WIK • Report

Study for Facebook

The Value of Rich Interaction Applications for Vietnam

Final Report

Authors:
Dr. René Arnold
Serpil Taş

WIK Wissenschaftliches Institut für Infrastruktur
und Kommunikationsdienste GmbH
Rhöndorfer Str. 68
53604 Bad Honnef
Germany

Bad Honnef, 2019

wik Wissenschaftliches Institut für Infrastruktur und Kommunikationsdienste

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@wik.org
www.wik.org

Person authorized to sign on behalf of the organization

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
Director Head of Department Regulation and Competition	Dr Bernd Sörries
Head of Administration	Karl-Hubert Strüver
Chairperson of the Supervisory Board	Dr Daniela Brönstrup
Registered at	Amtsgericht Siegburg, HRB 7225
Tax No.	222/5751/0722
VAT-ID	DE 123 383 795

Contents

Disclaimer

Parts of this report use the same or similar text as other reports (Arnold et al. 2017a, b, Arnold & Taş forthcoming) by the same authors. These parts refer to descriptions of our methodology, which is the same across all reports and to a lesser extent to the general literature review on the economic impact of the internet and digitization.

Executive Summary

Vietnam is one of the strongest growing global economies, with increasing internet penetration and digitization spurring this growth.

During the last decade, several studies were conducted, with varying approaches, to examine the economic impact of broadband. They confirmed a positive relationship between economic growth and the deployment and penetration of broadband. However, gaining access to the internet is only one part of the story. The actual value is in the applications and services offered. Of the various types of application and services available, the present study focuses on Rich Interaction Applications (RIAs). These applications cluster around core interaction functions such as text, picture, video or voice messaging, voice and video calls or group chats. They comprise applications such as Facebook Messenger, LINE, Skype, WeChat and WhatsApp, as well as Vietnamese applications such as Zalo, BeeTalk and VietTalk – which have become increasingly popular means of personal and business interaction.

RIAs integrate an increasing number of functions, with consumers using them more frequently and intensively, not only for communication, but also for other forms of interaction including dedicated third-party service providers (e.g. ride-sharing, food delivery), real-time translation and payment. The variety of functions on offer enables consumers to use RIAs for a large number of tasks that would otherwise have not been possible, or where the traditional means have additional costs associated with them. The WIK database on RIAs currently covers more than 220 such applications worldwide and tracks 30 of the most popular functions. During the last year alone, we added seven new popular functions covering event boards, gaming, screen sharing, shopping, statistics and translation functions.

Against this backdrop, the present study is the first to assess the consumer surplus added by RIAs as well as their contribution to GDP in Vietnam. 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.

Based on a representative survey of internet users in Vietnam, this study finds that RIA usage saves, on average, 242 minutes per week per user. Using the average annual income in Vietnam (VND60,792,000), this translates to an annual consumer surplus of US$6.4 billion (VND145 trillion) in 2018. Thus, each user of RIAs in Vietnam receives an average of US$145 (VND3.3 million) of consumer surplus annually. Applied to the entire population – not just RIA users – this equates to US$67 (VND1.5 million) per capita per year.

The present study applies the findings of an earlier study to the case of Vietnam to examine the GDP impact of RIAs and finds that, in Vietnam, a 10% increase in their usage increases GDP by US$39 billion over the 16 years from 2000 to 2015.

Beyond the economic impact measured in consumer surplus and GDP, RIAs create substantial local value in Vietnam that is not reflected in the figures above. First and foremost, RIAs are instrumental in creating employment opportunities for Vietnamese people, in sectors ranging from retail to tourism. In particular, RIAs tend to lower barriers to entry for entrepreneurs and enable otherwise underrepresented groups to participate in the trade of goods and services. Our report highlights that female entrepreneurs and so-called “mumpreneurs” appear to benefit disproportionately from RIAs as they enable quick interaction with customers independent of their location.

RIAs can also increase efficiency of processes in the healthcare sector. For instance, Jio Health is a service enabling voice and video interaction with a doctor. This process not only cuts costs for patients but also facilitates the treatment process by storing all important data in one place.

The findings of the present study also show that (local) RIAs employ Vietnamese people and upgrade the potential for innovation in the country’s ICT sector with Zalo, an RIA founded in Vietnam and used regionally, playing a profound role in this context. Its wide reach and user engagement, as well as its wide range of functions, have attracted the interest of significant marketing campaigns by global brand owners such as Unilever. BeeTalk, Mocha and VietTalk are further examples of a thriving and extremely innovative app economy in Vietnam.

To prolong and amplify the success of the existing technology ecosystem, a flexible and forward-looking policy approach is required. Overly prescriptive regulations cannot adapt to a fast-changing economic and digital environment. The group of applications explored in the present study – RIAs – are a particularly pertinent example of these rapid innovation cycles. Globally, RIAs evolve very quickly, adding new functions to reflect consumer demand. The local RIAs in Vietnam follow the same pattern. The most prominent and comprehensive example in terms of the number of functions is Zalo, which directly competes with other local RIAs, such as BeeTalk, Mocha or VietTalk, as well as with global players like Facebook Messenger, iMessage, LINE, Threema, WeChat and WhatsApp.

If overly prescriptive regulation precludes the Vietnamese market from certain functions, then the potential for local applications to compete on a global level may be hampered. Furthermore, since the added value of RIAs for consumers is strongly linked to their functions, a prescriptive regulatory environment may equally preclude Vietnamese consumers from benefiting from such functions.

1 Introduction

Since Vietnam entered the path towards a market-based economy in 1986, the country has been enjoying sustained economic growth. In fact, Vietnam is among the best performing countries in terms of average GDP growth in recent years. This has led to great improvement in the standard of living for Vietnamese citizens. Among various other indicators, the poverty rate decreased substantially – from 15.5% in 2006 to 5.8% in 2016. The ICT sector, digitization and rapid internet adoption by the population have all played a critical role in this recent success (Cameron, Pham, & Atherton 2018). If the growth of the ICT sector and digitization can be sustained, then Vietnam is likely to benefit from an expected increase in GDP due to digitization of US$1 trillion in the Association of Southeast Asian Nations (ASEAN) region (A.T. Kearney 2016). The government is facilitating the ongoing structural transformation of Vietnam with various policy initiatives, master plans, decrees and regulations.[1]

While there is ample evidence that broadband penetration has a positive economic impact,[2] there is much more to digitization than copper wires, fiber cables and mobile network towers. Most of the positive spillover effects stem from over-the-top (OTT) applications that can be accessed online. The present report focuses on the socioeconomic impact of a specific group of OTT applications: Rich Interaction Applications (RIAs).

RIAs comprise all applications – such as group chat, and photo and video sharing – that enable people to interact in ways not possible through traditional communications channels. Prominent examples of RIAs include applications such as Facebook Messenger, iMessage, KakaoTalk, LINE, Signal, Skype, Snapchat, Threema, Viber, WeChat and WhatsApp (Arnold et al. 2017a, b).[3] Notably, Vietnam is one of the countries with the highest number of home-grown RIAs, including Zalo, BeeTalk, Mocha and VietTalk.[4]

As the present study will show, RIAs already have a substantial economic impact in Vietnam and create significant local value. One may expect that as more and more functions are added, they will become even more relevant in the future. Notably, these applications can also play a role in the evolution of Vietnam's industry as they enable people to connect and share data as part of business processes.

---

1 For an overview of these see Appendix 2 in Cameron, Pham, & Atherton (2018).
2 For an overview see (ITU 2015) and Section 1.3 of this report.
3 See Annex 5 for a full list of RIAs analyzed for this report.
4 These RIAs are described in detail in Section 3.3.

1.1 The global impact of RIAs

RIAs follow an evolutionary path that is distinct from the development of SMS and telephony. The idea of using computer networks to communicate is in fact almost as old as computer networks themselves.[5] When the publicly available internet became more pervasive in the late 1990s and early 2000s, RIAs such as AOL Instant Messenger (AIM), ICQ, MSN Messenger and Yahoo! Messenger were very popular on desktop and laptop computers. At their peak in the early 2000s, around 235 million internet users[6] were registered with the messaging network of AOL[7] (AIM and ICQ). All of these applications offered many of the functions that can be found on today's RIAs, including profile pictures, icons, away messages and chatrooms (group chats).

Figure 1-1 shows WIK's estimate of how RIA-based messaging and SMS messaging have developed in terms of total messages sent worldwide between 1999 and 2016. The stark increase in messages sent on mobile RIAs is driven by two trends. First, an increase in the prevalence of mobile access networks in emerging and developing economies, where the mobile phone is typically the most important access point to the internet. Second, a switch towards mobile internet use in developed countries, where mobile RIAs have largely displaced desktop RIAs. Essentially, the number of RIA-based messages per user has not changed significantly over time, only the underlying technology. Today, the vast majority of messages that are sent are sent via mobile RIAs such as Viber, Line, WhatsApp, Facebook Messenger, Zalo or Threema, were previously sent via desktop- or laptop-based RIAs such as AOL Instant Messenger, ICQ or Yahoo! Messenger.

