in global GDP per capita by (approximately) 0.33%. This corresponds to an average global increase in GDP of US$5.6 trillion from RIAs over the 16-year period. These are conservative estimates, given that many uses and impacts of the RIAs are not captured in GDP.

In the present study, we extend the literature and understanding of the economic impact of RIAs by estimating their impact on **consumer surplus in India**. This is a unique exercise that has not been attempted for the Indian internet sector before and we believe it will help build a broader and more nuanced understanding of the impact of RIAs on the lives of consumers. The consumer surplus measure seeks to capture estimates of not only the added economic value to consumers (e.g. by being able to send a video quickly and at practically no separate monetary cost via a RIA instead of recording it and sending a DVD by mail), but also the consumers' own qualitative estimate of value added in their lives.

Again, the global study on RIAs provides some insights into the routes to qualitative added value from RIAs as perceived by users. Arnold et al. (2017) discuss group chats as a particularly salient example of qualitative

The early 2017 study found that, on average, a 10% increase in the global usage of RIAs leads to an increase in global GDP per capita by (approximately) 0.33%.

added value for consumers. Social groups fulfill many functions in our lives. These functions range from pragmatic purposes, such as teamwork in the office or a group to organize someone's wedding, to groups set up to share phatic[8] experiences with close friends and family to whom one has strong emotional ties. All of these situations are difficult if not impossible to negotiate in the type of limited one-to-one communication that SMS (text messages) offer.[9] However, RIAs enable group chats, sometimes with audio or audiovisual features. For instance, groups can be set up for a specific topic or occasion (e.g. "John and Jane's wedding") (König 2015). Due to the one-to-many communication and vivid interaction in such groups, social behavior can be enacted and experienced (O'Hara et al. 2014). With the popularity of this feature and users thus being part of many group chats at once, consumers may sometimes find such groups burdensome. However, they report enjoying following the thread of messages with close friends (Smith & Tang 2015).

These findings indicate that consumers do not use RIAs simply because they want to send texts and make phone calls for no direct monetary cost. Such a narrow focus on economically optimizing consumer behavior (Fishbein & Ajzen 1975, Ghose & Han 2011) does not account for the actual origin of RIA communication behavior or the fundamental differences in usage between SMS and RIA communication channels previously described. The relevance of social factors in the adoption of innovative technologies (Glass & Li 2010) is reflected in Church and de Oliveira's (2013) finding that the adoption of WhatsApp hinges on several factors beyond cost, such as intent, community, privacy, reliability and expectation. As explained by O'Hara et al. (2014: 2), it is necessary "to capture the quiddity of the experiences sought for and enabled by these applications [RIAs] in ways that reaches beyond economic or technological determinism and which accounts both for scale and the purpose of this use in ways that colours how that use is experienced and oriented to; how it is lived, if you like".

7. *https://techcrunch.com/2017/08/07/youtube-roll-out-in-app-video-sharing-and-messaging-to-users-worldwide/*

8. *Denoting or relating to language used for general purposes of social interaction, rather than to convey information or ask questions.*

9. *The SMS protocol (SMS-point-to-point or SMS-PP) can only carry one mobile number. There is an additional GSM specification SMS-CB (CB = Cell Broadcast) that allows bulk SMS to be sent e.g. to a dedicated geographic area (this is what is used for hazard weather warnings for example). SMS-CB does not allow for individual users to engage in group chat because it is only one way. There are, however, various RIAs, including iMessage, that can (besides sending IP-based messages) emulate SMS into group chats. Technically, multiple SMS have to be sent each time.*

1.2 Brief literature review of economic impact studies

While there are an increasing number of studies on the size of the app economy, studies investigating the economic impact of RIAs on the lives of consumers and society specifically are scarce. The global study on RIAs conducted by Arnold et al. (2017) approximates the impact of RIAs on GDP by assuming that due to their dynamic and evolutionary character, RIAs enable consumers to fulfill an increasing share of the activities they perform as part of a "full internet experience". Therefore, RIAs are moving further away from traditional telecommunications. In order to estimate the impact of RIAs on GDP, the authors estimated two endpoints, namely the impact of telecommunication usage (voice and text functionality) on GDP and the impact of internet usage on GDP as a proxy for the "full internet experience" (overall functionality). The impact of RIAs had to range between these two endpoints. The endpoints were estimated using a fixed-effects Cobb–Douglas production function framework using panel data for 164 countries from 2000 to 2015. They found that each 10% increase in RIA usage added an average US$5.6 trillion in global GDP (0.33% of GDP).

The second study that investigates one particular RIA (WhatsApp) is Rafert & Mate (2017). The authors present findings from data covering the period 2012–2015 for 157 countries to estimate the relationship between WhatsApp usage and GDP using panel regressions and instrumental variables. Their results suggest that a 5 percentage point increase in WhatsApp penetration in 2015 is associated with a US$22.9 billion increase in global GDP.

For India specifically, the latest study by ICRIER (2017) is noteworthy in the context of the present research. Unlike our study, it has a wider focus covering all applications. However, as RIAs are a part of these applications, the study's results can also provide an indication of their impact in India. The authors performed a panel analysis across 19 Indian states from 2013 to 2016 using an instrumental variable regression to assess internet usage elasticity. In addition to the input variables of labor and capital, the authors integrated total and mobile internet traffic into their model specification. They found an economic impact of a minimum of US$20.4 billion in India.[10]

All of these studies attempt to quantify the direct impact of RIA usage on the economy, measured in GDP. This approach is considered to be one of the conventional ways to estimate the economic impact of specific goods or services and is also commonly used for the impact assessment of related

10. *We discuss how and why this number differs from our finding referring to consumer surplus in Annex 3.*

segments, like telecommunications, broadband and internet as a whole.

Examples of studies that investigate the GDP of telecommunications or the internet include, but are certainly not limited to, the following. Roeller & Waverman (2001) provide evidence from 21 Organization for Economic Co-operation and Development (OECD) countries over a 20-year period for a significant positive causal link between telecommunications infrastructure and economic activity. Sridhar & Sridhar (2007) investigate the relationship between telephone penetration and economic growth using data for developing countries and find a robust positive impact of telecommunications penetration on economic output. With a regression on panel data of 192 countries from 1990 to 2007 using a production function with a system of simultaneous equations, Gruber & Koutroumpis (2011) find that mobile telecommunications' contribution to annual GDP growth is 0.11% for low-income countries and 0.20% for high-income countries. Czernich et al. (2011) estimate the effect of broadband infrastructure that enables high-speed internet on economic growth in OECD countries from 1996 to 2007 and find that a 10 percentage point increase in broadband penetration raises annual per capita growth by 0.9 to 1.5 percentage points. Farhadi, Ismail, & Fooladi (2012) find evidence for a positive relationship between growth rate of real GDP per capita and internet usage within a dynamic panel data approach with 159 countries over the period 2000–2009. They estimate that a 1% increase in the level of internet usage compared with the previous year will increase the economic growth rate of GDP per capita by 0.09%.

Our study seeks to make a significant and unique contribution to the above research by estimating the consumer surplus generated by the use of RIAs in India. Consumer surplus is an economic measure of consumer benefit, which is calculated by analyzing the difference between what consumers are willing and able to pay for a good or service relative to its market price, or what they actually do spend on the good or service.[11] It is therefore an estimate of the consumers' perception of value of the service relative to other available alternatives.

1.3 Structure of the study

This study is structured as follows:

- *Chapter 2* is an analysis of the consumer surplus added by RIAs in India. The economic impact of RIAs is further explored by analyzing other relevant studies that have investigated the economic impact of RIAs or the internet. We find that RIAs add US$98 billion in consumer surplus for RIA users in India. Key insights from other studies and usage data on RIAs in India suggest that the economic impact of RIAs in India today exceeds the economic benefits of basic telecommunication services. Moreover, we argue that as mobile broadband penetration increases in India and RIAs evolve to provide many of the functions of a "full internet experience" with lower bandwidth and hardware requirements (particularly relevant for a spectrum-hungry market like India), the value generated by RIAs will become even more significant.[12]
- *Chapter 3* is a description of how RIAs create additional value for the Indian economy using case studies. While the insights gathered in this chapter qualify the findings of the economic impact analysis, they also point to value creation that is not typically covered by GDP or consumer surplus analysis. In this chapter, we draw on case studies as well as research from sociology and psychology to understand how the impact of RIAs relates to the World Bank's framework of the internet's impact along the dimensions of *inclusion, efficiency* and *innovation* in emerging economies.
- *Chapter 4* is a summary of our results and provides an outlook on policymaking in India.

11. *www.investopedia.com/terms/c/consumer_surplus.asp*

12. *Overall, Indian operators have 20 MHz spectrum less at hand compared to the global average and will need at least an additional 100 MHz spectrum to cover the demand. Despite this inadequate availability of spectrum, just 62% was sold in 2016 because of the high reserve prices.*

2. Economic Impact of RIAs in India

Key insights

- Since 2009, the share of Indians with access to the internet has been increasing exponentially. This sets a positive environment for digital inclusion, innovation and economic growth.
- Our study finds that RIAs create a consumer surplus of **US$98 billion** in India. This is equivalent to 4.3% of India's GDP of $2.264 trillion in 2016.[13]
- Globally, a 10% increase in RIA usage will lead to US$1 billion in additional GDP **daily**. With increasing adoption and use of RIAs in India, the country is set to reap similar benefits (Arnold et al. 2017).

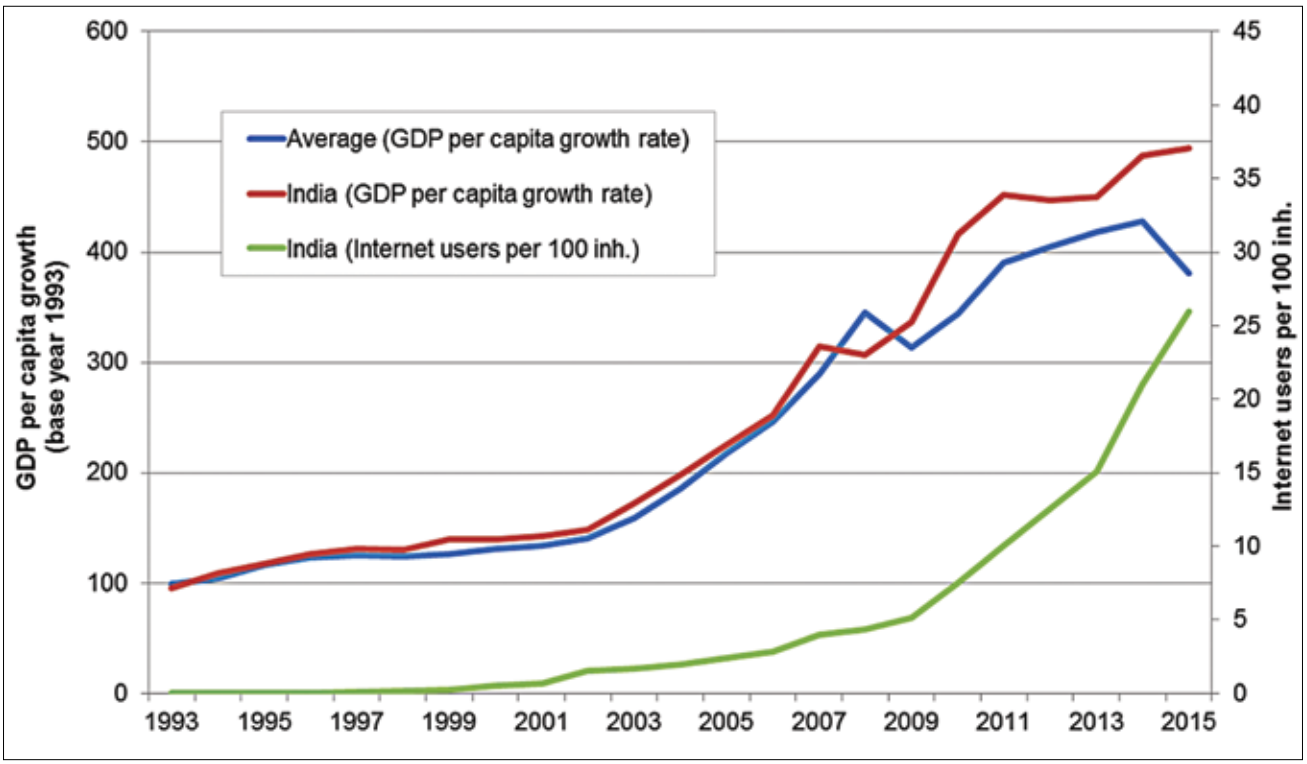
2.1 Accelerating digitization in India

India still has to catch up with many other countries as regards the share of inhabitants with internet access. World Bank (2016) data show that in 2015, around 26 in 100 inhabitants had access to the internet in India. In comparison, in Brazil, South Africa, China, Nigeria and Indonesia, it was 59%, 52%, 50%, 47% and 22% respectively.

According to the Telecom Regulatory Authority of India (TRAI), the total number of internet subscribers had increased to 422.19 million by the end of March 2017, registering a quarterly growth rate of 7.84%. While 21.58 million were wired internet subscribers and 400.62 million were wireless internet subscribers, the subscriber base for broadband internet increased to 276.52 million (growth of 17.12% compared to previous quarter) but narrowband internet subscriptions decreased to 145.68 million (decline of 6.26% compared to previous quarter) (TRAI 2017).

This coincides with a strong acceleration in India's growth of per capita GDP outperforming the worldwide average as shown in World Bank statistics (Figure 2 1). Facilitated by sharply decreasing prices for broadband access and mobile handsets, it is likely that internet adoption will further increase rapidly.

Figure 2-1: Development of GDP growth rate and internet users in India.