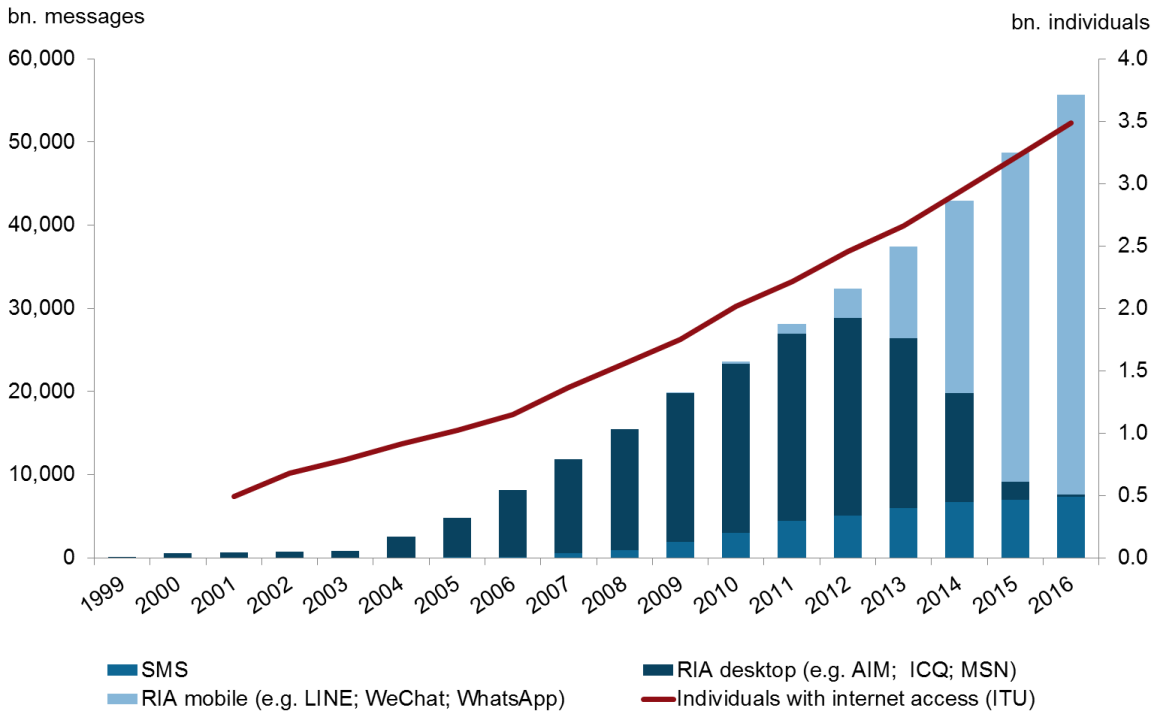
---

5 Early types of communication applications running on computer networks include MIT's Compatible Time-Sharing System (CTSS) (Van Vleck 2012), the Zephyr Notification System (DellaFera et al. 1988), the SDC5 time-sharing system (Hemmendinger 2014), and the bulletin board system (Rafaeli 1984, James, Wotring, & Forrest 1995).

6 According to internetlivestats.com, there were between around 400 million (2000) and 1 billion (2005) internet users at that time.

7 According to a presentation held by a member of AOL's staff in 2005 (Gill 2005).

Figure 1-1: Number of SMS and RIA messages sent annually (worldwide in billion messages; individuals with internet access in billion)

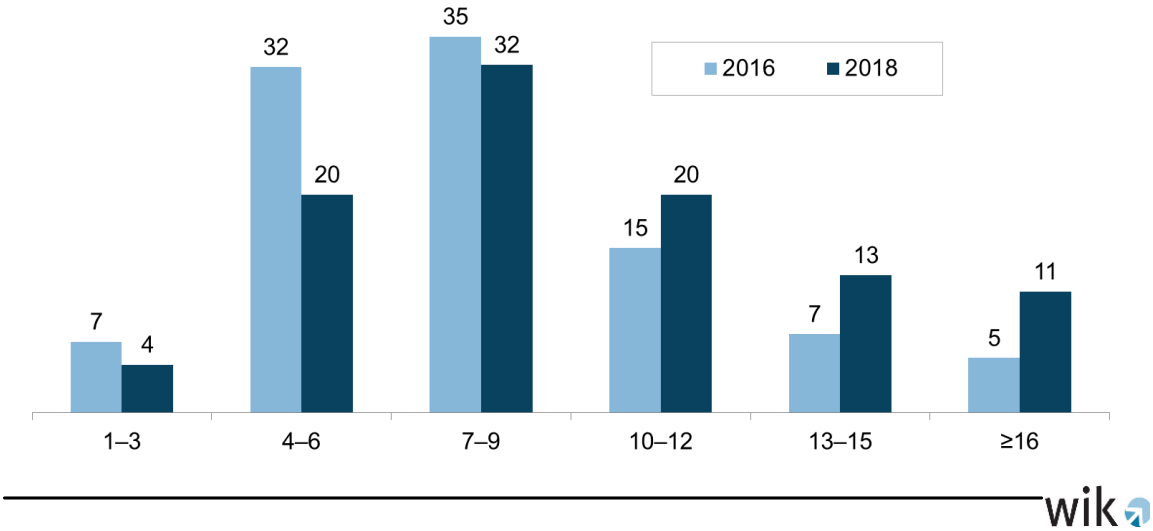


Source: Arnold et al. (2017a), p. 11. The authors' estimate based on Nielsen (cf. statisticbrain.com), press releases, International Telecommunications Union (ITU) and news articles.

The most important difference between RIAs and traditional SMS messaging and telephony is that RIAs are not usually interconnected to the public switched network and present a wealth of interactive functions that play an important role in their success and adoption (Arnold, Schneider, & Hildebrandt 2016). Arnold et al. (2017a) map the functions of 139 RIAs globally. An updated analysis of the sample of RIAs shows that WeChat is still the most comprehensive RIA, featuring 23 of the 30 functions tracked in WIK's dataset of RIA functions.[8] Others, like KakaoTalk (16 to 21 functions) and Facebook Messenger, (19 to 21 functions) are catching up. Ogo added 8 new functions (from just 2 to 10) and TextPlus added 10 new functions (from 3 to 13). On average, the number of functions has increased from around nine to ten in the two years from 2016 to 2018, with almost one quarter of RIAs featuring 13 functions or more (see Figure 1-2). This demonstrates the constant innovation of RIAs and the competitive pressure that is apparent among these applications.

8 Notably, WeChat features more than 23 functions in total, but some of them are not tracked in our dataset.

Figure 1-2: Number of functions available in RIAs

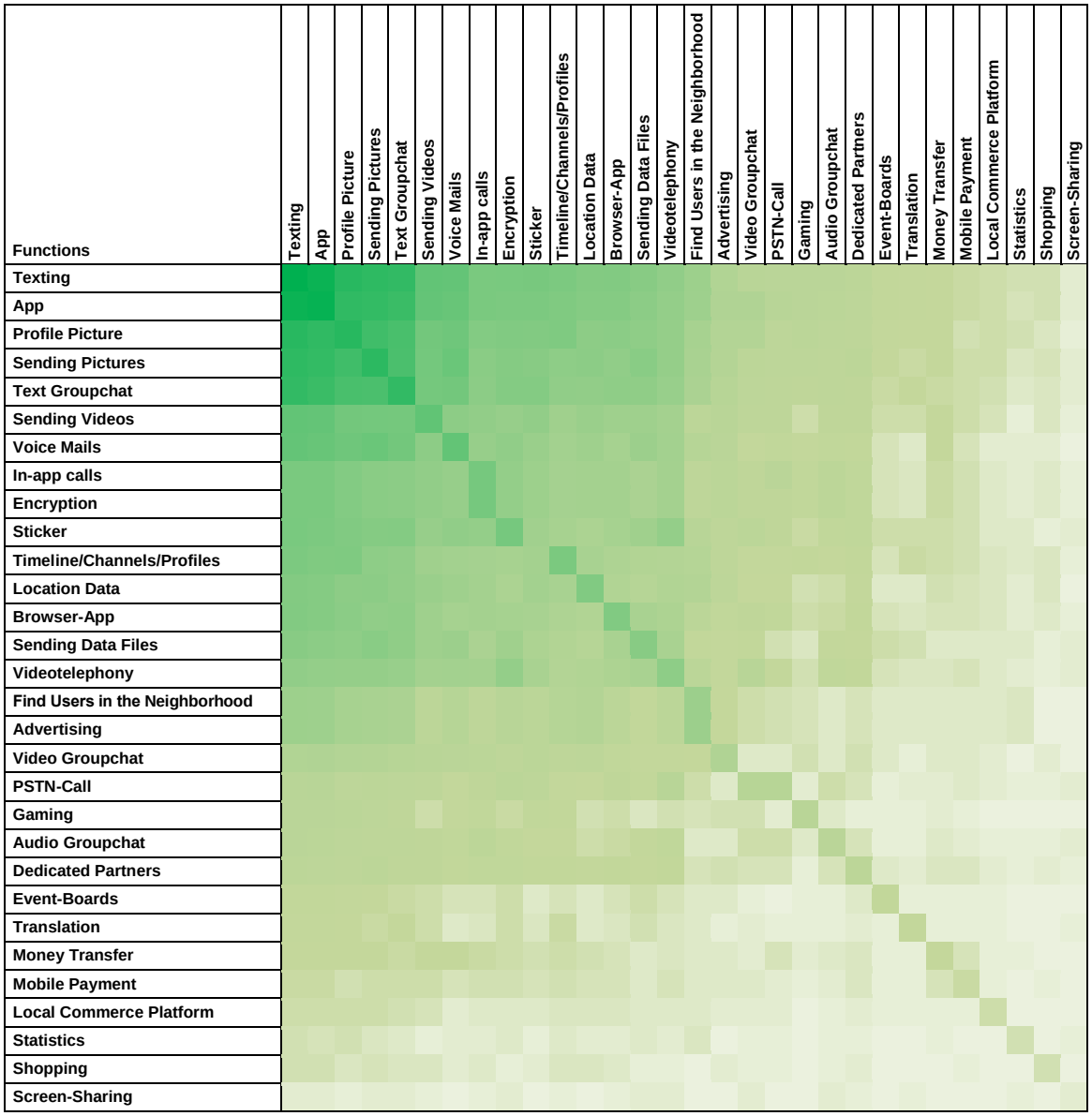


Source: Updated figure presented in Arnold et al. (2017a), p. 4. 139 and 135 RIAs were analyzed in 2016 and 2018, respectively. Four RIAs that were featured in 2016 had gone out of business by the time the dataset was updated in 2018.

This dataset has been extended to cover 222 RIAs. This extension provides further insights into RIAs currently in use worldwide. Figure 1-3 provides an in-depth view of the functions featured in RIAs today. The proportion of RIAs that feature specific functions, or rather combinations of functions, is depicted by the shade of green used – the darker the shade, the higher the proportion of RIAs that feature this particular function[9] or combination of functions.

9 Individual functions can be deduced from the diagonal of the matrix. For instance, the very dark shade of green for the combination of “Texting” and “Texting” indicates that almost all RIAs feature this functionality.

Figure 1-3: Functions of popular RIAs



Source: WIK RIA monitoring featuring 222 popular RIAs worldwide – constantly updated.

The current version of WIK's dataset on RIAs covers 30 instead of 23 functions, adding event boards, gaming, screen sharing, shopping, statistics and translation functions. 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, car-hailing apps, 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.[10]

In summary, the above analysis of the functions of RIAs shows a provenance and evolution that is distinct from that of traditional telecommunications services. As RIAs have evolved along their own technology pathway, the user experience with RIAs is becoming closer to that of general internet use. Whether one looks at the core rich interaction functionality, or the developing integration with the "full internet experience", any categorization (or regulatory regime) tied to the thin overlap with traditional telecommunications services truly falls short of reality (Arnold, Hildebrandt, & Waldburger 2016).