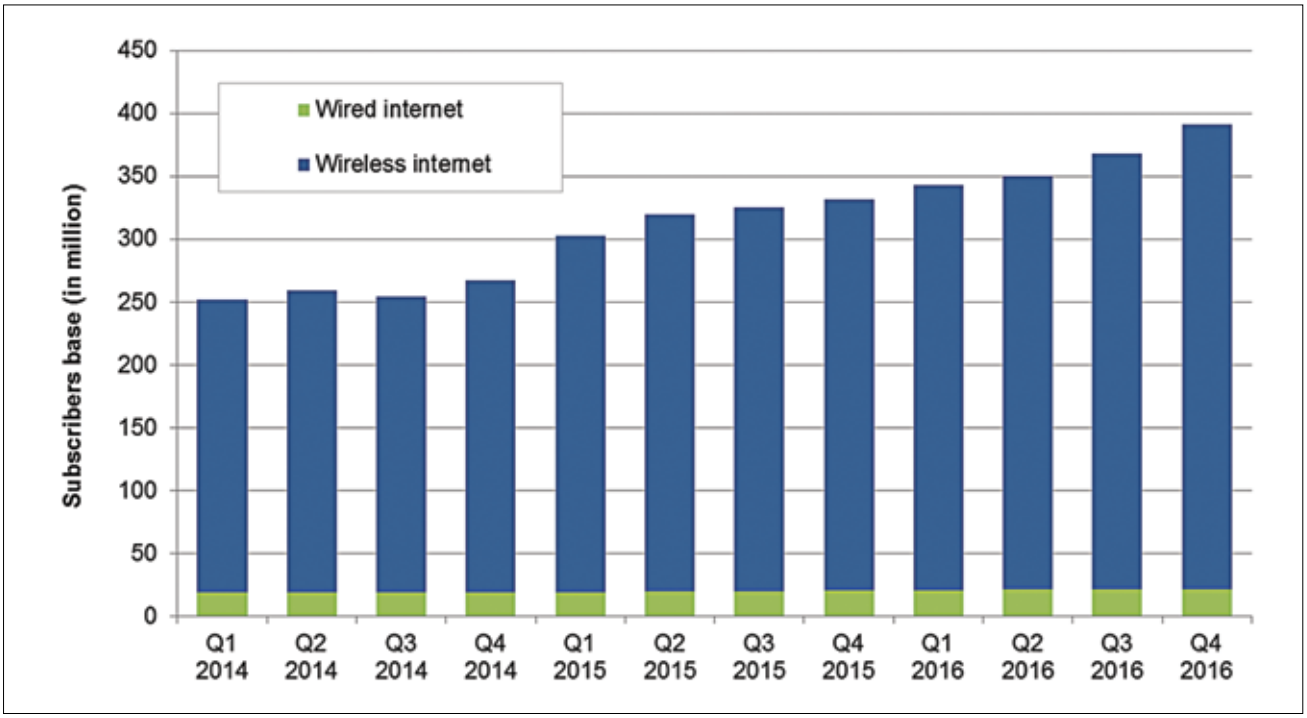
Source: *Own representation based on data from the World Bank database.*

13. *Based on data from the World Bank database.*

Access to the internet in India is predominantly a mobile story. TRAI reports show that in the years 2014, 2015 and 2016, over 90% of internet subscriptions in India were wireless (see Figure 2 2). The vast majority of subscribers use mobile broad- and narrowband to connect to the internet. Notably, almost all growth in internet subscriptions in India stems from mobile connections. This trend will likely continue.

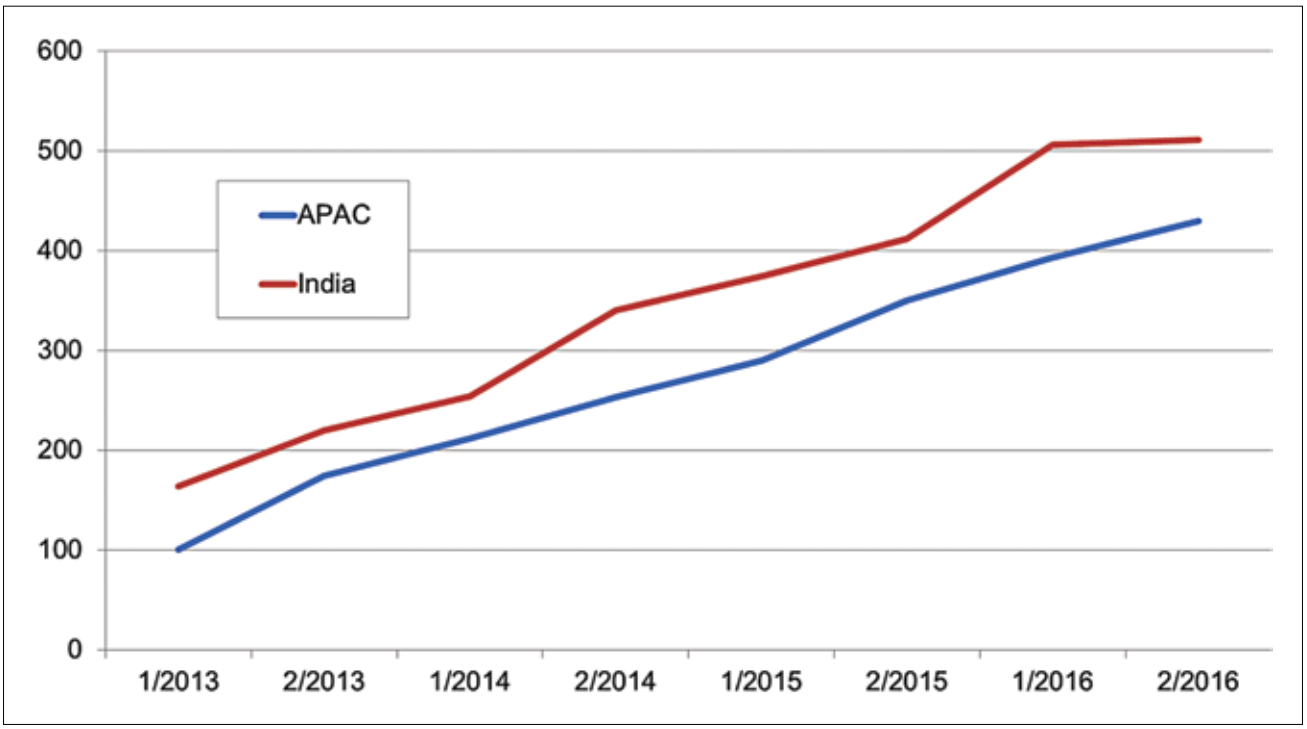
The dominance of mobile internet access technology in India pushes consumers to mainly use mobile apps for their online activities. Figure 2 3 shows that the share of internet subscribers who use RIAs in India has been

Figure 2-2: Share of wired and wireless internet subscriptions in India.



Source: *Own representation based on data from TRAI.*

Figure 2-3: Growth of RIA usage (share of internet subscribers) in APAC and India (Index = 100 equals APAC average in Q1 2013)



Source: *Own representation based on WIK calculations of data from the GlobalWebIndex.*

consistently higher than the APAC average. Notably, APAC is the world region with one of the highest average shares of RIA users.[14]

The importance of RIAs for consumers in India can be explained by the great variety of functions they offer. As discussed earlier, RIAs cover nearly the full range of common internet activities. Typically, RIAs provide these functions without high requirements on either the hardware or the internet connection.[15] Given the state of broadband infrastructure and many high-end mobile devices being unattainable for the majority of consumers, it is not surprising that these apps are among the most popular in India.

2.2 RIA functions create consumer surplus

The functions that RIAs offer create added value for consumers as they significantly reduce transaction, search and information costs. Furthermore, they bundle communication needs in one place, offering rich interaction with pictures, videos or recorded voice/video messages. All of these help users communicate more effectively than one could in a world without RIAs. Furthermore, RIAs enable new formats of communication and new opportunities and occasions for communication.

As discussed in Section 1.2, various studies have already looked at the GDP impact of the internet, apps and RIAs in particular. However, so far the existing literature has failed to recognize the added value for consumers stemming from RIA usage. For instance, this added value can be the time and money one saves by sending a video via a RIA instead of sending a DVD by post. These effects cannot be captured in the GDP impact. The present study captures them for the first time for RIAs in India using a representative survey of consumers with internet access. The study measures the consumers' perception of value added through the use of RIAs by estimating their perception of the consumer surplus generated by their use of RIAs.

The underlying idea of consumer surplus is to capture the difference in money spent or time required between two consumer activities that will essentially lead to the same outcome. Our methodology follows the concept of an experiment conducted at the University of Michigan (Chen, Jeon, & Kim 2014) that estimated the consumer surplus gained by using online search engines instead of offline searches. Specifically, Chen, Jeon, & Kim (2014) had participants perform online and offline searches in an experimental setting. They established that the average time saved per day is 3.75 minutes. Assigning that time to the average wage in America, the consumer surplus accounts for almost $500 per user annually.[16]

To arrive at the consumer surplus estimate for India, we followed the basic idea of Chen et al. (2014). However, rather than conduct an actual experiment, we captured the time saved in a representative survey among Indian internet users in June and July 2017. In total, we received 1,019 usable questionnaires from a representative online panel. A professional international field institute programmed and curated the survey. The details of the methodology and analysis are provided in Annex 3.

The aim of the survey was to explore the alternatives that consumers would use if RIAs were unavailable to them and what additional time cost this would entail. In other words, we were interested in knowing how much time consumers currently save by using RIAs compared to the available alternatives they identified. For each RIA function, we used the most likely alternative activity as indicated by respondents in the survey to calculate the time saved.

The results of our consumer surplus analysis show that RIA usage saves on average 803.9 **minutes per week**. Based on the average annual income in India (INR94,130) (Government of India 2017), this translates into an annual consumer surplus of **US$98 billion** in 2017. Thus, each user of RIAs in India receives on average **US$249** of consumer surplus annually. Applied to the entire population—not just RIA users—this results in **US$74 per capita.**

Arnold et al. (2017) provide estimates for the per capita consumer surplus across a selection of OECD countries

Table 2-1: Consumer surplus results overview

RIA consumer surplus in India	
Time saved by RIA usage	**803.9 minutes** per week
Consumer surplus (per user)	**US$249** annually
Consumer surplus (per capita)	**US$74** annually
Total consumer surplus from use of RIAs in India	**US$98** billion in 2017

Source: *Representative survey of consumers in India (n=1,019), WIK analysis.*

14. *Own calculations based on data from the GlobalWebIndex.*
15. *Notably, various RIAs are also available as "light" versions, e.g. Facebook Messenger or Skype.*
16. *For more details see Annex 3.*

for 2015. The consumer surplus ranges between US$32 for Greece and US$132 for Slovenia.[17] To compare our result for India, one first has to apply it to the full population, which results in US$18 per capita.[18] In light of the difference in income levels across the countries considered, the consumer surplus for India may appear relatively high. However, one has to account for the fact that **RIAs play a much more important role in India than in the selection of OECD countries.** This also transpires from the results shown in Table 2-2, which indicate that there is no direct correlation between average wages and consumer surplus from RIAs.

In fact, we argue that our analysis is conservative as we only capture the consumer surplus stemming from the most likely counterfactual activity[19] for a selection of RIA functions.[20] Various additional functions such as payment, money transfer, translation services or getting access to third-party services are not accounted for in our analysis. Furthermore, it should be noted that for comparability, the analysis refers to the average income in India as a whole. The average income in our representative sample of internet users in India is significantly higher. If the time saving was applied only to this sample, the absolute monetary value of the time saved would increase.

2.3 Impact of RIAs on GDP

These findings underscore the estimated impact of RIAs on GDP globally as identified in Arnold et al. (2017) (see Figure 2 4). **They find that a 10% increase in RIA usage will grow GDP by US$1 billion daily.** The total impact registered is US$5.6 trillion for 164 countries for the years 2000 to 2015. Notably, this impact exceeds that of basic telecommunications services (US$4.8 trillion). The "full internet experience" is estimated to have a global impact of US$7 trillion.

This is a conservative estimate of the economic impact of RIAs on global GDP. First and foremost, only part of the impact of these applications is actually captured in the GDP. Second, increased usage and steady innovation of

Table 2-2: Selected OECD countries' RIA consumer surplus estimates and average wages

Country	Estimated consumer surplus 2015 in US$	Average annual wages nominal US$ (OECD in 2015)
Greece	32	18,880
Austria	40	59,449
Germany	45	41,840
Italy	63	31,950
United States	64	59,691
Netherlands	68	51,558
Spain	69	30,553
Denmark	72	62,944
France	73	40,208
Belgium	79	48,165
Poland	83	11,533
United Kingdom	86	45,678
Finland	87	45,396
Switzerland	91	85,886
Hungary	97	10,525
Slovak Republic	101	13,588
Norway	105	64,282
Sweden	118	46,120
Slovenia	132	24,587

Source: *Arnold et al. (2017); OECD database.*

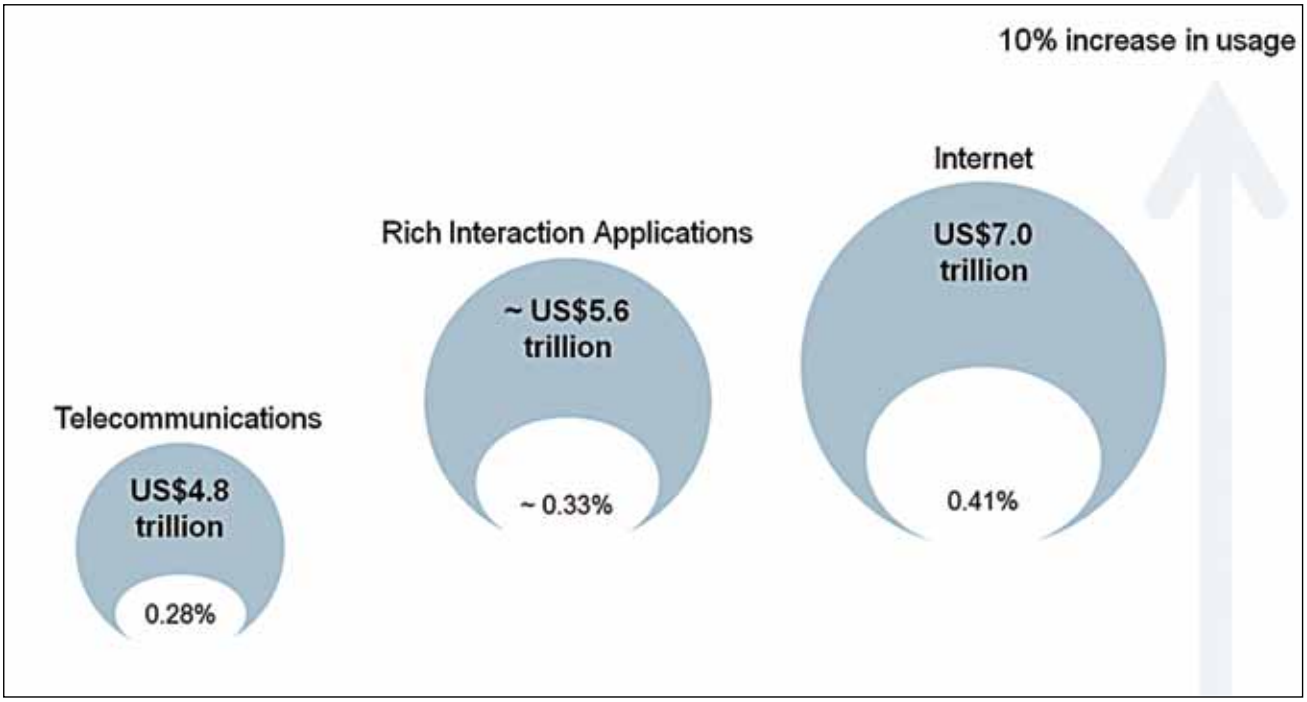
17. *Notably, the approach taken by Arnold et al. (2017) to arrive at these estimates is different from the methodology used in this study. They extrapolate from a conjoint analysis conducted by McKinsey in 2010 aiming to capture the difference between consumers' willingness to pay for specific functions on the internet and their actual price.*

18. *The figure for India refers to 2017 just as the figures in the table above it.*

19. *See Annex 3 for methodological details.*

20. *We selected six typical RIA functions based on Arnold et al. (2017): RIA call, RIA text, RIA video call, RIA picture message, RIA video message and RIA group chat. Notably, 86% of respondents in our sample use five or six functions out of the six tested typical RIA functions.*

Figure 2-4: Average impact of telecommunications, RIAs and the internet on global economic output from 2000 to 2015



Source: *Arnold et al. (2017).*

RIAs suggests that their impact has grown substantially over the observed period. This effect is particularly pronounced in India, where internet penetration has accelerated only recently and RIAs are more important than in other APAC countries (see Figure 2 3) and are used by a consistently larger share of consumers (see Figure 2 5). At the beginning of 2013, the share of internet users using RIAs and other applications[21] was almost the same (26% and 27%); however, in recent years, the share of internet users using RIAs increased more rapidly than the share for other applications (81% and 57%).