1.2 Brief overview of other studies investigating the economic impact of RIAs

Few researchers have approached the impact of RIAs so far. The analysis conducted by Arnold et al. (2017a) on the impact that 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 of (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 of the uses and impacts of the RIAs are not captured in GDP.

The second multi-country study, Rafert & Mate (2017), investigates one particular RIA (WhatsApp). 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% increase in WhatsApp penetration in 2015 is associated with a US$22.9 billion increase in global GDP.

Focusing on India, Arnold et al. (2017b) approach the economic impact of RIAs from a consumer perspective. They analyze six core functions of RIAs[11] to capture the value added by these applications for consumers in India. Their study estimates the consumer

---

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

11 The six core functions they analyze are (1) ordinary calling, (2) video calling, (3) texting, (4) sending pictures, (5) sending videos, and (6) group chats. As the analysis in Section 1.1 reveals, these are indeed some the most prevalent functions featured in RIAs.

surplus stemming from the use of these functions instead of traditional alternatives. On average, using RIAs instead of traditional alternatives saves **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 equates to **US$74 per capita per year.**

While one of the objectives of the present study is to conduct the first detailed investigation into the economic impact of RIAs in Vietnam – from both a GDP and a consumer surplus perspective – specifically, it needs to be positioned within the context of other studies investigating the impact of the internet more generally. The following section provides a brief overview of these studies, from which the discussion of our results will draw.

1.3 Brief overview of studies investigating the impact of the internet and digitization

During the last decade, several studies with varying approaches were conducted to study the economic impact of broadband, confirming a positive relationship between economic growth and the deployment and penetration of broadband.

Koutroumpis (2009) investigates this effect by using a structural econometric approach within a production function on panel data for 22 Organization for Economic Co-operation and Development (OECD) countries from 2002 to 2007. The author's analysis shows that a 10% increase in broadband penetration yields a 0.25% increase in GDP growth.

Czernich et al. (2011) estimate the effect of specifically high-speed-internet-enabling broadband infrastructure on economic growth in OECD countries from 1996 to 2007 and find that a 10% increase in broadband penetration raises annual per capita growth by 0.9–1.5%.

Similar results are obtained by Qiang, Rossotto, & Kimura (2009) and ICRIER (2017) . Qiang, Rossotto, & Kimura (2009) compare the impact of broadband on middle- and low-income countries and high-income countries. The authors apply an endogenous growth model on panel data from 120 countries between 1980 and 2006. The results suggest that an increase in broadband penetration has a positive impact in low- and middle-income as well as in high-income countries. However, the impact in low- and middle-income countries seems to be somewhat higher than the impact in high-income countries. In high-income countries, a 10% increase in broadband penetration increases GDP growth by 1.21% points. In low- and middle-income countries, however, the same increase in broadband penetration increases GDP growth by 1,38% points. ICRIER (2017) conducted a regression on panel data from 23 countries between 2011 and 2015. The authors find that a 10% increase in global internet will lead to a 1.3% increase in global GDP.

Farhadi, Ismail, & Fooladi (2012) find evidence for a positive relationship between growth rate of real GDP per capita and internet usage applying a dynamic panel data approach for 159 countries over the period 2000–2009. The authors also identify that internet usage has a lagged effect on economic growth. They estimate that a 1% increase in the level of internet usage of the previous year will increase the economic growth rate of GDP per capita by 0.09%.

Fornefeld, Delaunay, & Elixmann (2008) use a slightly different approach to quantify the economic impact of broadband and ICT. Rather than applying an economic regression based on panel data, they estimate broadband-related productivity gains and innovation-driven growth by using qualitative micro-level case studies. They find that broadband has a positive impact on employment and GDP growth.

Even though there is an extensive base of literature covering European and American regions, as well as studies analyzing the global impact of broadband and internet, there are, to the best of our knowledge, only a few studies investigating this impact for Asian countries. We did not find any study directly addressing the impact of broadband in Vietnam.

Notably, Cameron, Pham, & Atherton (2018) cite a study by the Vietnam National University and Economic Research Institute of Post and Telecommunication that investigates the economic impact of spectrum-based industry sectors in Vietnam. They find that the economic benefit of spectrum accounts for US$6.84 billion in 2015.[12]

One recent study was conducted by ICRIER (2017) for India. They performed a panel analysis across 19 Indian states from 2013 to 2016 by 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. ICRIER (2017) find 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%. Regarding mobile traffic, an increase of mobile traffic by 10% may lead to a 1.3% increase in India's GDP.

A recent study conducted by Damuri et al. (2018) focuses on Indonesia from a similar perspective. The authors conducted an econometric analysis using mainly regional data on Indonesia, enabling the authors to draw conclusions for different regions of Indonesia. They found that a 10% increase in network coverage will lead to an increase in regional GDP of 0.92%, whereas a 10% increase in social media penetration was associated with a 0.11% increase in regional GDP. Furthermore, the authors found that

12 The economic benefit consists of mobile (US$5.021 billion), satellite (US$82 million), radio & TV (US$77 million), and civil aviation (US$1.66 billion). Source: Vietnam National University and Economic Research Institute of Post and Telecommunication. 2015. The socioeconomic impact of allocating spectrum for mobile broadband services in Vietnam.

regions with high mobile internet and social media penetration were economically stronger than regions with low mobile internet and social media penetration.

ITU (2012) evaluate the effects that broadband have on economic growth and employment for several developing countries, among which are the Asian countries India, Indonesia and Malaysia. They find that for India, a 10% increase in broadband penetration results in a 0.28% increase in employment rate and 0.31% increase in GDP. For Indonesia, a 10% increase in the penetration rate among Indonesian households reduces unemployment growth by 8.61%. For Malaysia, a 10% increase in broadband penetration will increase GDP growth by 0.7%.

As mentioned in Chapter 1.1, this study seeks to add new insights to this extensive literature by investigating the impact of internet and RIA on Vietnam's economy by building on the econometric analysis in Arnold et al. (2017a).

1.4 The structure of the study

This study is structured as follows:

- *Chapter 2* is an analysis of the consumer surplus added by RIAs and their impact on GDP in Vietnam. **We find that RIAs add US$6.4 billion in consumer surplus for RIA users in Vietnam in 2018.** This translates to a consumer surplus of US$67 per capita. As regards their impact on GDP, we find that a 10% increase in their usage increases GDP in Vietnam by US$39 billion over the 16 years from 2000 to 2015. This finding implies that the impact of RIAs today exceeds the economic benefits of basic telecommunication services. Moreover, we argue that, as mobile broadband penetration increases in Vietnam, and RIAs evolve to provide many of the functions of a "full internet experience" with lower bandwidth and hardware requirements, their economic impact is also likely to increase.
- *Chapter 3* is a description of how RIAs create additional value for the Vietnamese 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 an exploration of the socioeconomic impact of social networks in Vietnam.
- *Chapter 5* is a summary of our results and provides an outlook on policymaking in Vietnam.

2 Economic impact of RIAs in Vietnam

2.1 Digitization in Vietnam

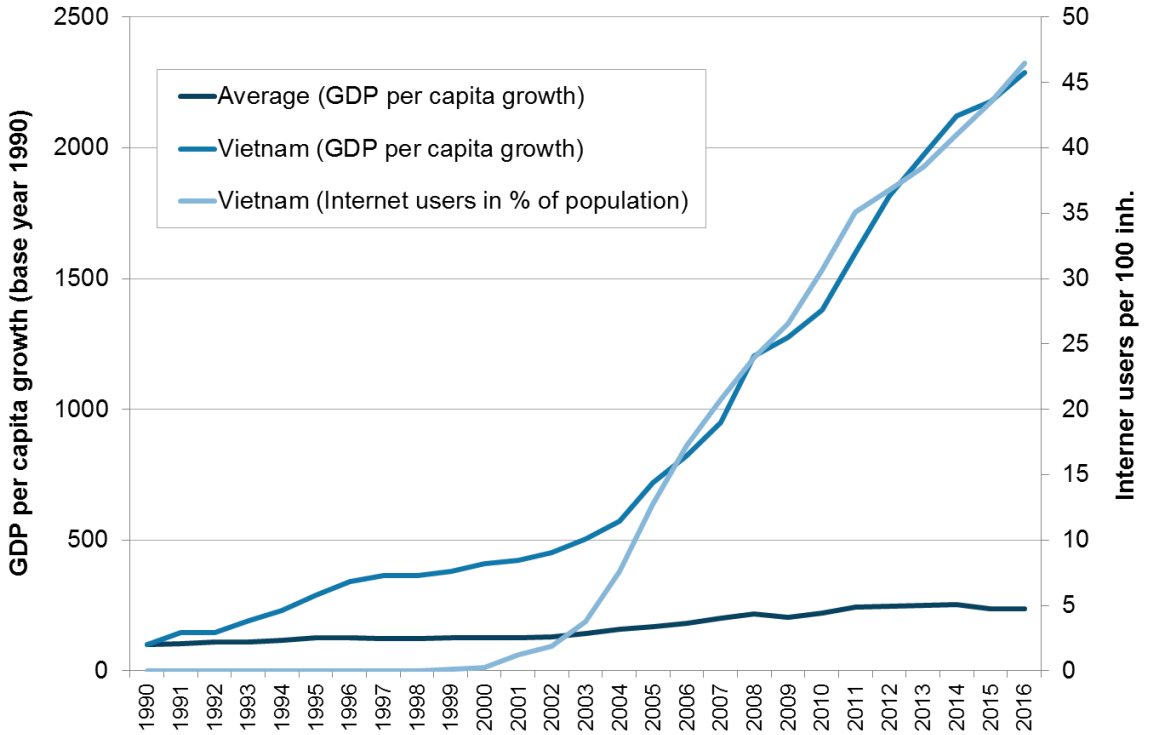
The Vietnamese economy is flourishing. Vietnam's GDP is increasing faster than in most other economies (Figure 2-1). Since the early 2000s, the economy has been growing at an annual rate of 12%. The beginning of Vietnam's immense economic growth correlates with an increase in internet usage. Between 2003 and 2016, the number of internet users rose by almost 21% each year. In 2016, 46% of the population were using the internet. The latest update from Internetworldstats.com shows the level of internet penetration to be 66% in December 2017.[13]

Even though the number of internet users continues to increase at a very fast pace, Vietnam still falls behind many nations in the Asia Pacific region regarding the share of inhabitants with internet access. In comparison, in Singapore, Thailand and Malaysia, the levels are 84%, 82% and 78%, respectively, in 2017.[14] The Inclusive Internet Index[15] ranks Vietnam 43rd among the 86 countries in the sample. Notably, Vietnam scores relatively high on the relevance and affordability sub-indicators.

In line with this assessment, Chakravorti, Bhalla, & Chaturvedi (2017) list Vietnam among the "Break Out" countries in their analysis of 60 countries as regards their state and evolution of digitization. They characterize "Break Out" countries as those with the most momentum to their digitization. This momentum, they conclude, should make them particularly interesting for investors, since these countries could soon catch up with others as regards the state of digitization infrastructure, making them "Stand Out" countries. Contenders to enter this group of countries – in addition to Vietnam – include China, Malaysia, Bolivia, Kenya, and Russia. Woetzel et al. (2014) arrive at fundamentally similar results when they consider the rapid uptake of new digital technology and devices in Vietnam.

13 https://www.internetworldstats.com/.
14 Ibid.
15 https://theinclusiveinternet.eiu.com/explore/countries/performance

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



Source: WIK representation based on data from the World Bank.

However, Vietnam is quite ahead in terms of internet usage compared to countries like India (29%), Indonesia (25%), and Bangladesh (18%) and the ICT sector contributes significantly to Vietnam's economic success. In 2016, the aggregated revenues from the ICT industry were around US$68 billion. The hardware industry makes up a large portion of total ICT revenues, even though the number of enterprises in this subsector is comparatively small.[16]

16 CSIRO (2018).

Table 2-1: Total Revenues of Vietnam's ICT Industry

	2015 (Mio. US$)	2016 (Mio. US$, estimated)	Growth rate (estimated)
Revenue of the hardware: electronic industry	53,023	58,838	10.97%
Revenue of the software industry	2,602	3,038	16.80%
Revenue of the digital content industry	638	739	15.83%
Revenue of IT services (not including trade and distribution)	4,453	5,078	14.04%
Total revenue of the IT industry	60,715	67,693	11.49%

Source: Cameron, Pham, & Atherton (2018).

Table 2-2: Number of Enterprises in Vietnam's ICT Industry

	2015	2016 (Estimated)	Growth rate (Estimated)
Hardware & electronic industry	2,980	3,404	12.46%
Software industry	6,143	7,433	17.36%
Digital content industry	2,339	2,700	13.37%
IT services (not including trade and distribution)	10,196	10,965	7.01%
Total number of businesses	21,658	24,502	11.61%

Source: Cameron, Pham, & Atherton (2018).

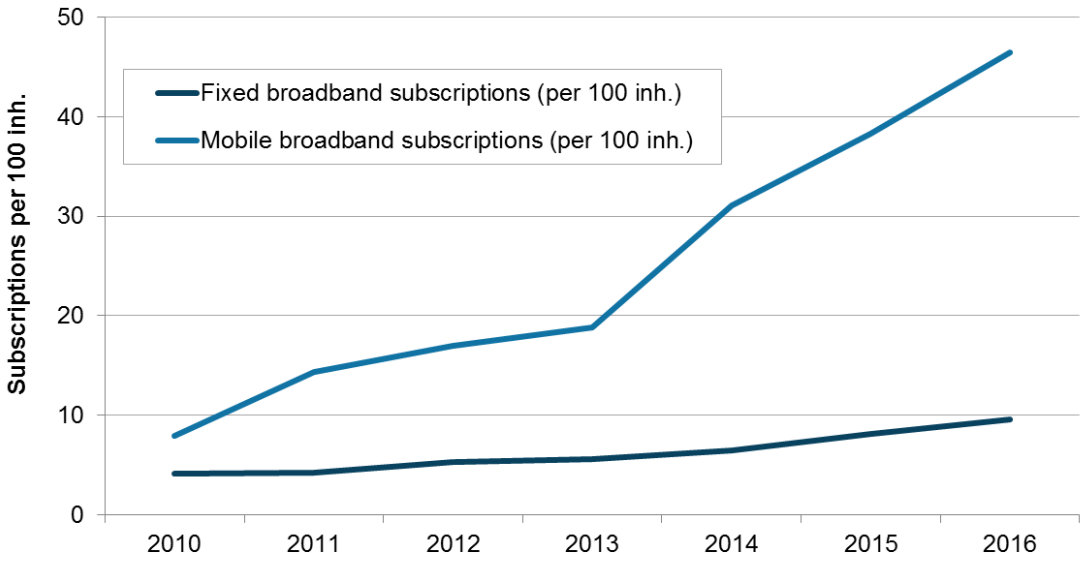
In addition, exports in the ICT sector are growing. At the beginning of 2010, ICT equipment's accounted for only about 10% of total exports in Vietnam, in 2016 however the share rose to 25%. Thus, the relative importance of Vietnam's ICT exports exceeds countries like Thailand (23% of total exports), Indonesia (7% of total exports), and India (6% of total exports).

The app economy in Vietnam is also growing constantly. Recently, Vietnam has become one of the leading app economies in Southeast Asia (Mandel & Long 2018). The production and distribution of mobile applications (apps) is a huge source of income. Like in most Asia Pacific countries, the majority of people accessing the internet in Vietnam do so by using mobile devices. In 2017, almost 94% of the population used a smartphone to access the internet at some point; however, only 70% had used a non-mobile device.[17] This may be mainly due to the fact that only a small portion of Vietnamese citizens have fixed broadband access at home. Only 11% had a fixed broadband subscription in 2017, whereas 47% had a mobile broadband

17 Based on GlobalWebIndex data. Notably, usage does not necessarily imply ownership of the device.

subscription.[18] Moreover, while the number of fixed broadband subscriptions rose only moderately in the last few years, mobile broadband subscriptions have risen exponentially.

Figure 2-2: Development of fixed and mobile broadband subscriptions



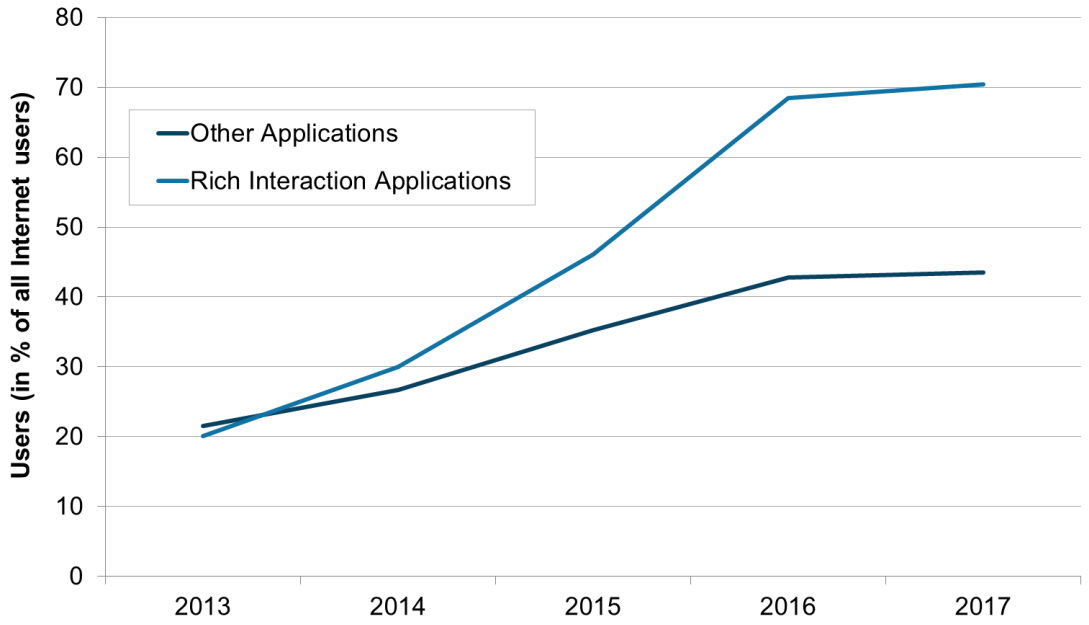
Source: WIK representations based on data from the ITU (2017), p. 245.

This dominance of mobile internet access technology in Vietnam pushes consumers to use mobile apps for most of their online activity. Applications that enable (rich) interaction play an important role for the Vietnamese. When accessing the internet they are more engaged in interactions than in any other activity (Figure 2-3).

In 2017, more than 70% of internet users interact on RIAs regularly, while 43% of internet users use other applications such as traveling apps, social apps or e-commerce apps regularly. Notably, Vietnamese people use, on average, 4.8 different RIAs and spend almost 100 minutes per day interacting on those RIAs.[19]

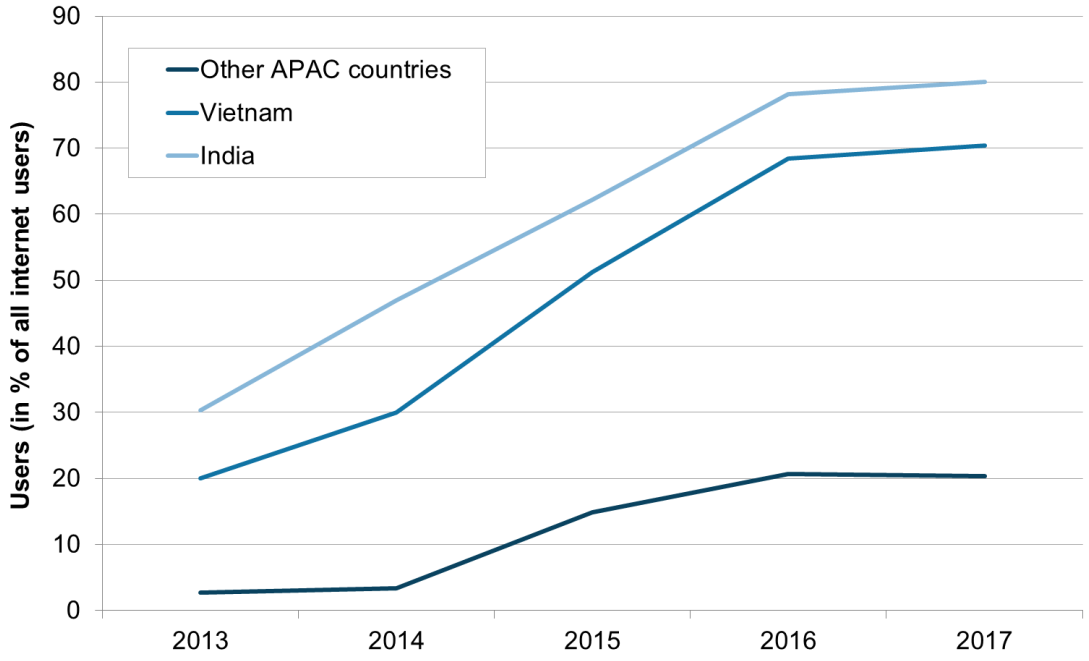
18 Own estimates based on ITU and World Bank.
19 Ecomobi (2017), Bain & Company (2017).