The impact of RIAs in India indicated in Arnold et al.'s (2017) econometric model refers to the years 2000 to 2015. Given India's recent exponential growth in internet penetration and the importance that RIAs have today in the country, it can be expected that the impact on GDP in 2017 is substantially larger and in fact relatively close to that of the "full internet experience".

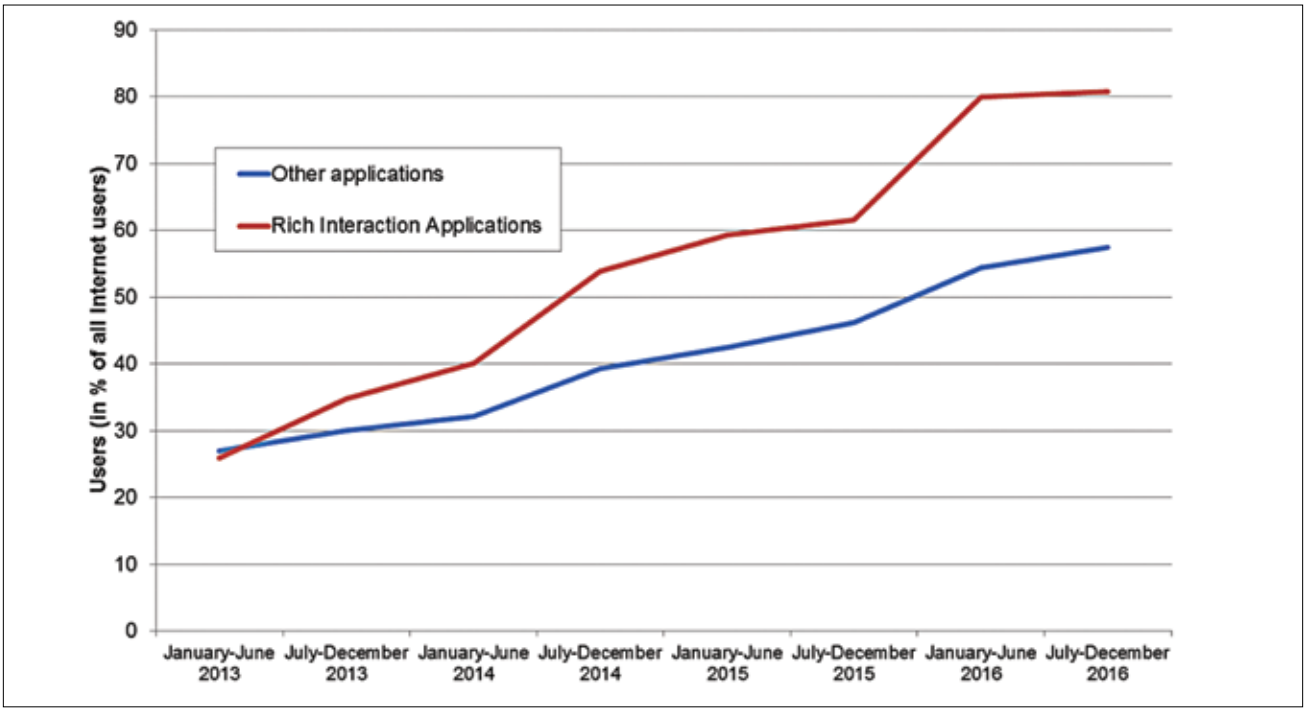
To understand the size of the current GDP impact of RIAs, one can refer to other studies that have estimated the economic impact of the internet and applications in India. The most recent study was conducted by ICRIER (2017), which is the first to estimate the impact of New Generation Internet-Based Applications (NGIBAs) (including RIAs) on national GDP for India. They performed a panel analysis across 19 Indian states from 2013 to 2016 using a Cobb–Douglas production function framework. In addition to the traditional input variables of labor and capital, total internet traffic and mobile internet traffic in petabytes per month were added to the model specification as proxies for internet usage. They found that a 10% increase in India's total internet traffic will lead on average to an increase in India's GDP of about 3.3%, and a 10% increase in India's mobile internet traffic specifically may lead to a 1.3% increase in India's GDP.

Counterbalancing these values by the time spent on mobile and desktop devices and the proportion of traffic that can be assigned to apps, the authors estimate an economic impact of next-generation internet-based applications at a minimum of US$20.4 billion in India in 2015–2016. They further predict that this impact is likely to increase in the future.

The usage of apps could contribute a minimum of US$270.9 billion to India's GDP in 2020 (ICRIER 2017). Our study, which finds a consumer surplus value of US$98 billion in India on RIAs alone, underscores the view that this measure is able to capture consumer perceptions of value that go beyond those that are captured in macroeconomic estimations of GDP impact. For the internet in general, ICRIER (2016) estimates that a 10% increase in the rate of growth of internet subscribers leads to an increase of 1.08% in the rate of growth of GDP.

21. *For example video and music streaming, shopping apps or navigation apps.*

Figure 2-5: Use of RIAs vs. other applications in India



Source: *Own representation based on WIK calculations based on data from the GlobalWebIndex.*

Rafert and Mate (2017) focus on one specific RIA (WhatsApp). They estimate that a 5 percentage point increase in WhatsApp penetration is associated with US$10.6 billion in Asia.[22]

The Indian government recognizes the economic and societal potential of the internet and digitization in its Digital India Programme.[23] McKinsey (2014) estimated that the adoption of new technologies and innovative ideas across sectors through the Digital India Programme will help India boost its GDP by US$550 billion to US$1 trillion by 2025.

Already today, the internet economy is a significant sector in India. According to BCG (2015), it represented US$60 billion in 2013, which equaled 2.7% of India's GDP at the time. They predict that the Indian internet economy will grow to over 4% of GDP by 2020.[24] Focusing on the potential value of online intermediaries in India, Copenhagen Economics (CE 2014) estimates a potential value of US$41 billion in 2015, which corresponds to 1.3% of GDP. Revenue accrued by firms working in the local internet economy is an example of the immediate impact on local value creation of the internet in general.[25]

Arnold and Schneider (2016a, b) find a significant indirect impact of consumers' usage of RIAs and streaming services for music and video. Based on a representative sample of German consumers, they show that with increasing usage intensity of online services, consumers' willingness to pay for telecommunications and data services increases. Their analysis also shows that consumers with high usage intensity of online services are more likely to have purchased a new (and likely more expensive) data plan. For India, these results suggest that consumer demand for data plans stems from their demand for online services. Thus, telecommunications providers benefit ultimately from innovative online services being available to everyone in the country. Given their importance for Indian consumers, RIAs likely play an important role for consumer demand for data services.

In summary, numerous studies suggest a strong impact of RIAs and other online applications on GDP. In addition, our approach adds further insights into the value that is added by RIAs for consumers beyond what is measured in GDP. The following chapter explores the impact of RIAs on local value creation in more detail using case study insights.

22. *Measured at purchase power parity (PPP) referring to 2015: A 5 percentage point increase in WhatsApp penetration is associated with the following increases in GDP: US$22.9 billion globally (PPP 2015); regionally: US$10.6 billion in Asia; US$5.4 billion in North America; US$3.9 billion in Europe; US$1.1 billion in the Middle East; US$1.0 billion in South America; US$0.8 billion in Africa.*

23. *http://digitalindia.gov.in/content/about-programme.*

24. *BCG (2015) estimated the value of the internet economy as a whole, considering several subsegments like e-commerce, online content, advertising, government spending, devices, infrastructure and connectivity.*

25. *CE (2014) estimated the impact of online intermediaries on India's GDP. The authors divided online intermediaries into five categories: internet access and service providers; data processing and web hosting providers; internet search engines and portals; third-party platforms for e-commerce; and social media. In order to quantify the GDP impact of online intermediaries, the authors identified all activities related to online intermediaries and then concluded its contribution to GDP growth.*

3. Local Value Creation by RIAs in India

Key insights

- RIAs help to overcome obstacles to good health outcomes created by poor infrastructure, like in the case of water accessibility. Specific RIAs like Waattr and NextDrop are supporting clean water supply in several Indian cities.
- RIAs can play an important role in education and knowledge transfer when direct face-to-face communication is not possible (e.g. Teno and Arch-The Way).
- RIAs increase productivity and efficiency within organizations. RIAs like Flock increase transparency and reduce email transfer and in-person meetings by a considerable amount, leading to a significant cost reduction for small and large enterprises.
- Each new and innovative RIA entering the Indian market will create many new jobs. Hike alone is estimated at having created about 2,000 jobs in India and is expected to create even more positive spillover effects at the regional level, e.g. supporting start-up businesses.
- RIAs are simplifying trade, job searches and citizen participation in policy formation. RIAs like WhatsApp and Lookup help new businesses enter the market, increase their visibility and connect them to potential customers. Reportedly, SMEs using WhatsApp generate 30% of their sales through this channel. Upwork enables businesses to find freelancers across the world. The lifetime value of jobs posted in India amounts to almost US$167 million. Citizen engagement (for example sharing ideas and participating in policy formation) with the government is enabled via the application MyGov.
- RIAs offer new communication options for those facing communication barriers, for example people with disabilities.

The preceding chapter positioned the economic impact of RIAs close to that of the full internet in developing countries and in particular in India. It also highlighted the significant consumer surplus that RIAs add in India. These findings rest on the fact that RIAs develop and adopt more and more functions typically fulfilled by applications and websites on the internet as well as the fact that RIAs are the most commonly used applications in India. The present chapter further underpins RIAs' proximity to the internet as it demonstrates how their local impact mirrors that of the internet.

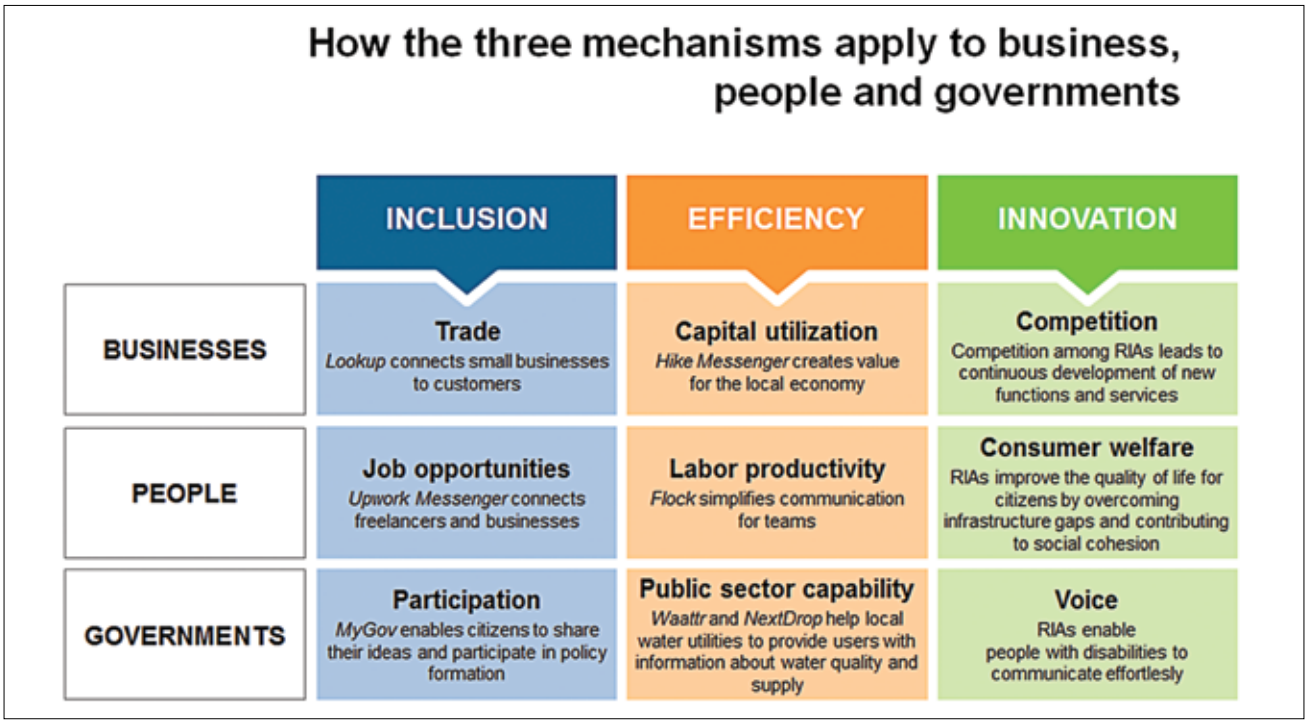
For the internet's socioeconomic impact and its effect on businesses, people and governments, the World Bank (2016) establishes three basic mechanisms: inclusion, efficiency and innovation (see Figure 3-1). To describe how RIAs put these three mechanisms into practice, this chapter will use case studies from India to illustrate the World Bank Framework.

A recent Zinnov (2017) study underscores this argument as it shows that RIAs help online reselling businesses run by housewives to achieve US$9 billion in revenue.

3.1 Local value creation through increased inclusion

RIAs like Lookup (see case study) meaningfully extend the inclusion mechanism of the internet. For many small shops in India, a fixed broadband connection and a desktop computer with appropriate software may be difficult to get. Instead, RIAs offer an easily accessible platform to such local businesses that bears almost no financial risk. They can successfully use RIAs to connect to existing and new customers, access local, regional and possibly international markets or negotiate with suppliers. While businesses profit from the subscriber base of RIAs, the subscribers benefit from seamless integration of purchases or even their daily shopping into apps that they use most often. A recent Zinnov (2017) study underscores this argument as it shows that RIAs help online reselling businesses run by housewives to achieve US$9 billion in revenue.