Figure 2-3: Use of RIAs vs. other applications in Vietnam



Source: WIK representation based on data from the GlobalWebIndex.

Figure 2-4: Use of RIAs (% of internet users) compared to other Asia Pacific Region (APAC) countries



Source: WIK representation based on data from the GlobalWebIndex.

Overall, RIAs play an important role in Vietnamese society. The majority of internet users rely on those applications to connect with others, not only on a social level but also for business purposes. They create value for those who use them by enabling social interactions but they go further than social value creation – they also created a whole new industry subsector, creating new jobs and businesses, that ultimately leads to economic growth. How RIAs create consumer surplus and economic growth will be the focus of the following chapters.

2.2 RIA functions create consumer surplus in Vietnam

As discussed in Sections 1.2 and 1.3, various studies have already looked at the GDP impact of the internet, applications in general and specific RIAs. 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 digital photos via an RIA, instead of sending printed photos by post.

These effects cannot be captured in the GDP impact. Arnold et al. (2017b) capture 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 results of the 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 per year.**

The present study replicates this methodology to investigate the consumer surplus generated by RIAs in India by Arnold et al. (2017b) for Vietnam. 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.

We captured the time saved in a representative survey among Vietnamese internet users in June 2018. In total, we received 1,000 usable questionnaires

from a representative online panel.[20] A professional international field institute programmed and curated the survey.

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, 242 minutes per week. Based on the average annual income in Vietnam (VND60.792 million) this translates into an annual consumer surplus of US$6.4 billion (VND145 trillion) in 2018. Thus, each user of RIAs in Vietnam receives, on average, US$145 (VND3.3 million) of consumer surplus annually. Applied to the entire population – not just RIA users – this results in US$67 (VND1.5 million).

Table 2-3: Consumer surplus results overview

RIA consumer surplus in Vietnam	
Time saved by RIA usage	**242** minutes per week
Consumer surplus (per user)	**US$145** annually
Consumer surplus (per capita)	**US$67** annually
Total consumer surplus from use of RIAs in Vietnam	**US$6.4** billion in 2018

Source: Representative survey of consumers in Vietnam (n=1,000), WIK analysis.

The consumer surplus in Vietnam is somewhat lower than in India. This is due to the lower usage intensity of RIAs in Vietnam compared to India. In India a larger share of internet users also use RIAs. Furthermore, a comparison of the survey data in the two countries reveals that Indians use RIAs more frequently than Vietnamese consumers. Notably, the true value of RIA functions for Vietnamese, especially those living in rural areas, is likely to not be fully captured in the consumer surplus here since, for many Vietnamese, RIAs have for the first time enabled them to send or receive rich information across large distances.[21]

20 See Annex 3 for more details.

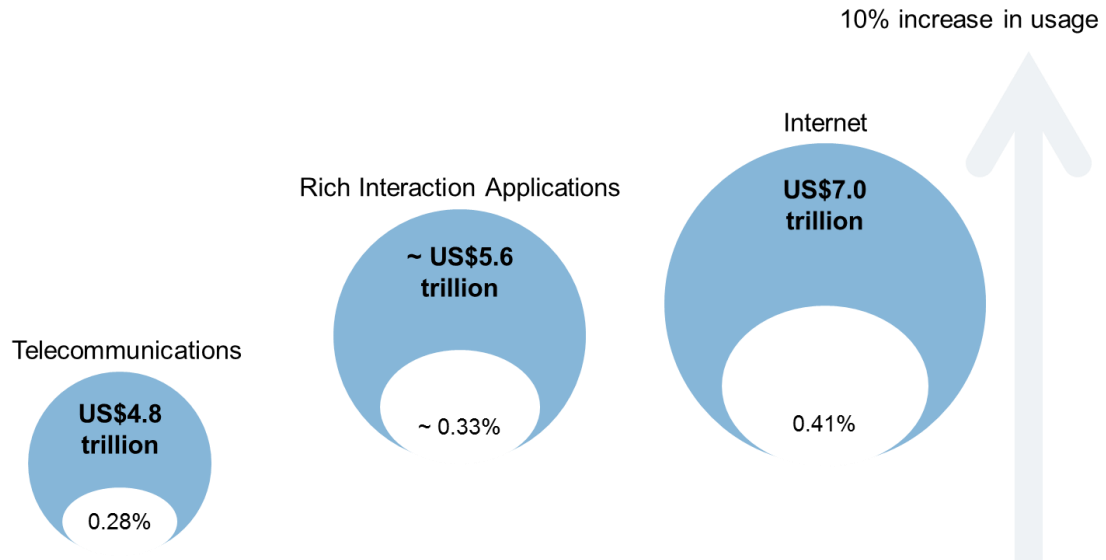
21 The World Bank (2016) states that only around 35% of Vietnamese people can receive postal deliveries to their homes due to a lack of infrastructure.

2.3 Impact of RIAs on GDP in Vietnam

Arnold et al. (2017a) applied an econometric model based on the Cobb–Douglas production function to 164 countries over 16 consecutive years (from 2000 to 2015) to approximate the economic impact of RIAs on global GDP. By estimating the impact of telecommunications and internet, the authors were able to identify the range in which the true value of the impact of RIAs on the global economy may lie. Making the assumption that RIAs are developing to integrate almost all of the functionalities associated with a "full internet experience", the impact of RIAs has to be greater than the economic impact of telecommunications, because RIAs integrate more functionality – hence economic value – than basic telecommunication services. However, it has to be smaller than the impact of the internet, because it does not yet provide all the functions associated with the full internet experience. 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.

Arnold et al. (2017a) found that, on average, a 10% increase in the global usage of RIAs leads to an increase in global GDP per capita of approximately 0.33%. This corresponds to an average global increase in GDP of US$1 billion daily. The total impact registered is US$5.6 trillion for 164 countries for the 16 years from 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 (Figure 2-5).

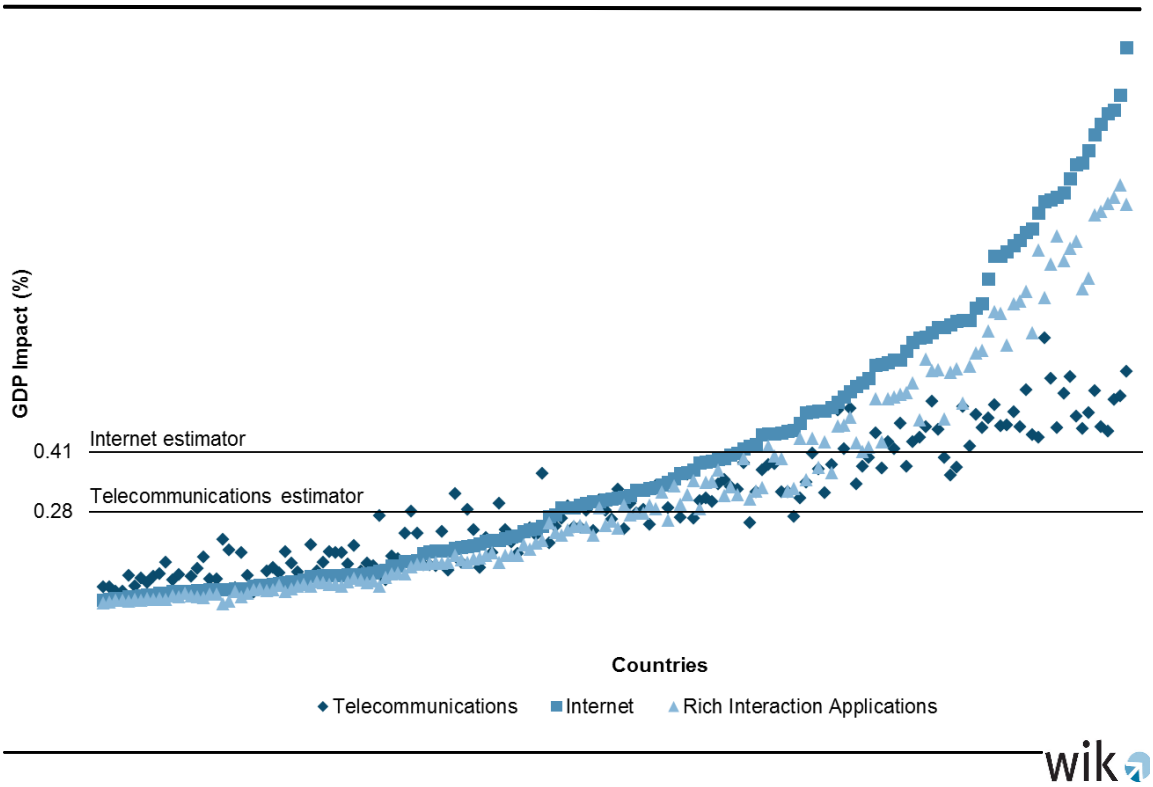
Figure 2-5: Average impact of telecommunications, RIAs and the internet on global economic output from 2000 to 2015



Source: Arnold et al. (2017a), p. 33.

The impact of telecommunications, RIAs and the internet across the 164 countries differs substantially in some cases. Figure 2-6 illustrates these differences by depicting the GDP per capita impact of RIAs in relation to telecommunications and the "full internet" for each country covered in the panel dataset over the 16-year period. For countries located at the bottom half of the scatterplot (generally, those with lower levels of broadband penetration), an increase in internet usage and, therefore, in RIA usage has little or no impact on global GDP per capita. For countries located in the upper half of the scatterplot, an increase in internet usage and, therefore, in RIA usage has a strong impact on global GDP per capita. These include Australia, Austria, Bahrain, Canada, Costa Rica, Germany, Hungary, Kuwait, Lebanon, Macao (SAR China), Malaysia, Mexico, New Zealand, Qatar, Serbia, Slovakia, United Arab Emirates, United Kingdom, and United States.