Figure 3-1: Three mechanisms of the internet's socioeconomic impact

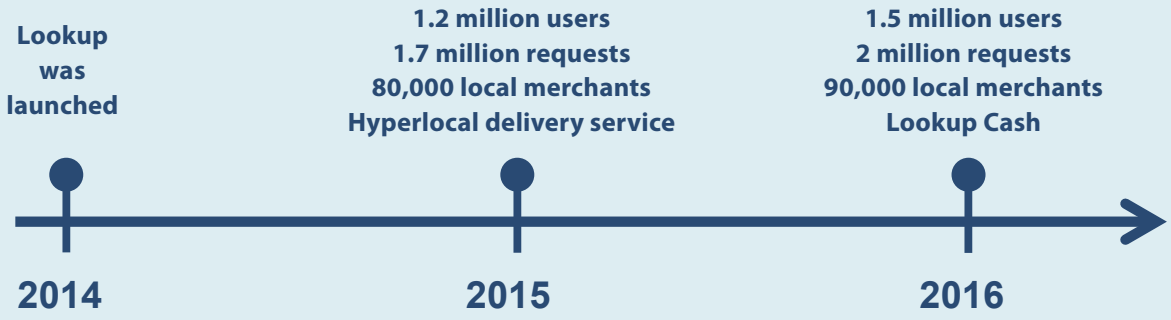


Source: *Own presentation based on World Bank Framework (2016).*

One of the most important characteristics of RIAs is that they enable companies of all sizes, but especially SMEs, to interact with customers and provide information quickly as well as real-time support. As a result, RIAs significantly improve the customer service experience, which helps companies to increase sales and lower marketing costs. According to Abeer Media (2016), 30% of sales generated by SMEs are created by using RIAs.

Lookup connects customers to nearby stores

Lookup provides a platform that enables customers to connect to nearby shops. In 2015, the messaging application already attracted 1.2 million users who were using the app to connect with around 80,000 merchants across Bangalore, Pune, Delhi and Mumbai. While customers can reach local businesses that cannot afford other means of online marketing, such as their own website or online advertising, businesses are given the opportunity to increase their visibility and customer base and thereby to grow. The service also enables hyperlocal deliveries in cooperation with another India-based venture. Today, more than two million requests have been sent and thousands of additional local businesses have joined the platform.[26]



Source: *Lookup and press reports.*

26. *http://lookup.to/company/about/*
https://techcrunch.com/2015/10/14/lookup-a-chat-app-that-connects-retailers-and-customers-in-india-raises-2-5m/
http://lookup.to/faq/
http://blog.lookup.to/post/128184137430/lookup-introduces-hyperlocal-deliveries-in

As Rafert and Mate (2017) find in their study of WhatsApp's economic impact, around a fifth of WhatsApp users interact with businesses via the application, mostly to confirm an appointment or make a purchase. Businesses reportedly benefit from this direct contact by using the app to tailor customer services that resonate well with consumers.

> **For the government, RIAs create a completely new level of citizen reach and participation.**

As regards the **inclusion of people**, the World Bank identifies job opportunities as the most relevant inclusion mechanism. Of course, RIAs create local jobs in India. Hike employs more than 2,000 people in India. Facebook has generated 335,000 jobs in India through its marketing, platform and connectivity efforts (Deloitte 2015). Furthermore, by increasing data usage, RIAs are also partly responsible for the growth of major telecommunications providers in India who in turn employ more people.

Most of these jobs are part of the prospering IT sector in India. In total, the IT sector employed close to 3.7 million people in the financial year 2016.[27] According to the World Bank (2016), people with jobs in the IT sector typically enjoy above-average salaries. More importantly, however, IT sector jobs tend to have one of the highest multiplier effects on adjoining industries. For comparison, in the US and in Germany, around 4.9 jobs are created in other industries for every existing IT job. It can be expected that these effects are similar in India. Government support for the IT industry by setting the right framework conditions for innovation and growth could consequently have significant multiplier effects for the economy as a whole.

Beyond this direct impact, RIAs also help freelancers to find new projects. A particularly noteworthy example for India is Upwork, a platform for freelancers that uses its own messenger app to advertise jobs, present profiles of freelancers and negotiate the freelance job details, payment and so forth. According to the World Bank (2016), 44% of freelancers on Upwork are women who would otherwise find it hard to gain an income since it allows them to balance family and work commitments. Furthermore, Rafert and Mate (2017) conducted a consumer survey among WhatsApp users and found that 42% of Indians use WhatsApp for job and business-related communication. By doing so, they are able to simultaneously reduce costs and boost efficiency and productivity.

For the **government**, RIAs create a completely new level of citizen reach and participation. For instance, the Indian government launched the **MyGov** application

Connecting employees and employers

Upwork, formerly Elance-oDesk,[28] enables businesses to find suitable freelancers across the world. In August 2014, the lifetime value of jobs posted amounted to more than US$5 billion, with 4.9 million jobs posted in total.[29] While the majority of the demand for online labor came from high-income countries, the majority of the supply came from low-income countries. India, however, is an exception.[30] The country has ranked favorably on both sides of the market. In 2013, India was ranked as the second largest country with freelancers.[31] The lifetime value of jobs posted in India amounted to US$167 million. In 2013, 112,378 jobs had been posted in total, making India one of the top five countries using Upwork in terms of job value.[32]

In 2015, the company launched an Upwork Messenger App to connect businesses and freelancers in a more immediate way.[33] The application enables users to react and interact faster, which in turn speeds up the recruitment process and ultimately increases the number of signed freelance contracts.

Source: *Elance, Upwork and press reports.*

27. *http://www.sganalytics.com/blog/automation-in-indian-it-industry/*
28. *https://en.wikipedia.org/wiki/Upwork*
29. *https://www.elance.com/trends/skills-in-demand/geo#GeoRanking*
30. *https://phys.org/news/2016-06-exploring-global-digital-labour.html*
31. *https://www.elance.com/q/online-employment-report*
https://en.wikipedia.org/wiki/Freelancing_in_India
32. *https://www.elance.com/trends/skills-in-demand/geo#GeoRanking*
33. *https://www.upwork.com/blog/2015/06/upwork-messenger-app-android/*
https://play.google.com/store/apps/details?id=com.upwork.android&hl=de

that offers citizens the chance to share their ideas and participate in policy formation. A central part of the application is the two-way communication feature for exchange between government and citizens. The Right to Information (RTI) group also launched an app that facilitates communication between citizens and RTI activists.[34] Beyond specialized applications, RIAs in general enable social interaction of citizens and access to information and knowledge exchange, thus supporting the democratic process.

3.2 Local value creation through increased efficiency

For businesses, the most important aspect of increased **efficiency** through Information and Communication Technology (ICT) implementation is cost reduction. As Rafert and Mate (2017) show, companies using WhatsApp for business purposes by and large agreed that using this RIA lowers the cost of production and marketing. They furthermore agree that internal and external communications become more efficient. The following case study illustrates the various effects of WhatsApp usage in companies.

WhatsApp improves business performance of local merchants

Countless entrepreneurs in India started using WhatsApp to further promote their businesses and engage with both potential and repeat customers. The majority of these businesses use WhatsApp to market their products and increase sales. For instance, Sachdeva Resource Management does not own a website but has been able to create a pan-Indian presence through WhatsApp, which triggers 60% of the company's business.

Another reason for the increased usage of WhatsApp by several ventures is to provide real-time support and customized services to their clients. Bonn's Photography uses WhatsApp this way. As a photography service provider, the ability to share photos and videos helps him to react quickly to his clients' needs and wishes. The firm generates almost 60% of its sales through WhatsApp.

WhatsApp further enables customers to order online or give feedback. The food delivery service Ujjain On Wheels is located in Madhya Pradesh. It employs 12 people. To be able to provide timely deliveries, seamless teamwork is required. WhatsApp enables just that. Customers also use it to provide feedback and this is used to constantly improve the firm's service. After using WhatsApp for almost a year, around 30% of Ujjain On Wheels' sales are generated through the app.

Queen's Wedding Invitation Cards uses WhatsApp to replace email. The app is the owner's primary customer communication channel. This cuts costs and time spent on communicating with their worldwide customer base. Around 90% of their sales are generated on WhatsApp.

Source: *Abeer Media Pvt. Ltd. (2016).*

For individual workers, RIAs can significantly increase labor productivity. For instance, communication via RIAs can reduce travel expenses, save time and ease collaboration. Everything from simply collecting and exchanging information and ideas about scheduling and confirming meetings to sending documents can now be done via RIAs. Flock is a RIA dedicated to business usage. The case study illustrates its impact on internal and external efficiency.

RIAs can also increase the efficiency of **public service** delivery. In particular in developing countries, this can be of critical importance. Clean drinking water is an essential precondition for a healthy and productive population. Although significant progress has been made on water supply, in many areas it is only intermittent and sometimes not clean enough to drink. Information about when water is available or alerts when the water may not be drinkable are crucial, as this can help avoid wasting time waiting for water or walking to another more remote water supply. Apps such as Waattr can provide exactly this type of information.

34. *http://exams.careerlauncher.com/6-mobile-apps-indian-government/*

Flock improves efficiency and productivity of businesses

Flock was launched in 2014 and has already attracted users from more than 25,000 companies. This messaging app for teams intends to simplify communication. According to a survey among users, the deployment of Flock has raised collaboration, efficiency and productivity by 30%. The application is also increasing transparency at work, as well as reducing email transfer and in-person meetings by 50%. This in turn will reduce costs. Originally founded in India, Flock serves clients across the world, thereby creating value for both the localized and globalized economy.[35]

Source: *Flock and press reports.*

Every drop counts

In 2010, the United Nations University indicated that more people own a cell phone in India than have access to a toilet. This shocking finding raised international awareness of the poor infrastructure conditions in developing and emerging countries.

While according to the WHO and UNICEF there is some improvement globally, the situation is still difficult for many people living in India. Water supply there is intermittent and sometimes of poor quality. This is due to a predominantly manual system of valves in the Indian cities, which makes water supply unpredictable. Thus, information about when good clean water is available is crucial. The Indian-based service NextDrop has been providing this kind of information to its subscribers via SMS for almost six years now, reaching more than 75,000 households in four Indian states. After interacting with the people operating the valves, NextDrop sends out a text message to its subscribers with information about when and where to expect water. In 2015 the venture also launched a smartphone app called Waattr[36] that allows users to find and share information about water quality and supply with the local community.

Integrating this system into a RIA could further empower the crowdsourcing approach with pictures and videos of leaks or other faults in the system. This additional information may improve the overall quality of the infrastructure as early intervention could reduce maintenance costs. Furthermore, picture analysis algorithms could help people to evaluate the quality of the water they receive.

Source: *Press reports.*

WhatsApp reunites families

After a train derailed in northern India in 2016, doctors used WhatsApp to reunite victims with their relatives. Most of the injured passengers were separated from their families and friends after they were rescued and rushed to different hospitals in the same area. Doctors in those hospitals immediately took pictures of each patient coming in and shared their names and identities on WhatsApp. This meant that families were reunited within just hours. This was the case for an eight-year-old girl traveling with her grandfather and uncles. Her brother was able to track her down quickly due to the doctors' approach.[37]

Source: *Press reports.*

35. *https://www.flock.co/?utm_expid=.xkVwepncRaSL712xkITykA.0&utm_referrer=https%3A%2F%2Fwww.google.de%2F*
http://www.dqindia.com/flock-a-start-up-aiming-to-improve-efficiency-and-productivity/
http://www.marketwired.com/press-release/flock-launches-flockos-worlds-first-chat-operating-system-2184600.htm
https://www.crunchbase.com/organization/flock-2#/entity
http://startup2day.in/story-fullview/ceo-bhavin-turakhia-has-decided-to-invest-25-million-in-flocks-team-messenger-app

36. *http://www.npr.org/sections/goatsandsoda/2015/08/29/434649468/no-more-standing-by-the-spigot-messaging-app-alerts-water-availability;*
http://www.firstpost.com/business/startups-business/nextdrop-a-startup-that-informs-you-what-time-water-will-be-supplied-in-your-area-1615803.html;
http://www.moneycontrol.com/news/business/startup/world-environment-day-here-are-8-indian-startups-that-are-making-the-earth-better-2296137.html;
http://www.thealternative.in/society/waattr-nextdrop-a-start-up-to-solve-water-problem-through-modern-technology/

37. *http://www.dailymail.co.uk/indiahome/indianews/article-3958312/Doctors-turn-WhatsApp-reunite-survivors-India-train-disaster-children-families-separated-chaotic-scenes-following-derailment.html*

Furthermore, responding to crises and providing education are two other major areas of public services provided by governments that can benefit from RIA usage.

3.3 Local value creation through increased innovation

As regards the local business environment, the World Bank (2016) links increased competition to the **innovation mechanism** of the internet. Indeed, RIAs benefit from the generally low entry barriers and significant scaling potential that the internet offers. In addition, among RIAs themselves there is significant competitive pressure. Established RIAs creators develop new functions continuously. New startups sometimes introduce completely new ways to interact or focus successfully on a specific target group. Indian startups have also been very successful in the area of RIAs. Table 3 1 highlights some examples of local RIAs.

Most of the firms in Table 3-1 are young, locally born companies that can be characterized as highly innovative, responsible for creating new services, and empowering the local Indian economy. While some of the RIAs above have already been considered in earlier case studies, the following case study highlights Hike's local impact. In addition to its economic impact, Hike is also very innovative in terms of the new functions it introduced in its app.

Table 3-1: RIAs from India

NGCS	Est. in	Description
Flock	2014	Communication app for teams
Hike Messenger	2012	Cross-platform instant messaging service
JioChat Messenger	2015	Messaging app
Lookup	2014	Chat-based platform connecting customers to nearby stores
Nimbuzz	2008	Free chat and calling app

Source: *Own representation based on press reports.*

RIAs also contribute substantially to **consumer welfare** by improving the quality of life and social cohesion. Education is a key enabler of economic progress (Shaw & Allison 1999). Consequently, improving the success and impact of education is one of the top priorities in both developed and developing countries. Communication is a fundamental requirement of knowledge transfer and thus plays an important role in education. However, there are various situations when

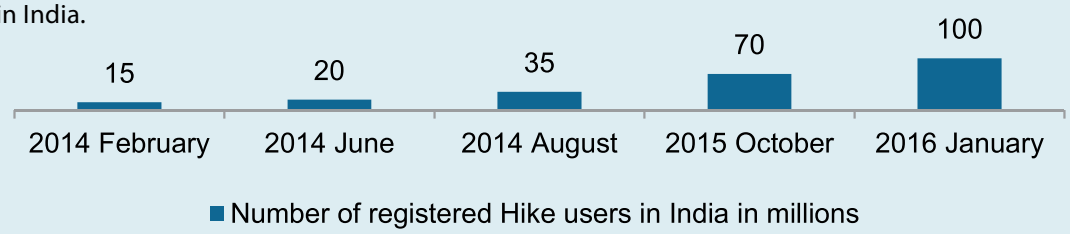
Table 3-2: Hike Messenger innovation timeline

Hike Messenger (launched in Dec 2012)	
Month/Year	**Functionality implemented**
Dec 2012	Texting; videos/photos; group chats; SMS
Jan 2013	End-to-end encryption and voice messages
Jun 2014	File transfer
Jan 2015	Voice calls
Sep 2015	Group conference calls
Oct 2015	Hike direct
Dec 2015	Multilingual interface, keyboard
Jan 2016	Carpooling/ride sharing
Mar 2016	Gaming
Oct 2016	Video calls
Nov 2016	Sharing stories (timeline)

Source: *Arnold et al. (2017) based on press reports; the functionalities listed above represent major steps in the development of Hike Messenger and are not meant as a full reflection of all it offers.*

Hike Messenger creates local value in India

Hike Messenger is creating significant local value in India. As a fast-growing Indian company with a market capitalization of US$65 million in March 2016 (SoftBank Group 2016), Hike is expected to create new jobs and generate other positive spillover effects at the regional level. In January 2016, Hike crossed the 100 million user mark in India.



Hike offers localized stickers and two-way chat themes and has been developed to solve cultural and infrastructural problems such as lack of privacy and inconsistent data connectivity. In addition, it is the only messaging app in India that allows users to send messages from smartphones to feature phones and vice versa. With the introduction of Diwali coupons in 2015, which users can get from online shopping websites such as Amazon, eBay, Jabong, Domino's and Pizza Hut, over 100 local shops and restaurants are supported by such coupons, thus creating value for the localized economy.[38]

Source: *Hike Messenger and press reports.*

direct face-to-face communication is not possible, either because pupils live in remote areas or when the learning is to be extended beyond the classroom. This is where RIAs can play an important role. The most common application of RIAs in education is to distribute educational material. However, RIAs are also used to improve the overall interaction process between teachers, parents and pupils. To this end, various specialized RIAs, so-called classroom communication apps, exist. These are messaging apps, like Teno[39] and Arch-The Way[40] in India, that connect teachers with students and their parents. In general, the classroom apps enable teachers to broadcast messages, images, videos, tabular schedules and files to the entire class or receive feedback from the students and parents. Participants have to sign up via an app to connect in a secure manner. These apps support critical aspects of interaction between schools, students and parents, like controlled distribution of data and filtering of information that might harm children.

Besides these specialized RIAs, mainstream RIAs are often used to achieve similar results. In many developing countries, general purpose RIAs play the main role since specialized services are rarely available. The following case study demonstrates this point.

Telling the story of education success: RIAs in teaching

In India, two development organizations, Voluntary Services Overseas (VSO) and Pratham, developed a training plan[41] to improve reading and writing skills for children in the rural district of Bundi. For seven weeks, teachers received a daily language lesson plan via SMS and WhatsApp. The plans became more complex as the weeks went by, and in the latter stages of the pilot, WhatsApp was used to deliver audio and song-based teaching aids, and to provide a forum for educators' discussions.

The results were impressive: after seven weeks, 63% of the children at participating schools were able to correctly read words and sentences compared to 35% at the beginning of the seven-week program. This is significantly higher than results at other schools (an increase from 35% to 42%) that did not participate in the learning program. In addition, the learning program is very cost-effective at just 10 Indian paise per child, which is only 1.4 euro cents.

Source: *VSO International.*

38. *http://indianexpress.com/article/technology/social/hike-messenger-introduces-special-diwali-coupons-for-its-users/*
39. *https://tenoapp.com/*
40. *https://yourstory.com/2016/01/arch-the-way/*
41. *See full report: https://www.vsointernational.org/sites/default/files/sms_report_final_v1_4.pdf*

Finally, RIAs also support people with disabilities that potentially face some barriers to interacting with others. For example, with respect to deaf people and those hard of hearing, there is only a limited population base that speaks sign language, and there are variations of sign language all across the globe. RIAs create new and enriching ways for those who are deaf or hard of hearing to communicate and connect with others, giving them a voice that they otherwise may not have had. There is an increasing trend among individuals with communication disabilities to use standard commercial devices Bornman et al. (2016). Standard commercial technologies such as touchscreens and speech recognition are playing an increasingly important role in supporting people with specific access needs, in many cases replacing the more expensive Augmentative and Alternative Communication (AAC) technology previously used for these purposes (Raja 2016). Alper & Haller (2017) have found that mainstream technologies are comparatively more powerful, compact, and have a longer battery life, which is essential for communicating without having to stop and recharge a device, as is often the case with specialized AAC devices. However, it should also be noted that in the Bornman et al. (2016) study, negative perceptions of mainstream devices also resonated with participants. Despite adaptions to the mobile devices, participants identified frustrations using them, like having difficulty entering a lot of text (30%), and having difficulty reading something on their device because the screen was either too small or the screen reader could not read the text aloud (17%).

There have been dedicated developments, such as 3D touchscreens and cell phones that can be turned on by voice command or manipulated with head movements like the Sesame phone, but developers of RIAs are also working to provide equal access for everyone. An app called Ava translates spoken language into written language displayed in the app on the smartphone of a person who is deaf or hard of hearing. Another app called Five allows users to use sign language (existing or new) and send the message to friends in Five or connect with Facebook Messenger.

(Bornman et al. 2016) also found that 40% of the studied population used one or two apps on their wireless devices, with the most popular being social networking apps; 67% of the individuals have a profile on Facebook, Twitter and/or LinkedIn and 43% visit these sites several times a day. This is in line with other studies, like Caron & Light (2016) and Light & McNaughton (2014), which suggest that social media via networked mobile technologies give individuals with significant communication disabilities opportunities to increase, maintain or improve their own communication in everyday contexts. Indeed, RIAs can also play a crucial role in this respect. For instance, the Australian app Hireup enables rich interaction between people with disabilities and potential professional care workers. The app facilitates socializing before the actual interaction commences. This means that common interests can be explored, resulting in an improved matching process for care workers and people with disabilities.

4. What's Next for RIAs in India?

India appears to be on the fast track to becoming a digital country, with mobile phones at the center of this revolution.[42] Internet adoption is growing exponentially and is showing a measurable effect on India's economic development as the country has been outpacing the worldwide economic growth trend over recent years, coinciding with a strong growth in internet penetration. As the present study has shown, RIAs play an essential role in India's digitization and economic and social welfare. Besides various globally successful RIAs, local innovators like Hike, Flock, Lookup, JioChat Messenger and Upwork play an important role in developing locally relevant RIAs.

RIAs provide consumers with numerous innovative functions that traditional communications services cannot offer. Arnold et al. (2017) find that RIAs indeed follow a separate evolutionary path from traditional communications services, from desktops to mobile devices. Given their rapid innovation and adoption of innovative functions, RIAs' distance from traditional communications services is bound to grow. The study also reaffirmed the significant economic impact of RIAs on GDP globally.

For India, the present study highlights the consumer surplus that these applications create by reducing information, search and transaction costs for consumers. For 2017, we estimate a total consumer surplus by RIAs in India of US$98 billion, a surplus of US$74 per capita and time savings of about 13 hours per week. Thus, each user of RIAs in India receives on average US$249 of consumer surplus annually. This corresponds to almost two monthly incomes, which was about US$122 in 2016.

Mostly importantly though, this is not the only way in which the local economy benefits from RIAs. Local businesses can significantly increase their market access and consequent sales. Groups like housewives who previously did not have access to the job market or found it hard to balance family commitments with paid employment can use RIAs to overcome typical barriers.

Finally, RIAs help India to achieve its sustainable development and digitization goals. Innovative RIAs

RIAs provide consumers with numerous innovative functions that traditional communications services cannot offer.

are particularly relevant in India to overcome the challenges of scale and scope as well as gaps in India's physical infrastructure. In fact, RIAs may represent a very cost-effective and efficient way to drive the Digital India Programme. For example, digital illiteracy is a significant barrier in India. RIAs can help to tailor devices and services with multilingual interfaces as well as interfaces that are appropriate for citizens with less formal education and limited digital experience.

Innovation is engraved in the DNA of RIAs as the Hike case study (among others) in Chapter 3 shows. Only through constant innovation, in a market with low barriers to entry, can these applications stay ahead of their competition and generate local value. This is likely to drive demand for data services, increasing opportunities for telecommunications providers to gain additional revenue. It also pushes the Indian internet economy to be the best it can be. The popularity and increasing use of RIAs in India is testament to the fact that these innovative products and features have added perceptible value to consumers' lives and welfare.

As the functionalities of RIAs expand and develop to get closer to the full internet experience, it becomes increasingly important that these innovations are allowed to grow unhampered. A highly regulated market not only affects the existing market, but also affects negatively the willingness of people to try to become entrepreneurs. To ensure that the internet economy flourishes, and that consumers, entrepreneurs and the market see sustained benefit, policies that encourage innovation must remain a top priority for policy makers. Heavy-handed regulation will stifle innovation, and policy uncertainty could discourage investment. While there has been intense debate in many countries surrounding regulation of this sector, given its fast-evolving nature, the general direction of this has been through informal and light-touch regulation.

42. *ICRIER (2017) has substantiated this in their recent report.*

Annexures

Annex 1: Overview of key studies on the economic impact of telecommunications services, the internet and RIAs

Authors	Methodology	Dependent variable	Key explanatory variable (and covariates)	Range of impact on GDP
Roeller & Waverman (2001)	Regression on panel data from 21 OECD countries from 1970 to 1990 using a production function framework with fixed effects	GDP	Stock of telecommunications infrastructure (stock of capital net of telecommunications capital, stock of human capital, exogenous time trend, geographic area, government surplus, investment in infrastructure, price of telephone service, waiting list for main lines per capita)	A 10% increase in telecommunications penetration will lead to economic growth by 0.34%
Sridhar & Sridhar (2007)	Regression on panel data of 63 developing countries from 1990 to 2001 using a production function with a system of simultaneous equations with and without country fixed effects	GDP	Telephone penetration (capital, labor, total telephones per 100 population)	A 1% increase in telephone penetration increases GDP by 0.15% without country-specific fixed effects and by 0.10% with country-specific fixed effects
Gruber & Koutroumpis (2011)	Panel data regression of 192 countries for a time period of 18 years (1990–2007) using a production function with a system of simultaneous equations	GDP	Level of mobile penetration in 100 inhabitants (capital, labor, population living in urban areas, mobile subscriptions, mobile revenue)	Adoption in mobile telecommunication will lead to an average annual GDP growth of 0.19% for low-income countries and 0.35% (non-OECD) to 0.39% (OECD) for high-income countries
Czernich et al. (2011)	Logistic panel regression on OECD countries between 1996 and 2007 using production function with year and country fixed effects and an instrumental variable	Per capita GDP growth	Broadband penetration (pre-existing traditional networks, capital, labor, human capital)	A 10% increase in broadband connectivity is associated with an increase of per capita GDP of between 0.9% and 1.5%
Farhadi, Ismail & Fooladi (2012)	Dynamic panel data model with country fixed effects covering 159 countries between 2000 and 2009	GDP	ICT use measured by number of internet users, fixed broadband internet subscribers and the number of mobile subscriptions per 100 inhabitants (previous year's GDP)	If a country improves the ICT use index by 1%, economic growth will increase by 0.09%
Rafert & Mate (2017)	Regression of panel data of 157 countries from 2012 to 2015 using year fixed effects	GDP per capita	WhatsApp penetration (government expenditure (% of GDP), gross capital formation (% of GDP), inflation, worldwide governance indicator, fixed broadband subscription (%), mobile and cellular telephone subscriptions (%), proportion of people living in urban areas, population density)	A 5% point increase in WhatsApp penetration is associated with the following increases in GDP: -US$22.9 billion globally (PPP 2015) -And regionally: US$10.6 billion in Asia; US$5.4 billion in North America; US$3.9 billion in Europe; US$1.1 billion in the Middle East; US$1.0 billion in South America; US$0.8 billion in Africa

Arnold et al. (2017)	Regression on panel data of 164 countries from 2000 to 2015 using time and country fixed effects	GDP per capita	Telecommunications usage index and internet usage index and capital/labor ratio	A 1% increase in telecommunications leads to a 0.028% increase in GDP per capita and for internet usage the increase is 0.041%
ICRIER (2017)	Regression on panel data of 23 countries from 2011 to 2015 and a panel regression of 19 Indian states from 2013 to 2016 using a production function framework with country fixed effects	GDP	Total and mobile internet traffic (capital/labor ratio)	A 10% increase in global internet will lead to a 1.3% increase in global GDP, whereas a 10% increase in global mobile internet traffic will lead to a 0.7% increase in GDP. A 10% increase in India's total internet traffic is associated with a 3.3% increase in India's GDP. India's GDP will rise by 1.3% when India's mobile internet traffic increases by 10%

Annex 2: Methodology for the estimation of the global economic impact of RIAs

In order to estimate the impact of RIAs on GDP, we have to estimate the two endpoints, namely the impact of telecommunications (voice and text functionality) on GDP and the impact of the "full internet experience" (overall functionality) on GDP. In the second step, we approximate the impact of RIAs, which is assumed to range between these two endpoints.

Table A2-1: Global impact of telecom/internet usage on GDP per capita

	(1) telecom	(2) internet
VARIABLES	Log(GDPpc)	Log(GDPpc)
Log(K/L)	0.168***	0.141***
	(0.039)	(0.037)
Log(IndexTelecom)	0.028**	
	(0.013)	
Log(IndexInternet)		0.041***
(0.008)	Multilingual interface, keyboard	
Constant	6.818***	7.188***
	(0.406)	(0.386)
Observations	2,616	2,607
Number of countries	164	164
R-squared	0.800	0.814

Source: *Arnold et al. (2017). Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

The table A2-1 presents the results of the econometric estimation of the impact of telecommunications and the internet on global economic output per capita over the 16-year time span for 164 countries. The overall models as well as the individual coefficients are statistically significant in both equations. R-squared (the share of the variance in the sample that can be explained) is around 80% in both specifications. Further tests were conducted and all of them supported the robustness of the estimates.

Column 1 presents the results for the common logarithm of the telecom index. The estimated coefficient for the telecom index is statistically significantly different from zero at the 5% level. According to this coefficient, a 10% increase in the global level of the telecom index leads to a 0.28% increase in the level of global GDP per capita. On average, this 10% increase corresponds to an economic magnitude of about US$4.8 trillion of global GDP over the 16-year period.

Column 2 shows findings for the common logarithm of the internet index. The estimated coefficient for the internet index is statistically significant at the 1% level and reveals an even higher impact on economic output than telecommunications. The coefficient indicates that a 10% increase in the internet index results in a 0.41% increase in the level of global GDP per capita. On average, this 10% increase relates to an economic magnitude of about US$7.0 trillion of global GDP over the 16-year period.

Our findings are consistent with the economic literature that telecommunications and internet usage are positively correlated with economic output. Our results can be interpreted as conservative estimates, in particular for the internet impact on GDP, since there are several non-monetary aspects of internet functionality, such as reduced information, search and transaction costs, and further efficiency gains, such as rather large spillover effects due to time saved. These non-monetary aspects that are not considered in GDP tend to have quite a large effect in economic terms at a global level.