Figure 2-6: Scatterplot of GDP impact referring to a 10% increase in telecommunications, RIAs and internet usage

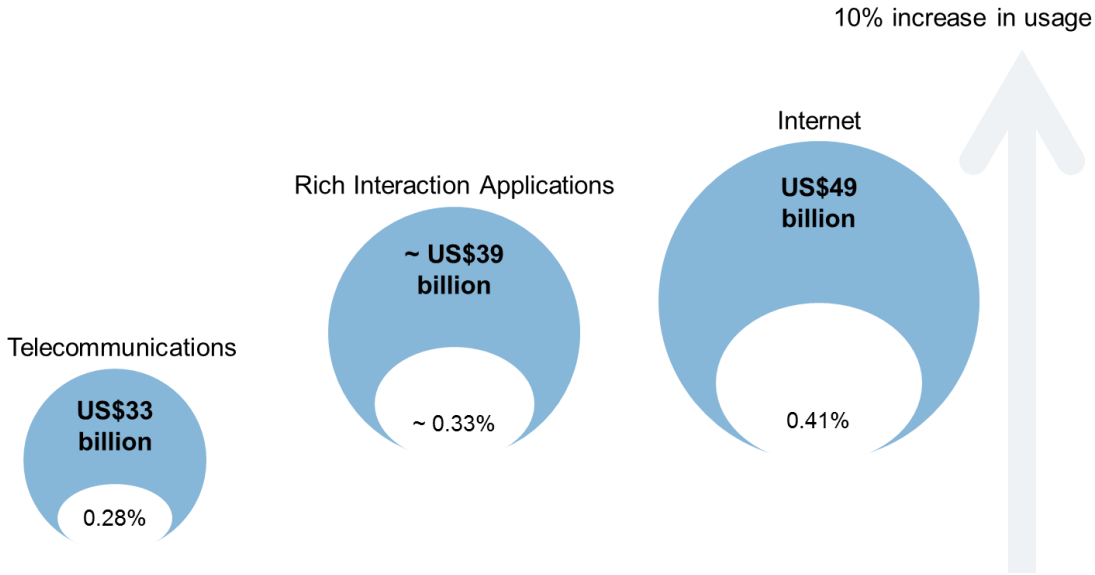


Source: Arnold et al. (2017a), p. 34.

The countries which are located in the middle part and close to the telecommunications and internet estimators are expected to have seen the same impact of telecommunications, RIAs, and internet on their national economy as has been seen by the global economy as a whole.

Vietnam is one of these countries located in this area. So, by imposing the assumption that a 10% increase in RIA usage leads to a 0.33% increase in GDP in Vietnam as well, we were able to quantify the economic impact. Based on the aforementioned approach for quantifying the GDP impact of RIAs in Vietnam**, the economic value of the usage of RIAs is US39$ billion in Vietnam over the 16-year period from 2000 to 2015. The impact of telecommunications and the internet was US$33 billion and US$49 billion, respectively, over the same period of time.**

Figure 2-7: Average impact of telecommunications, RIAs and the internet on economic output in Vietnam from 2000 to 2015



Source: Own estimations based on insights gathered from the original study conducted by Arnold et al. (2017a).

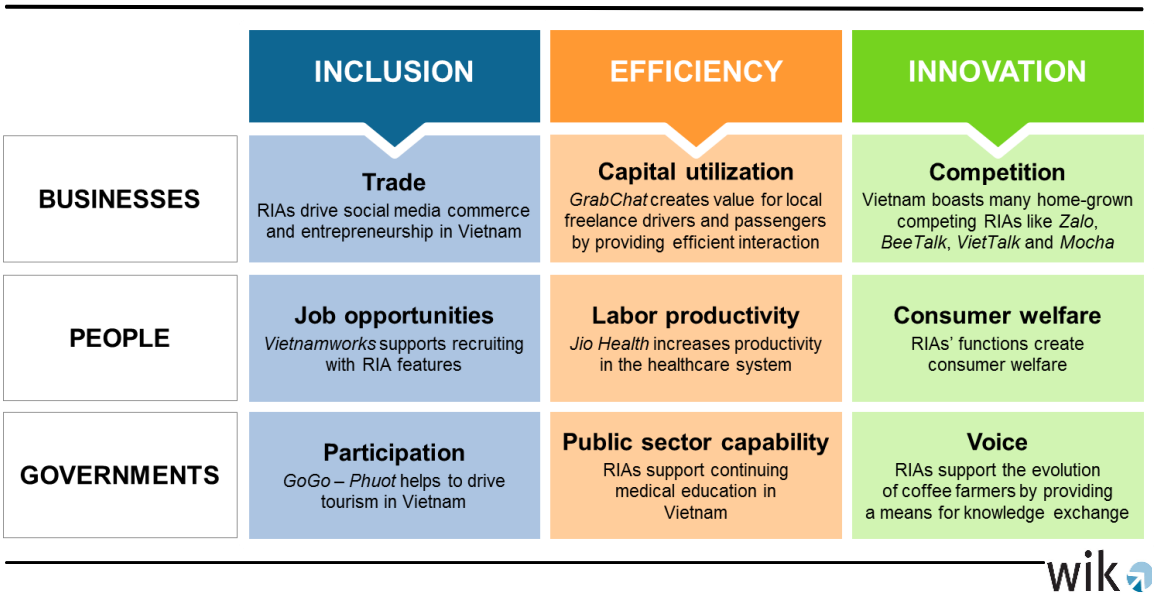
3 Local value creation by RIAs in Vietnam

The preceding chapter shed light on the economic impact of RIAs in Vietnam as measured by the realized consumer surplus and the impact on GDP. The impact on GDP is in line with the global estimates presented by Arnold et al. (2017a). There are however significant effects on local businesses and citizens that these economic indicators cannot capture. Consequently, this chapter intends to explore exactly these effects on local value creation.

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 secondary data and case studies from Vietnam to illustrate the World Bank Framework.

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



Source: Arnold et al. (2017b), p. 18. The authors' own presentation based on the World Bank Framework (2016).

3.1 Local value creation through increased inclusion

RIAs in Vietnam play an important role in extending the inclusion mechanism of the internet, as outlined by the World Bank (2016). As an increasing number of internet users become digital consumers in Vietnam,[22] e-commerce becomes an important source of revenue for many businesses. However, Vietnam's e-commerce landscape differs markedly from e-commerce in western markets, and even most other Asian

22 According to Bain & Company (2017), 35 million Vietnamese people were digital consumers in 2017 – an increase of 63% over 2016.

markets, as social media sales play a disproportionately large role.[23] Within this category of e-commerce, a significant share of revenue is generated through RIAs. The RIA that is typically used for this kind of activity is Zalo, often in combination with Facebook and Viber to sell and purchase items (Nguyen 2017, Nguyen 2018).

This enables many small- and medium-sized enterprises (SMEs), micro-enterprises, as well as otherwise underrepresented groups to participate in trading goods and services. In particular, micro and small enterprises provide (additional) income for many Vietnamese people. With a growing economy, affordable labor costs and low barriers to entry, it is an attractive entrepreneurial landscape and poses generally lower risk for one's personal financial situation than in developed countries (Jones & Masters 2016).[24] **RIAs lower the entry barriers to entrepreneurship even further and enable otherwise unrepresented groups to become entrepreneurs.**

However, women still struggle to become entrepreneurs in Vietnam. Thus, it is not surprising that while women represent a little over half of the population in Vietnam, only 25% of business owners in Vietnam were female, according to an estimate by the International Labour Organisation (ILO 2011). They estimated this figure to grow to 30% by 2015 and indeed there are indications that female entrepreneurship is advancing positively in Vietnam (Anh et al. 2016, Zhu et al. 2015). RIAs facilitated this process.

Bui Tu Ngo – a female entrepreneur – says, hers was the first store in Vietnam to import Greek olive oil and other fine food products. Her example underscores the importance of Zalo and Facebook to her store's success. She was able to increase her customer base by 20% when she added social media commerce to her web presence (WomenBizPH 2017). Notably, the so-called "mumpreneurs" use RIAs as they enable quick interaction with customers independent from their location (Nguyen 2017).

The initiative #phunuladoanhnhan (#Shemeansbusiness) seeks to further tap the potential of female entrepreneurs in Vietnam and elsewhere. The initiative builds awareness of entrepreneurship among women by presenting showcases of other women who have started their own business successfully with the help of Facebook and/or Instagram. The initiative provides additional support by offering the necessary online toolkits and guidance. The showcases highlight that using RIAs and social media for your business is not only a good way to reach customers, but can also support other parts of the company such as recruitment of new employees.[25]

---

23 According to recent Appota (2017) and Bain & Company (2017) reports, around half of the (urban) population in Vietnam use this Facebook feature to purchase items online. This is same level of social media e-commerce as in Thailand, which is typically cited as the leading nation in social media commerce engagement (Asian Development Bank 2018, PriceWaterhouseCoopers 2016). Furthermore, Bain & Company (2017) mention that in addition to social media sales, around 44% of all online sales have been influenced by social media in Vietnam. Less than 5% of consumers in Vietnam stated that they did not use social media as part of the customer journey.

24 In 2017 126,859 new enterprises were established in Vietnam (Asian Development Bank 2018).

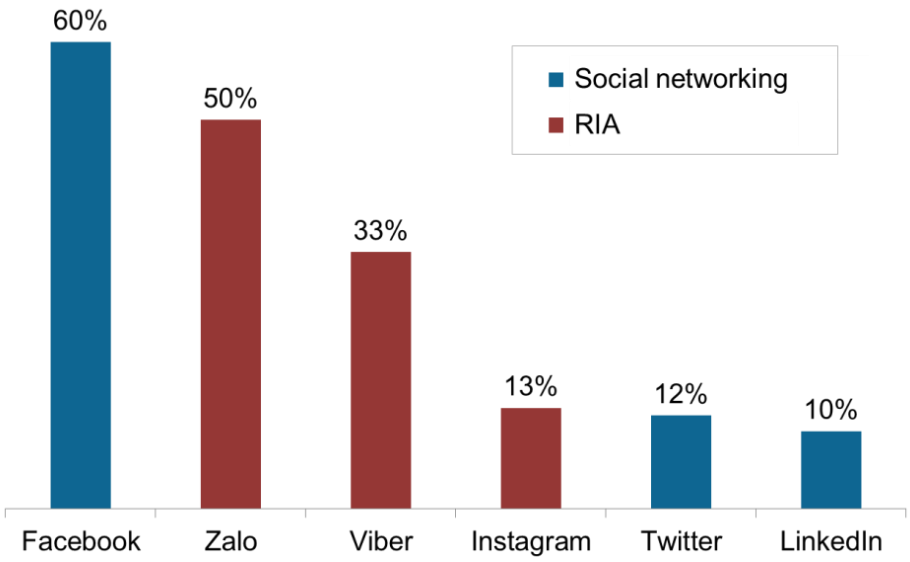
25 For more information on the showcases and the initiative: https://shemeansbusiness.fb.com/vn/

HARAVAN – The first all-in-one e-commerce platform integrating RIAs in Vietnam

HARAVAN, founded in 2014, provides logistic services to SMEs, payment solutions, forum integration for SMEs, and a customer service toolset including email, newsletter, call center and chat services. The platform is used by shops, retailers and new SME e-commerce merchants to work on their business development on an online and offline basis. Over **50,000 websites** are connected to HARAVAN, with over **4,000 trusted and satisfied customers**. With **15,000 paying merchants** and **200,000 registered users**, it is the most popular e-commerce platform and solution provider in Vietnam, linking shops, retailers, SMEs and customers.