For the estimation of the impact of telecommunications and the internet on GDP, we use the World Development Indicators database of the World Bank for macroeconomic data such as the purchasing-power-parity-adjusted (PPP-adjusted) GDP per capita (GDPpc) and labor (L) and the Penn World Table data for the PPP-adjusted capital stock (K). International Telecommunications Union (ITU) data for five indicators are used for the construction of two indices: an index for telecommunications and an index for internet usage.[43] For the indicators selected for the construction of our two indices, the normalization of the data is based on the recommendations of the ITU. Normalization of the data is necessary before any aggregation can be made to ensure the data set uses the same unit of measurement. The weighting of the indicators is also based on the ITU recommendations to construct both indices.

The telecom index covers indicators that provide an indication of the available telecom infrastructure and individuals' access to basic telecommunications services.[44] The internet index covers indicators that capture internet usage.[45] Overall, the ITU obtained the data for countries through national household surveys that are either provided directly to ITU by national statistical offices or obtained by ITU through its own research. There are certain data limits to some indicators, insofar as estimates have to be calculated by ITU for many developing countries that do not yet collect ICT household statistics.

Our panel data set covers 164 countries with a time span from 2000 to 2015. We use an aggregate production function framework (Cobb–Douglas setting) that captures the effects of the inputs—capital, labor, and telecommunications or the internet (see equation 1)—on the output measure GDP:

$$GDP_{jt} = f\left(K_{jt}, L_{jt}, Telecom_{jt}/Internet_{jt}, t\right) \quad (1)$$

Thus, we relate national aggregate economic activity to the stock of capital *K* and the stock of labor *L* as the two main production/input factors and a *Telecom* index or an *Internet* index (see equation 2) as well as an exogenous time trend *t*. Therefore, we have the PPP-adjusted GDP per capita as a function of the capital/labor ratio (K/L) and an index for telecoms or an index for internet usage (based on the ITU indicators).

43. *The ITU ICT Development Index is a composite index (based on 11 indicators) designed to be global and reflect changes taking place in countries at different levels of ICT development. It therefore relies on a limited set of data that can be established with reasonable confidence in countries at all levels of development.*

44. *Indicators used for the telecom index are the following: fixed telephone subscriptions per 100 inhabitants; mobile cellular telephone subscriptions per 100 inhabitants.*

45. *Indicators used for the internet index are the following: percentage of individuals using the internet; fixed broadband subscriptions per 100 inhabitants; active mobile broadband subscriptions per 100 inhabitants.*

The econometric model is a fixed-effects (FE) specification with a Cobb–Douglas production function framework (logarithmic scale) to estimate the effect of several inputs (capital, labor, and telecommunications or internet) on the output measure (GDP per capita). Our econometric model is the following:

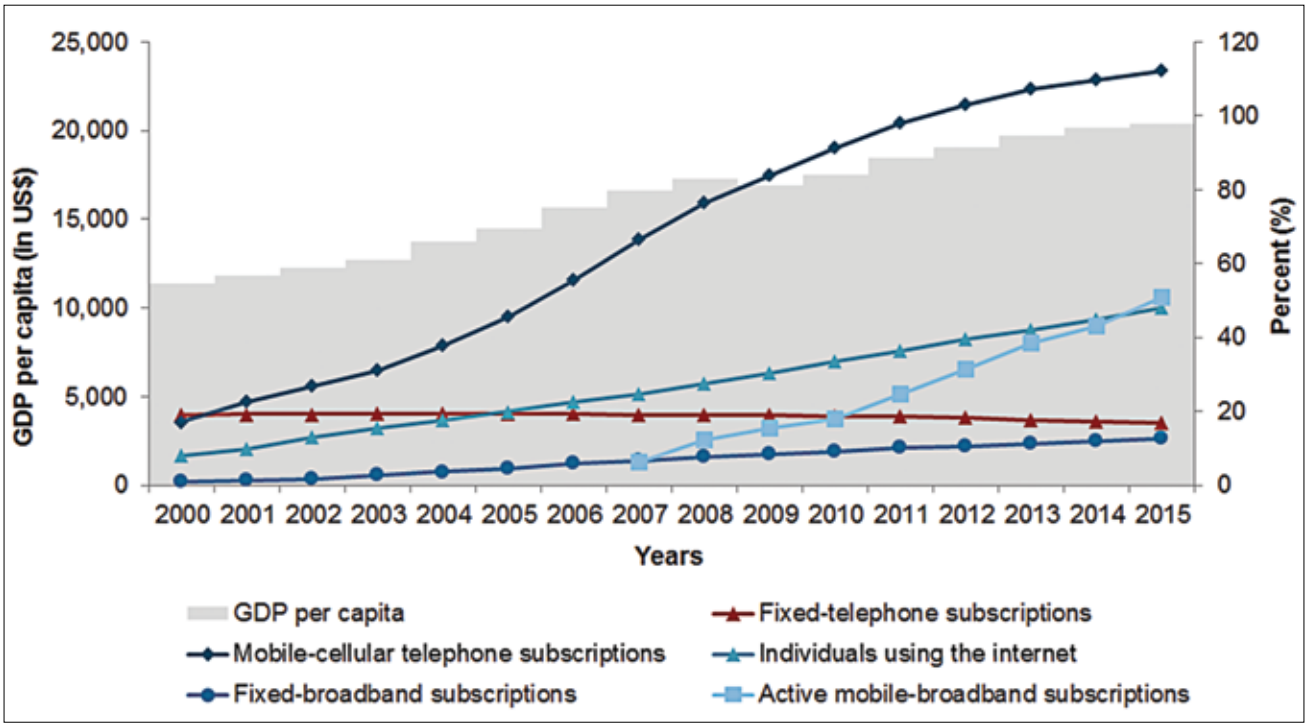
$$\log(GDPpc_{jt}) = \beta_0 + \beta_1 \log\left(K_{jt}/L_{jt}\right) + \beta_2 \log(Index_{jt}) + \alpha_j + \gamma_t + \varepsilon_{jt} \quad (2)$$

In equation 2, $log\ (GDPpc_{jt})$ is the dependent variable referring to the PPP-adjusted level of GDP per capita (common logarithm of economic output) for country j in year t. β_0, β_1 and β_2 are the parameters to be estimated. The independent variables are $\log\ (K_{jt}/L_{jt})$ as the common logarithm of the PPP-adjusted capital/labor ratio for country j in year t and $\log\ (Index_{jt})$, which refers to either the logarithmic telecom index or the logarithmic internet index for country j in year t. α_j are country FE removing time-invariant effects out of the 164 countries; j in this sample and γ_t are time FE controlling for macroeconomic changes in the sample period 2000–2015. Last but not least, ε_{jt} is the residual for country j in year t consisting of unobserved effects. Robust standard errors are clustered at the country level. The unit of observation is the country year.

The empirical method is based on a linear panel FE model that enables analysis of causal relationships under relatively weak assumptions. FE models estimate average deviations from the mean. Taking the common logarithm of the dependent variable $GDPpcjt$ and the independent variables (K_{jt}/L_{jt}) and $Index_{jt}$ means focusing on an elasticity analysis. The key assumptions are that unobservables are time-invariant and that all controls are exogenous with respect to the outcome and hence uncorrelated with the residual ε_{jt}. Here, γ_t stands for a set of time dummies and α_j is a vector of country binary variables. Coefficient β_2 is the parameter of interest and measures the elasticity of $GDPpc_{jt}$ to variations in the level of the respective $Index_{jt}$ for either telecom or internet usage. Thus, our specification uses the variation from differences across country-specific economic activity with respect to developments in the respective index. The model may be subject to endogeneity bias: while telecom/internet usage may cause GDP per capita growth, the reverse may also be true. Since there are strong positive network externalities from telecommunications and the internet, the first effect strongly dominates the other one according to the economic literature. Thus, we can refrain from identifying the causal relationship. To account for several methodological issues, we conducted several tests on our model specification. The results are qualitatively similar to those reported in the table A2 1.

Figure A2 1 displays the global GDP per capita for each year along with the development of the five ITU indicators incorporated in our two indices over the sample period 2000–2015.

Figure A2-1: Global developments in telecommunications and the internet sector

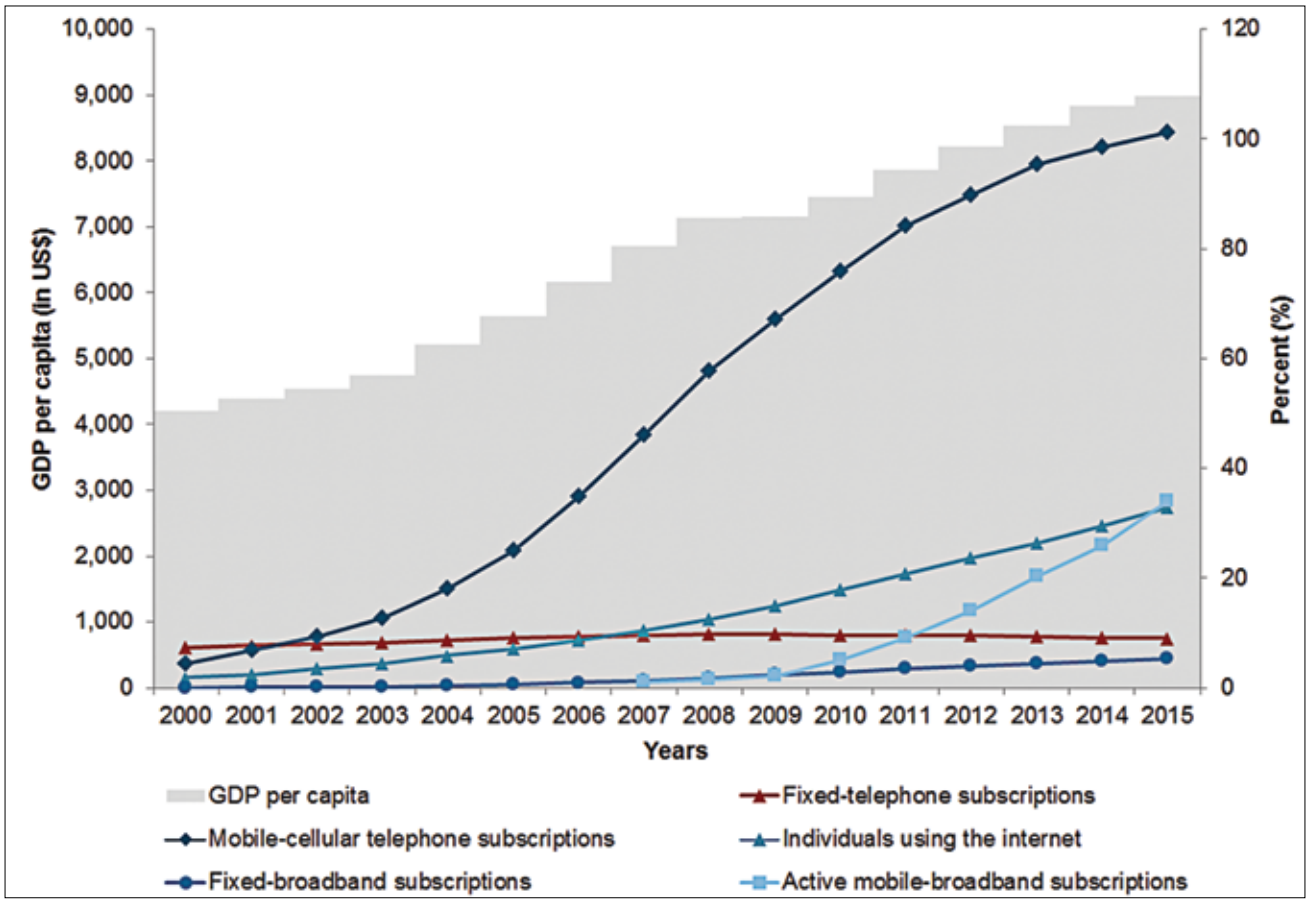


Source: *Arnold et al. (2017).*

The purpose of Figure A2 1 is to show that we experience different rates of GDP growth and volatility in telecommunications and internet usage with respect to the different indicators. Using country FE and time FE in the analysis, the main contribution comes from global shocks with diverse impacts on the different countries. Thus, the figure illustrates the identifying variation we are going to use in the estimation procedure. It indicates that it should be possible to draw inferences from these data patterns.

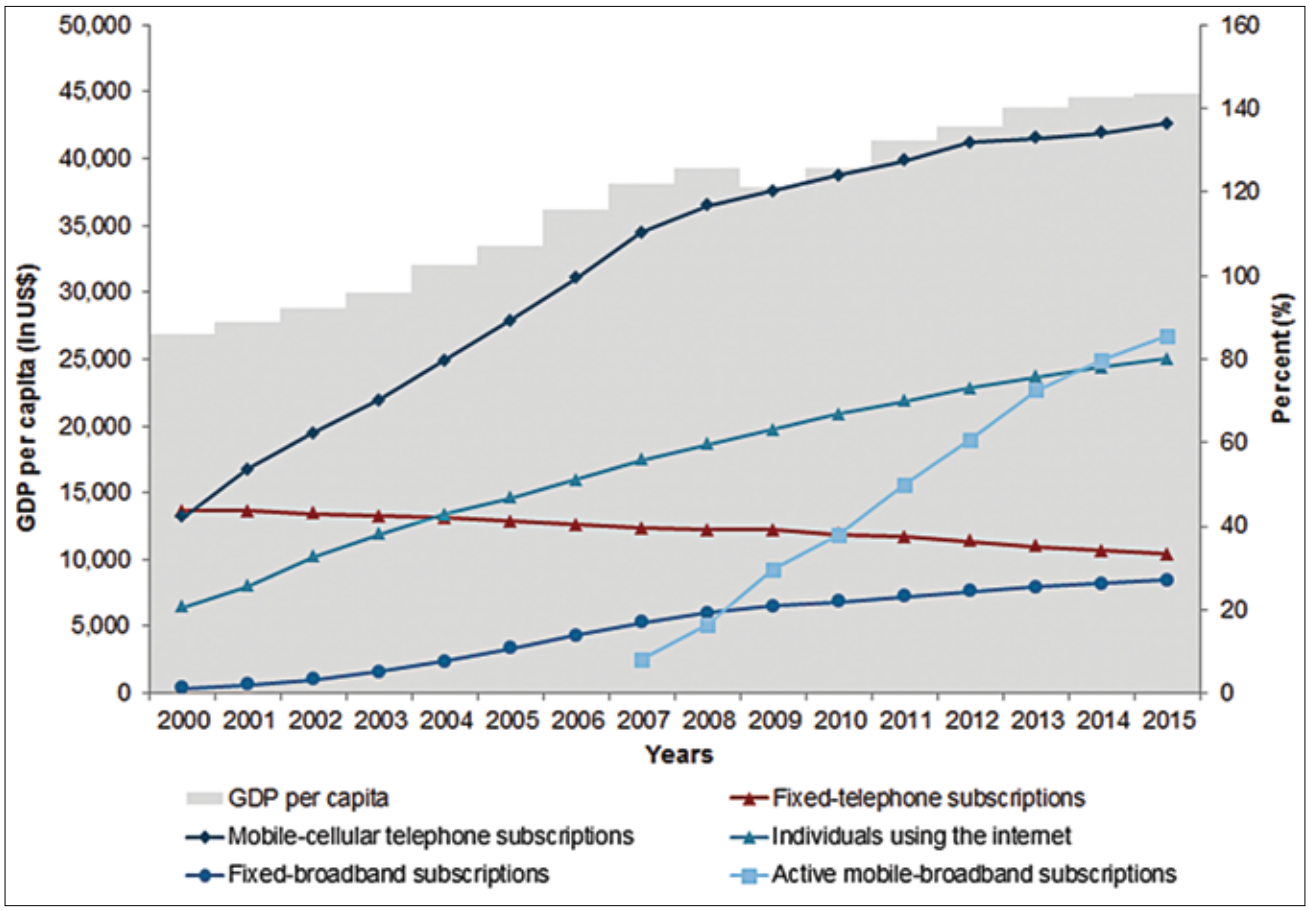
The global average impact of these technologies ignores the differences at the micro-level. As a result, looking at the difference between developing and developed countries reveals more insights about the relative economic impact of RIAs. The following two figures show the development of the indicators, in the first figure for developing countries and in the second figure for developed countries.

Figure A2-2: Developments in telecommunications and the internet sector in developing countries



Source: *Arnold et al. (2017).*

Figure A2-3: Developments in telecommunications and the internet sector in developed countries



Source: *Arnold et al. (2017).*

In both figures, the increasing trend in the indicators "individuals using the internet", "mobile cellular telephone subscriptions" and "active mobile broadband subscriptions" is apparent. Mobile internet usage and RIAs are on the rise in both developing and developed countries. In contrast, fixed telephone subscriptions and fixed broadband subscriptions are losing impact in relative terms. Moreover, they have stagnated in developing countries in recent years, therefore supporting the important role of economic development in mobile broadband infrastructure. As a result, there is a higher relative value creation of adding new users and further encouraging the adoption of RIAs for developing countries in economic terms than for developed countries. This implies that the potential of RIAs to transform the economy is many times greater in developing countries than in developed countries.

Since RIAs act as intermediaries that evolve continuously by incorporating more (new) functions that provide economic value, they will finally converge to the "full internet experience", and therefore the impact of RIAs on economic activity will continue to increase in the future.

Annex 3: Methodology for the estimation of consumer surplus created by RIAs in India

Two of the most commonly used methods to quantify the economic impact of a specific good or service is to estimate its contribution to the economy expressed as a proportion of GDP or consumer surplus. The first approach is the more conventional one and mainly measures the direct impacts. The consumer surplus, however, measures the exceeding personal value of or the utility gain from consuming a good or service, thus the indirect impact. Hence, these two concepts capture different aspects of economic welfare.

To the best of our knowledge, to date only two studies have attempted to quantify the economic impact of Rich Interaction Applications (RIAs) and New Generation Internet Based Applications (NGIBAs) using solely the first direct approach. Arnold et al. (2017) approximated the impact of RIAs on global GDP by assuming that RIAs are constantly evolving and adding new functions. Therefore, they are moving further away from traditional telecommunications and becoming applications able to provide a "full internet experience". In order to estimate

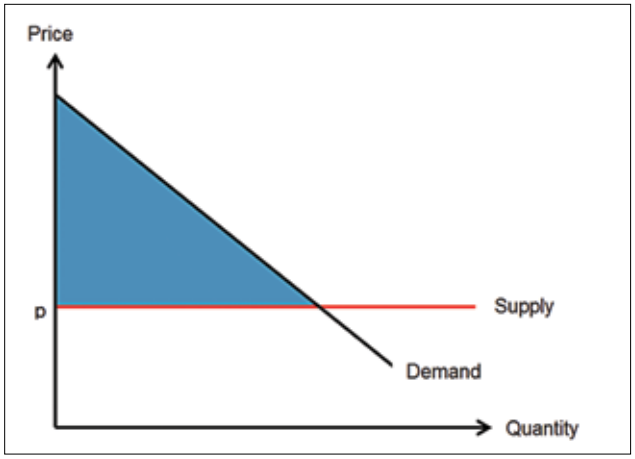
the impact of RIAs on GDP, the authors had to estimate the impact of telecommunication usage on GDP and the impact of internet usage on GDP as a proxy for the "full internet experience" first. The impact of RIAs had to range between these two. The impact of telecommunication usage and internet usage was estimated using a fixed-effects Cobb–Douglas production function framework using panel data for 164 countries from 2000 to 2015. The authors found that each 10% increase in RIA usage added on average US$5.6 trillion in global GDP (0.33% of GDP). [46]

To derive the economic value of NGIBAs in India, ICRIER (2017) conducted an approach different from Arnold et al. (2017). The authors performed a panel analysis across 19 Indian states from 2013 to 2016 using an instrumental variable regression with a Cobb–Douglas production function model specification. Besides labor and capital, the authors used total and mobile internet traffic as additional input variables. They found that a 10% increase in India's total internet traffic increases India's GDP on average by 3.3%, and a 10% increase in India's mobile internet traffic leads to a 1.3% increase in India's GDP. Derived from these findings, the authors estimate an economic impact of new-generation internet-based applications of a minimum of US$20.4 billion in India in 2015–2016.

Focusing on the consumer surplus as a way of estimating the economic impact of RIAs is, to the best of our knowledge, a new approach. It is also rarely applied for similar analysis of related subjects like the internet economy as a whole. McKinsey & Company (2010) estimated the consumer surplus of free internet-based services by conducting a conjoint analysis on a total of 3,360 online interviews in Europe and the US. BCG (2015) also used a conjoint analysis to estimate the impact of mobile internet in Europe. However, as far as we are aware, approaches directly addressing the consumer surplus of RIAs are missing from the literature.

Traditionally, the consumer surplus is defined as the difference between the consumer's willingness to pay for a specific good or service and its actual price. For example, consider a person who is willing to pay around US$8 for a given good, even though the market price for that good is only US$5. In this case, this person's receiving surplus is US$3. Figure A3 1 illustrates this simple equation graphically. The downward sloping aggregated demand curve indicates the quantity of a specific good or service consumers are willing to buy for any given price. The red line depicts the actual market price of that specific good or service, shown here as p. On the right side of the demand curve, the consumers are willing to pay more than they actually have to. Therefore, the blue area between the demand curve and the price line depicts the aggregated consumer surplus.

Figure A3-1: Graphical representation of consumer surplus estimation



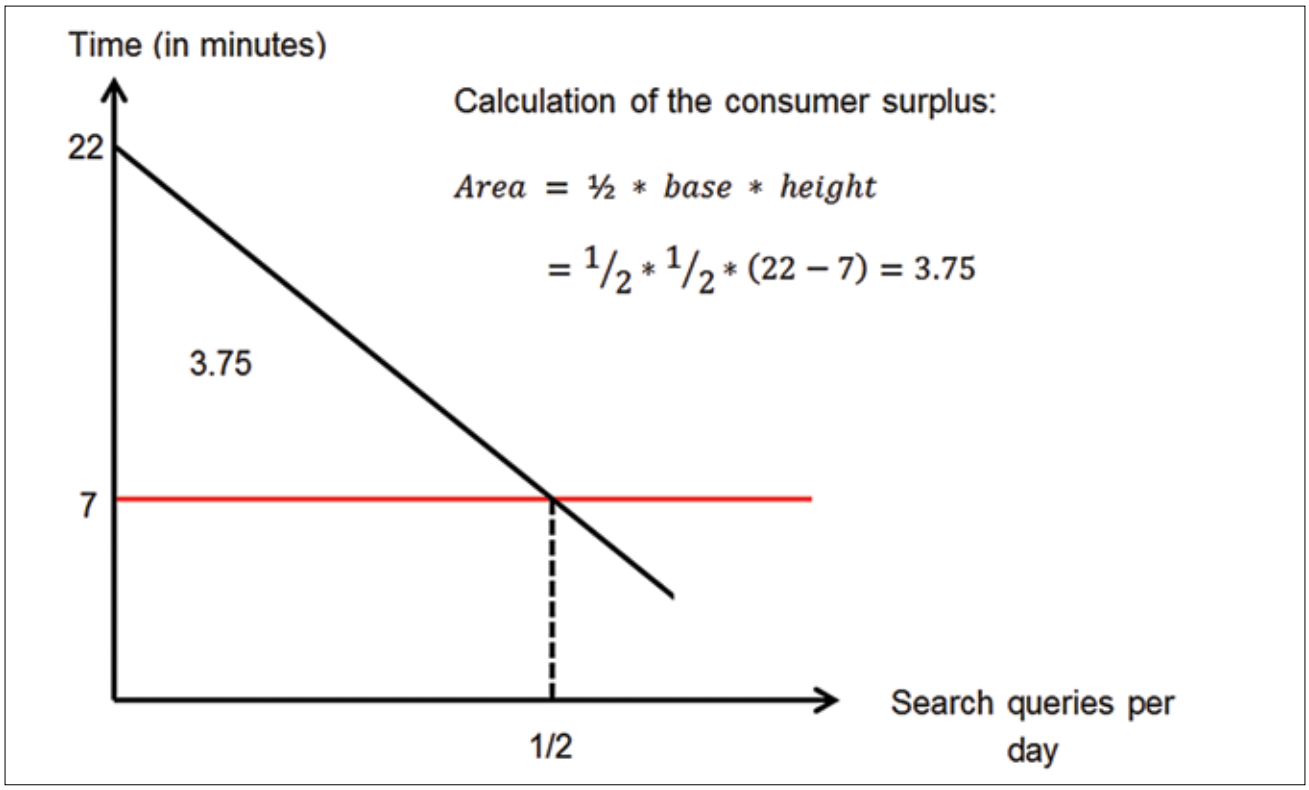
Source: *Own representation based on Arnold & Schiffer (2011).*

However, the value of goods or services cannot always be quantified in monetary terms. This problem is particularly prevalent with services that can be accessed or used via the internet. To address this issue, a second common approach to calculate consumer surplus is to determine the time savings enabled by using a product. Researchers from the University of Michigan used this approach when estimating the consumer surplus gained by search engines. They conducted an experiment to compare the time needed for searching online with the time needed for the corresponding offline search. While an online search takes on average around 7 minutes, the offline search takes more than three times as long (22 minutes). In this scenario, time may equal price, while quantity may equal the usage amount. They find that a typical user might save around 3.75 minutes per day. Assigning that time to the average wage in America, the consumer surplus accounts for almost US$500 per user annually.[47]

To estimate the consumer surplus created by RIAs in India, we adopted a similar approach. For this analysis,

46. *For detailed information see Annex 2.*
47. *See Arnold & Schiffer (2011), Chen, Jeon, & Kim (2014) and https://www.economist.com/news/finance-and-economics/21573091-how-quantify-gains-internet-has-brought-consumers-net-benefits.*

Figure A3-2: Estimation of time savings by Arnold & Schiffer (2011)



Source: *Arnold & Schiffer (2011).*

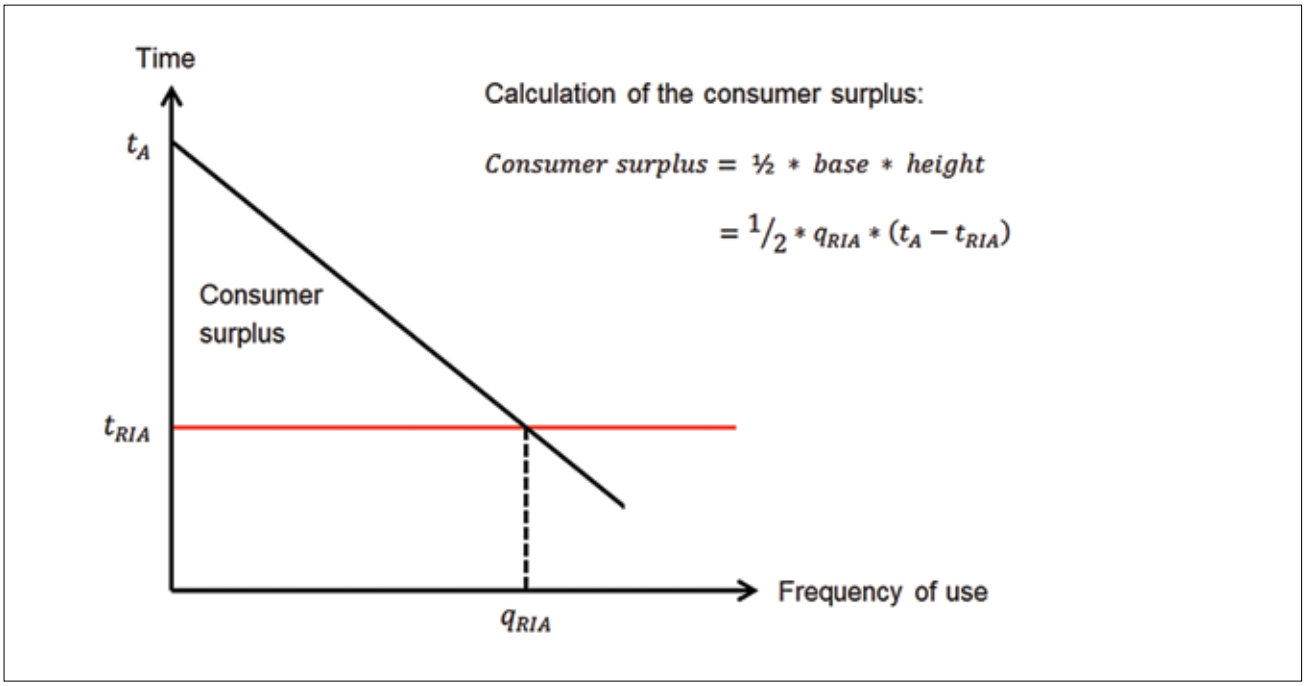
a survey was conducted among Indian internet users in June and July 2017. In total, we received 1,019 usable questionnaires from a representative online panel.

The questionnaire consisted of five questions. The aim of the survey was to explore the alternatives that consumers would use if RIAs were unavailable to them. The questionnaire mainly focused on six core functionalities of RIAs: (1) ordinary call, (2) video call, (3) texting, (4) videos, (5) pictures, and (6) group chat. After indicating the frequency of use for each functionality, participants were asked about the potential alternatives. A pre-defined set of alternatives was provided to the participants from which they could choose, with multiple responses being allowed. The alternatives were "make a regular phone call", "pay a visit", "send a letter/a CD-ROM/DVD-ROM", "send an SMS". The last three questions gathered information about the participants' perceived cost of using the alternatives expressed in time and money as well as the value they would assign to the RIAs. In particular, we were interested in how much time consumers would be able to save by using RIAs when compared to the (traditional) alternatives if RIAs were unavailable to them.