Against this backdrop, it is not surprising that Vietnamese micro-, small- and medium-sized enterprises (MSMEs) frequently use RIAs.

Figure 3-2: Percentage of MSMEs in Vietnam reporting frequent use of RIAs and social networks



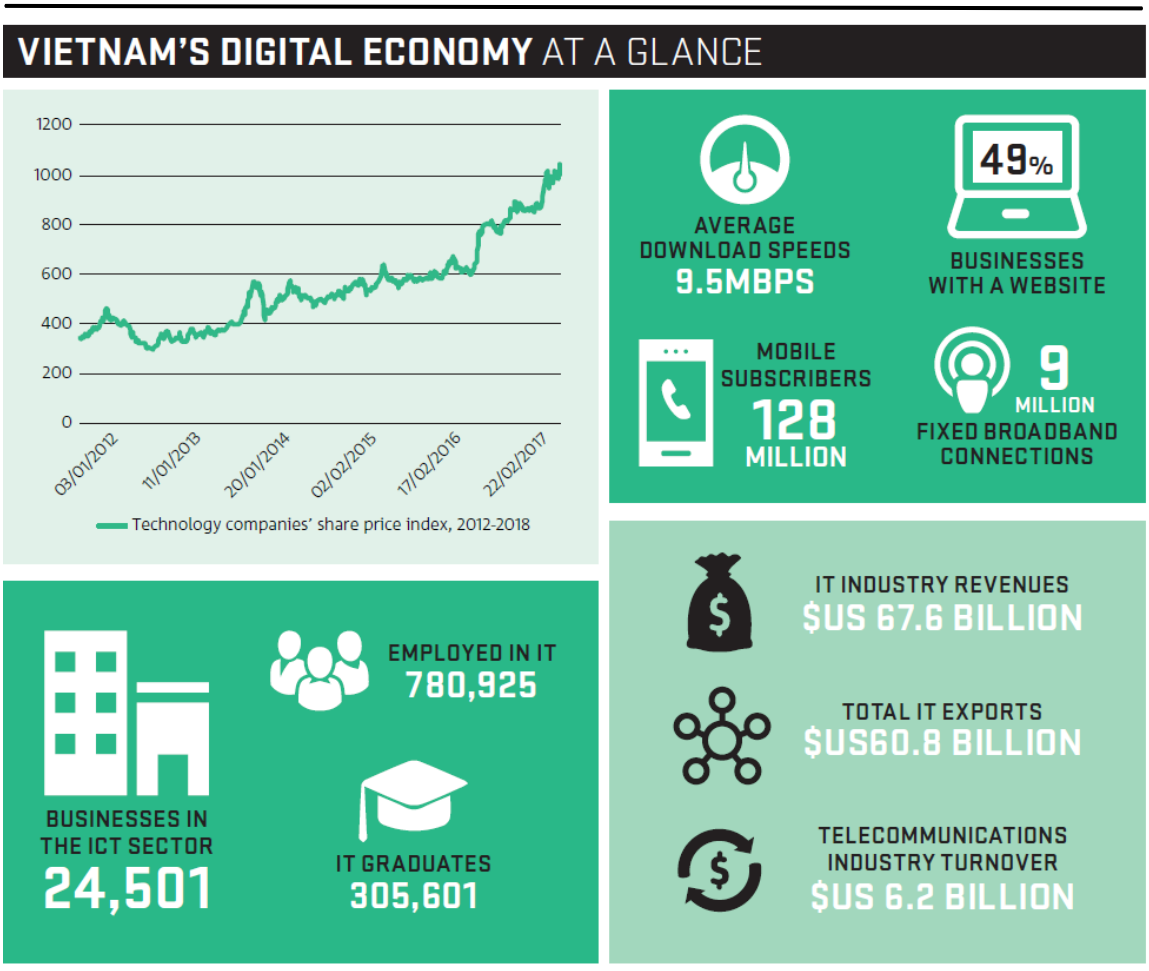
Source: Figure based on Asia Pacific Foundation of Canada (2017) – Results based on a survey of n=681 entrepreneurs and MSMEs in Vietnam in 2017.

Successful digitization requires the right tools in terms of hardware and software. Thus, a thriving ICT sector often emerges as digitization progresses. This helps to create jobs and thereby to include people in the workforce. Since ICT jobs typically offer above-average salaries as well as quick elevation of one's own skills, a growing ICT sector usually has significant positive spillover effects (World Bank 2016). Vietnam's ICT sector has been booming – supported by a structural transformation of Vietnam's economy towards tertiary occupations.

From 2010 to 2016, the ICT sector's aggregated revenues grew roughly nine-fold from US$7.6 billion to US$67.7 billion. In 2016, the ICT sector in Vietnam employed 342,700 people and was the largest contributor of exports (measured in export value in US$) in 2017 (Cameron, Pham, & Atherton 2018). Due to this apparent success, some call the country Asia's Silicon Valley (Nylander 2016, Marvin 2015, Jones & Masters 2016).

Although the vast majority of revenue (around 85%) in Vietnam's ICT sector stems from hardware production (Cameron, Pham, & Atherton 2018), there is a thriving app economy, in particular in Da Nang, Hanoi and Ho Chi Minh City. According to the Progressive Policy Institute (Mandel & Long 2018), the app economy contributed 42,500 jobs in December 2017.

Figure 3-3: Overview of Vietnam's ICT sector



Source: Cameron, Pham, & Atherton (2018), p. 23.

Notably, Vietnam's other industrial sectors are prone to digital disruption in the coming years. According to ILO (2016), Vietnam has a higher probability of jobs being displaced by digitization than most other economies in the ASEAN countries. Thus, it is crucial for Vietnam to further support its vibrant tech start-up scene, to invest in upskilling of its workforce and to encourage all genders to participate in the digital transformation of the country. RIAs may have an important role to play in this as they are one of the most prevalent applications that people engage with, capable of triggering interest in further expanding one's own skillset and thereby making it easier for government initiatives to succeed.

Personal communication can be important in finding a job. Vetting an initial set of candidates is easier online than it is offline. Only promising candidates will be invited, saving time and money on both sides. Vietnamworks is a recruiting app that recognized the need for more personal interactions prior to meeting in person in a job interview. They offer a chat feature on their website and in their app that jobseekers and potential employers can use to get to know each other. This is part of the success of Vietnamworks.

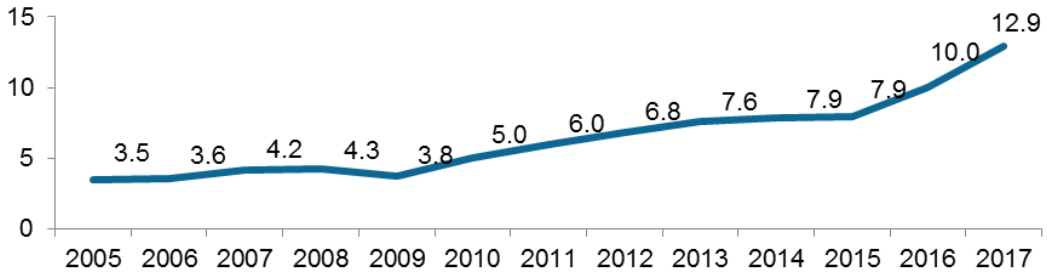
Vietnamworks

Besides common features such as job searching by category, location or position, Vietnamworks offers a chat function to get in touch with companies on an informal, explorative level. In addition to that, Vietnamworks offers professional advice on the application process, ranging from CV templates to interview guidelines.

Founded in 2002 by Jonah Levey as part of the Navigos Group, Vietnamworks now hosts 3.6 million job seekers and 13,000 companies looking for employees. Since 2009, they have been an official partner of Yahoo. To date, Vietnamworks has arranged three job fairs and a Vietnamese career reality show called OVERTIME.

One of the objectives of the Vietnamese government is to sustain economic growth and to include more private investment in the country's economy. Tourism is one promising route to achieving this objective and also supports Vietnam's currency as it brings in substantial foreign money. In fact, Vietnam has been experiencing a boom in tourism since 2010. This is partly due to considerable efforts on the part of the government. To reach the goal of a 7% contribution to the GDP and the creation of three million new jobs by 2020, aggressive marketing strategies and strategic rebranding of several high-interest tourist hubs, like Hanoi, is planned for the next few years.

Figure 3-4: Development of the number of international tourists in Vietnam, in millions



Source: Decision 2473/QĐ-TTg on "Strategy on Viet Nam's tourism development until 2020, vision to 2030".

Thus far, Vietnam is particularly well known as a hotspot for backpackers and similarly active young travelers. In order to achieve its ambitious objectives, the government will need to also attract different (mainstream) target groups, who may be more risk-averse.

Smartphones and online applications can play an important role in this scheme. Already today, several applications have emerged that provide information to tourists covering food preparation, the spreading of diseases and sign language specifically designed for the Vietnamese tourist regions. However, so far their information remains static. RIAs, on the other hand, are dynamic by default.

GoGo – Phuot Vietnam is a particularly promising example of an RIA-like application that lets tourists join traveling groups to improve overall safety. Within the group, every member has access to other members' GPS location and is able to notify emergencies and accidents. This allows for quick reactions in dangerous situations.