The approach of the calculation of the consumer surplus is graphically illustrated in Figure A3 3. Here, t_(RIA)denotes the time spent using a RIA function, t_(A)denotes the time spent using the corresponding alternative and q_(RIA) denotes the number of times that same RIA function has been used in a specific time frame.By considering secondary data from the Telecom Regulatory Authority of India (TRAI) and Indian postal statistics, we designed time caps for the alternatives to adjust the data for outliers. To derive the time savings per occasion created by each RIA functionality, the average of the weighted[48] differences between the time spent on the specific RIA function and the pre-selected alternatives was calculated. The time savings corresponding to the considered core functionalities are listed below in Table A3 1.

48. *The weighting factor was based on the frequency with which the pre-selected alternative was chosen by the respondents.*

Figure A3-3: Graphical representation of the estimation of consumer surplus in terms of time savings



Source: *Own representation based on Arnold & Schiffer (2011).*

Table A3-1: RIA functions and most likely alternatives

RIA functionalities	Alternatives	Time savings per occasion*
RIA calls	**Regular call** Visit Letter Regular SMS Other	3.37 minutes
RIA video calls	**Regular call** Visit Letter Regular SMS Other	4.83 minutes
RIA texts	**Regular call** Visit Letter Regular SMS Other	3.52 minutes
RIA pictures	**Visit** Letter Regular SMS Other	10.46 minutes
RIA video	**Letter** Other	0.56 minutes
RIA group chat	**Regular call** Visit Letter Regular SMS Other	6.65 minutes

Source: *Own representation; *based on average time spent on each RIA function and its counterparts across the entire sample. The most frequently chosen alternative is marked in blue. The alternatives are not displayed in a ranking manner.*

The total weekly time savings for each functionality is calculated by multiplying those time savings by the corresponding frequency of use. Since RIAs integrate many functions that are used side by side depending on the occasion, the average time saved across all functions was used to calculate the consumer surplus. Notably, 86% of respondents in our sample use five or six functions out of the six tested typical RIA functions.

In total, the consumer surplus created by RIAs in India amounts to US$98 billion in 2017. To arrive at this result, the time saved was valued at the average income in India (INR94,130) and the assumption that the actual time frame for using RIAs will be 15.1 hours a day for 52 weeks of the year.[49] RIA users in India are saving almost 13.4 hours per week due to RIAs.

Annex 4: Alphabetical list of RIAs analyzed for this study

2go
Air Chat
AireTalk
Airplanemessenger
Alien chat
AV by AOL
Avaamo
Badoo
BBM
BeepTool
BeeTalk
Bleep
Blend
BM Chat
Briar
Bridgefy
Care Messenger
Charge Messenger
Chat
Chat offline
ChatCall
Chatscene
Coco
Confide
Cryptocat
Disney MIX
Dust
Ekiga
Facebook Messenger
Facetime
Fire Message
FireChat
Fleep
Flock
Flows
Fring
GeckoLife
Gigglemail
Glide
Google Hangouts
GroupMe
HeyTell
Hi
Hike
HipChat
Hipe
Hood
Howfar
ICQ
iMessage
IMOnow
Instagram
Invi
Jaxtr
JioChat
Jongla
Jott
JusTalk
KakaoTalk
Kids in Touch
Kik
KingsChat
Koda Chat
Life
Line
Lookup
Loud-Hailer
Maaii
Maily
Mara Online
Meet4U
MeetMe
Mico
Mig Me
Monster Messenger
MySMS
NearPeer
N-gage
Nimbuzz
OfflineChat
OgO
Omlet Chat
OoVoo
Pelichat
Pinch
Pinger
PlayMessenger
QQ
Rawr
React
Reel
Rounds
Rush
Saya
Sendboo
Signal
Silent Phone
SimsMe
Skype
Slack
Snapchat
SOMA
Surespot
Talkatone
Talkray
Talkshow
Tango
Telegram
Telepathy
Text Me
TextPlus
The Serval Mesh
Threema
Tinder
Tinychat
Tox
Trillian
Twnel Messenger
UppTalk
Viber
Vk.com Messenger
VMC Next Messenger
Vobee
Vojer
Voxer
Waplog
Wave 'Off The Grid' Chat
WeChat
WhatsApp
Wickr
Wire
Yahoo! Messenger
YeeCall
YikYak
YO!
Zalo
Zipt
ZombieChat

49. *Time spent sleeping in India accounts for about 528.1 minutes per day according to data provided in the OECD database.*

Annex 5: Alphabetical list of the countries used for the econometric analysis

Albania
Algeria
Angola
Argentina
Armenia
Australia
Austria
Azerbaijan
Bahamas
Bahrain
Bangladesh
Barbados
Belarus
Belgium
Belize
Benin
Bhutan
Bolivia (Plurinational State of)
Bosnia and Herzegovina
Botswana
Brazil
Brunei Darussalam
Bulgaria
Burkina Faso
Burundi
Cabo Verde
Cambodia
Cameroon
Canada
Central African Republic
Chad
Chile
China
China, Macao SAR
Colombia
Comoros
Congo
Costa Rica
Croatia
Cyprus
Czech Republic
Côte d'Ivoire
D. R. of the Congo
Denmark
Djibouti
Dominican Republic
Ecuador
Egypt
El Salvador
Equatorial Guinea
Estonia
Ethiopia
Fiji
Germany
Ghana
Greece
Guatemala
Guinea
Finland
France
Gabon
Gambia
Georgia
Guinea-Bissau
Haiti
Honduras
Hong Kong, China
Hungary
Iceland
India
Indonesia
Iran (Islamic Republic of)
Iraq
Ireland
Israel
Italy
Jamaica
Japan
Jordan
Kazakhstan
Kenya
Kuwait
Kyrgyzstan
Lao (People's DR)
Latvia
Lebanon
Lesotho
Liberia
Lithuania
Luxembourg
Madagascar
Malawi
Malaysia
Maldives
Mali
Malta
Mauritania
Mauritius
Mexico
Mongolia
Montenegro
Morocco
Mozambique
Myanmar
Namibia
Nepal
Netherlands
New Zealand
Nicaragua
Niger
Nigeria
Norway
Oman
Philippines
Poland
Portugal
Pakistan
Panama
Paraguay
Peru
Qatar
Republic of Moldova
Romania
Russian Federation
Rwanda
Saint Lucia
Sao Tome and Principe
Saudi Arabia
Senegal
Serbia
Sierra Leone
Singapore
Slovakia
Slovenia
South Africa
Spain
Sri Lanka
St. Vincent and the Grenadines
Sudan (Former)
Suriname
Swaziland
Sweden
Switzerland
TFYR of Macedonia
Tajikistan
Thailand
Togo
Trinidad and Tobago
Tunisia
Turkey
Turkmenistan
U. R. of Tanzania: Mainland
Uganda
Ukraine
United Arab Emirates
United Kingdom
United States of America
Uruguay
Uzbekistan
Venezuela (Bolivarian Republic of)
Vietnam
Yemen
Zambia
Zimbabwe

REFERENCES

- Abeer Media. 2016. SME's using WhatsApp.
- Alper, Meryl, & Beth Haller. 2017. "Social media use and mediated sociality among individuals with communication disabilities in the digital age." In Disability and Social Media: Global Perspectives, edited by Katie Ellis & Mike Kent. New York: Routledge.
- App Annie. 2017. "App Annie - Market Forcast 2016-2021."
- Arnold, René, Christian Hildebrandt, Peter Kroon, & Serpil Tas. 2017. The economic and societal value of Rich Interaction Applications. Bad Honnef: Wissenschaftliches Institut für Infrastruktur und Kommunikationsdienste (WIK).
- Arnold, René, & Marleen Schiffer. 2011. Faktor Google- Wie deutsche Unternehmen Google einsetzen. Study by IW Cologne.
- Arnold, René, & Anna Schneider. 2016a. OTT Services and Consumer Communication Behaviour in Germany. Bad Honnef, Cologne: WIK and Fresenius University of Applied Sciences.
- Arnold, René, & Anna Schneider. 2016b. OTT Streaming Services in Germany. Bad Honnef, Cologne: WIK and Fresenius University of Applied Sciences.
- Arnold, René, Anna Schneider, & Christian Hildebrandt. 2016. "All Communications Services Are Not Created Equal– Substitution of OTT Communications Services for ECS from a Consumer Perspective." TPRC44 Conference, Arlington, VA, Sept. 30 - Oct. 1st.
- BCG. 2015. India@Digital.Bharat: Creating a $200 billion Internet Economy. Study for the Internet and Mobile Association of India (IAMAI) by the Boston Consulting Group.
- Bornman, Juan, Diane Nelson Bryen, Enid Moolman, & John Morris. 2016. "Use of consumer wireless devices by South Africans with severe communication disability." African Journal of Disability 5 (1):1-9.
- Caron, Jessica, & Janice Light. 2016. "Social Media has Opened a World of 'Open Communication': Experiences of Adults with Cerebral Palsy who use Augmentative and Alternative Communication and Social Media." Augmentative and Alternative Communication 32 (1):25-40. doi: 10.3109/07434618.2015.1052887.
- CE. 2014. Closing the Gap: Indian Online Intermediaries and a Liability System not yet Fit for Purpose. Study for the Global Network Initiative by Copenhagen Economics.
- Chen, Yan, Grace YoungJoo Jeon, & Yong-Mi Kim. 2014. "A day without a search engine: an experimental study of online and offline searches." Experimental Economics 17 (4):512-536. doi: 10.1007/s10683-013-9381-9.
- Church, Karen, & Rodrigo de Oliveira. 2013. "What's Up with WhatsApp?: Comparing Mobile Instant Messaging Behaviors with Traditional SMS." Proceedings of the 15th International Conference on Human-Computer Interaction with Mobile Devices and Services, Munich, 30th August 2013.
- Czernich, Nina, Oliver Falck, Tobias Kretschmer, & Ludger Woessmann. 2011. "Broadband Infrastructure and Economic Growth." Economic Journal 121 (552):505-532.
- Deloitte. 2015. Facebook's global economic impact - A report for Facebook.
- Farhadi, M., R. Ismail, & M. Fooladi. 2012. "Information and Communication Technology Use and Economic Growth." PLOS One 7 (11):1-7.
- Fishbein, Martin, & Icek Ajzen. 1975. Belief, Attitude, Intention, and Behavior - An Introduction to Theory and Research. Reading, MA: Addison-Wesley.
- Ghose, Anindya, & Sang Pil Han. 2011. "An Empirical Analysis of User Content Generation and Usage Behavior on the Mobile Internet." Management Science 57 (9):1671-1691. doi: doi:10.1287/mnsc.1110.1350.
- Glass, Richard, & Suhong Li. 2010. "Social influence and instant messaging adoption." Journal of Computer Information Systems 51 (2):24-30.
- Government of India. 2017. National Accounts Statistics - 2017. edited by Ministry of Statistics and Programme Implementation. India.
- Gruber, Harald, & Pantelis Koutroumpis. 2011. "Mobile Telecommunications and the Impact on Economic Development." Economic Policy 26 (67):387-426.

- Helsper, Ellen, Alexander van Deursen, & Rebecca Eynon. 2016. Measuring Types of Internet Use: From Digital Skills to Tangible Outcomes Project Report.
- Hildebrandt, Christian, & Lorenz Nett. 2016. "Die Marktanalyse im Kontext von mehrseitigen Online-Plattformen." WIK-Diskussionsbeitrag Nr. 410, Bad Honnef.
- ICRIER. 2016. Quantifying the Value of an Open Internet in India.
- ICRIER. 2017. Estimating the Value of New Generation Internet Based Applications in India.
- König, Katharina. 2015. "Dialogkonstitution und Sequenzmuster in der SMS- und WhatsApp-Kommunikation." Revue Tranel (Travaux neuchâtelois de linguistique) 63:87-107.
- Light, Janice, & David McNaughton. 2014. "Communicative Competence for Individuals who require Augmentative and Alternative Communication: A New Definition for a New Era of Communication?" Augmentative and Alternative Communication 30 (1):1-18. doi: 10.3109/07434618.2014.885080.
- McKinsey & Company. 2010. Consumers driving the digital uptake. The economic value of online advertising-based services for consumers. In Study for the Interactive Advertising Bureau (IAB) Europe.
- McKinsey & Company. 2014. India's technology opportunity: Transforming work, empowering people.
- O'Hara, Kenton, Michael Massimi, Richard Harper, Simon Rubens, & Jessica Morris. 2014. "Everyday dwelling with WhatsApp." Proceedings of the 17th ACM conference on Computer supported cooperative work & social computing.
- Ofcom. 2015. Adults' Media Use and Attitudes Report. London: Ofcom.
- Rafert, Greg, & Rosamond Mate. 2017. The Global and Country-Level Economic Impacts of WhatsApp. Boston: Analysis Group.
- Raja, Deepti Samant. 2016. Bridging the Disability Divide through Digital Technologies - Background Paper Digital Dividends.
- Roeller, Lars-Hendrik, & Leonard Waverman. 2001. "Telecommunications Infrastructure and Economic Development: A Simultaneous Approach." American Economic Review 91 (4):909-923.
- Rogers, Everett M. 1962. Diffusion of Innovations. New York: Free Press of Glencoe.
- Shaw, Julie Keane, & Janelle Allison. 1999. "The intersection of the learning region and local and regional economic development: Analysing the role of higher education." Regional Studies 33 (9):896-902.
- Smith, Madeline E, & John C Tang. 2015. ""They're blowing up my phone": Group Messaging Practices Among Adolescents." CHI 2015.
- SoftBank Group. 2016. Annual Report 2016.
- Sridhar, K. S., & V. Sridhar. 2007. "Telecommunications Infrastructure and Economic Growth: Evidence from Developing Countries." Applied Econometrics and International Development 7 (2):37-61.
- TRAI, (Telecom Regulatory Authority of India). 2015. The Indian Telecom Services Performance Indicators - October - December, 2014. New Delhi, India.
- TRAI, (Telecom Regulatory Authority of India). 2017. The Indian Telecom Services Performance Indicator - January - March, 2017. New Delhi, India.
- World Bank. 2016. World Development Report 2016: Digital Dividends. Washington, D.C.
- Zinnov. 2017. Study on Online House Wife Resellers of Clothing & Lifestyle Products in India. Bangalore.

IMPRINT

WIK Wissenschaftliches Institut für
Infrastruktur und Kommunikationsdienste GmbH
Rhöndorfer Str. 68, 53604 Bad Honnef, Germany
PHONE: +49 2224 9225-0 | **FAX:** +49 2224 9225-63
EMAIL: info(at)wik.org | **WEBSITE:** www.wik.org

Person authorised to sign on behalf of the organisation

General Manager and Director	**Dr. Iris Henseler-Unger**
Director Head of Department Postal Services and Logistics	**Alex Kalevi Dieke**
Director Head of Department Networks and Costs	**Dr. Thomas Plückebaum**
Head of Administration	**Karl-Hubert Strüver**
Chairman of the Supervisory Board	**Winfried Ulmen**
Registered at	**Amtsgericht Siegburg, HRB 7225**
Tax No.	**222/5751/0722**
VAT-ID	**DE 123 383 795**