Furthermore, RIAs are instrumental in the marketing of online start-ups in the tourism sector in Vietnam such as "I Love Hue Tours". The company offers motorbike tours in the cities of Hue and Hoi An. Founded in 2014, the company grew substantially by targeting tourists looking for an authentic experience of Vietnam on social media channels and in particular Facebook. Today, they find that most bookings for tours arrive via Messenger and WhatsApp. As outlined in the above, the direct and rich interaction that these applications enable is a key driver of the success for I Love Hue Tours, as it emphasizes the authenticity of the link between tourists and the organizer of the tours.[26]

26 More information on the case study can be found here: https://www.facebook.com/ilovehuetour/.

3.2 Local value creation through increased efficiency

According to the World Bank (2016), improved efficiency is the most important aspect for businesses when introducing ICT solutions. In particular, MSMEs in Vietnam use RIAs to make their processes more efficient. For instance, the International Finance Corporation (IFC 2014) highlights an SME seller from Da Nang who runs a children's clothing store. She receives product details from her suppliers via Viber and Zalo. "Without this it would have been more challenging for her to get new product details from the suppliers. Clothes are fast-selling products and she orders frequently, even daily." (ibid. p. 24). This is further supported by Nguyen & Schiffbauer (2015),[27] who find that total factor productivity for companies in Vietnam increases when they use e-commerce.

Furthermore, the former study (IFC 2014) indicates that RIAs also drive efficiency by making it easier to pay cashless – often directly in the application. The interviewed SMEs state that more than half (58%) of their customers purchasing goods and services through RIAs use non-cash payments. This is a significantly higher percentage than for customers shopping on e-marketplaces or e-retailers (11% use non-cash payments) and online-to-offline services (10% use non-cash payments). Grab recently introduced an RIA-like chat feature into its successful ride-hailing application to make the interactions between drivers and passengers more reliable and efficient (see box below).

GrabChat – a new efficient feature within the most successful ride-hailing app in Vietnam

The application Grab became the first ride-hailing app in Southeast Asia, connecting freelancers and customers. In 2016, the GrabChat feature was launched. GrabChat is an instant messaging platform within the application – making the connection between passenger and driver much easier and faster. In addition, the feature enabled a significant reduction in ride cancellations. This new feature is particularly well-suited for international travelers who want to avoid roaming charges for SMS or voice calls. Furthermore, it is readily accessible within the application and offers predefined standard questions and answers to make conversations more efficient. All messages are deleted once the destination is reached.

Notably, Grab is constantly enriching its service by adding new functions. For instance, GrabFood and GrabPay became available in Vietnam in May 2018 – connecting restaurants with consumers and enabling e-payments. As Grab has evolved and increased its service offerings, Vietnamese entrepreneurs have benefitted from new opportunities and individuals from more choice and convenience.

27 Cited from World Bank (2016).

Efficiency gains for people and government intersect in healthcare. In this sector, RIAs in Vietnam offer some innovative solutions to persisting issues in the country. Jio Health is a service that enables voice and video interactions with doctors – this reduces costs for patients. **While an average home visit by a doctor costs VND500,000, a video consultation is only about a fifth of this price (around VND100,000)**. Doctors charge separately for additional tests and prescriptions on Jio Health. If the patient has put his or her insurance details into the application, then the bill can also be settled within the app. In fact, Jio Health puts a lot of effort into presenting everything that is needed in one place. For example, the application also tracks the user's blood pressure and other vital signs and can connect to other healthcare and fitness devices.[28]

Jio Health can help to overcome some persistent shortcomings in Vietnam. These include crowded waiting rooms, limited interactions with doctors and a consistent lack of a system that enables the sharing of patients' medical records.

The government in Vietnam is equally aware of these challenges in the healthcare system and seeks to mitigate them by various decrees and regulation. Among them is a law that requires continuing medical education for all clinical workers since 2009. Unfortunately, so far, there is little uptake of continuing medical training among Vietnam's clinical staff. **RIAs, and especially Zalo due to its functionality and widespread use, could facilitate continuing medical education** (McNabb 2016). For this to take off, better broadband infrastructure would be needed, especially in rural areas.

3.3 Local value creation through increased innovation

There are very few countries that feature as many local RIAs as Vietnam. First and foremost, there is Zalo.[29] It is the most widely used mobile application, next to Facebook Messenger. In total, 70 million people use it globally. Our analysis shows that Zalo is one of the most innovative RIAs worldwide, featuring 15 functions, including voice calls within the app, video calls and location data. Other local RIAs include BeeTalk, Mocha and VietTalk. While fewer consumers use them, they sometimes offer innovative functions such as whispering and swiping, which will be explained in the following boxes that provide a detailed analysis of each of the local RIAs.

28 Information from Jio Health's website https://www.jiohealth.com and press articles.
29 https://zalo.me.

A detailed look at Zalo

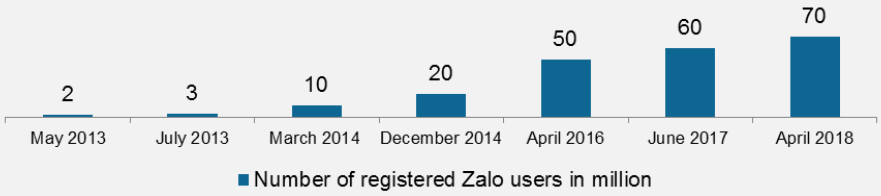
Evolution of Zalo

Aug 2012	Beta launch with functions: texting; stickers; voice calls; location data
Nov 2012	Official launch
Jan 2013	VIP microblogging feature and Retina app icon
Sep 2014	Developers API
Nov 2015	Zalo for Mac; video calls
Sep 2016	Integration with social networks (Facebook and Google)

Zalo creates local value in Vietnam and worldwide

Zalo was launched by VNG – a leading IT firm in Vietnam – in 2012. In the first half of 2017, Vietnamese people already used 48 million smartphones (Appota 2017). Zalo can be found on around 80% of these smartphones. The Vietnamese home-grown RIA, which is part of VNG, is one of the most popular mobile applications in Vietnam. Its reach goes beyond Vietnam as in April 2018, 70 million people used Zalo. They exchange around 800 million messages a day. It earns money from sticker sales and other in-app purchases as well as marketing campaigns purchased by large international corporations.

Recently, it reported a revenue of US$100 million. With this revenue Zalo contributes a significant share to the success of VNG, which posted a pre-tax profit of $50.3 million in 2017. This result is the highest profit reached since the company was established in 2004.



Zalo is suitable for private digital conversations, as well as a customer service app for SMEs, offering a wide range of 15 functions.

Given its enormous reach and user engagement, Zalo is well-suited for local marketing campaigns and other business use cases. One of the most famous marketing campaigns on Zalo was launched by Coca-Cola.

The campaign used Zalo's hugely popular sticker function. Coca-Cola devised its own branded version of popular stickers under the tagline "Share a Coke" which they called "EmotiCokes". These EmotiCoke stickers became very popular with Zalo users, not only because they were funny and cute, but also because stickers in general aide the communication on RIAs immensely by transcending typical language and other communication barriers. In fact, the success of the marketing campaign exceeded Coca-Cola's expectations. Coke sales in Vietnam increased by 30% and Zalo recorded a total 11.7 million sticker downloads.

This is by no means the only example of leading global brands collaborating successfully with Zalo to reach their Vietnamese audience. Other examples include Sunsilk haircare products (owned by Unilever) and Manulife Financial Corporation, one of the largest insurers worldwide. For Sunsilk, Zalo provided a subtle yet intimate and successful communication and engagement channel. Haircare products is one of the most predatory Fast-Moving Consumer Goods (FMCG) categories in Vietnam. Competition is fierce and marketing pressure on consumers is high.

Sunsilk used Zalo to translate the idea of the hair's softness into haptic interaction using the smartphone's virtual keyboard to "chibi" drawings (manga-like cartoon images). The campaign included a competition that would turn the best drawings into stickers. The campaign led to an increase in value market share of 0.5% in Sunsilk's key local markets within Vietnam. The brand gathered over 100,000 followers on Zalo, received 75,000 photos and 32,000 chibi drawings. The stickers that were created from these chibi drawings were downloaded more than two million times and shared around 260,000 times a day by Zalo users.

A detailed look at BeeTalk

BeeTalk was first released in 2014. Like all RIAs, its core functions revolve around interpersonal interaction with texting, voice calling and recorded messages. Unlike other RIAs though, BeeTalk strikes a balance between very private and very public user presence. On the one hand, BeeTalk features Snapchat-like whisper messages which destroy themselves as soon as the recipient has opened them, on the other hand users can swipe through photos of other nearby users.

Combining selected functions of WeChat, Snapchat, Tinder and Line has made BeeTalk hugely popular across Asia. Just four months after its launch, BeeTalk had gained 10 million users. Within Asia, Taiwan is the fastest-growing market for the application. It accumulated two million users within six weeks of release. BeeTalk is, along with Zalo, an example of a Vietnamese RIA being successful both inside and outside of its home country.

A detailed look at Mocha

Evolution of Mocha

Apr 2015	Texting; voice messages; sending pictures, videos, and data; streaming music; money transfer; group chat; translation
May 2016	Voice sticker; airtime transfer
July 2017	Encryption; VoIP

The digital communication provider Viettel launched its Mocha application in April 2015. Viettel Communication Company provides value-added services within the field of mobile phones, the internet and television. Mocha now reaches over one million active users in Vietnam and is being offered in nearly 200 countries and territories. With its direct translation feature, the app allows the bridging of language barriers, supporting Mocha users with over 90 languages. Furthermore, Mocha won the IT World Awards in 2017 held in the US; the application won gold in the category "Mobile App Development Solutions". In April 2018, Viettel announced that Mocha has now 12 million users and is adding a video content store.

A detailed look at VietTalk

VietTalk is a free RIA developed by VNPT, excluding 3G charges. VietTalk users can comfortably connect with their friends and family without using their data allowances or incurring data charges. In addition, VietTalk supports SMS messaging and telephony, reducing average call charges by 40%. Users are provided with a virtual phone number, which saves the cost of communication. A social account within the VietTalk community helps to form a close relationship with other app users, sharing photos and status updates.

This varied sphere of local RIAs, as well as popular foreign RIAs, offer a large number of functions that provide additional consumer choice and welfare. We captured this impact in the present report in the consumer surplus added by RIAs in Vietnam. This has to be considered a conservative estimate since the RIAs, especially Zalo, offer various shopping functions that were not considered in the consumer surplus estimate for this study.

Sustained strong economic growth and the upskilling of the labor force are the prerequisites for further successful transformation of the country as it faces the challenge of digitization disrupting many of its strongest industrial sectors. Consequently, upskilling of the labor force should be one of the most important objectives of the government. RIAs can be instrumental in this process. For instance, RIAs support the research and learning that feeds into the World Coffee Research project to ensure the future of coffee.[30] The program works closely with coffee farmers in various countries – among them Vietnam – where coffee is one of the most important export goods, to evolve crops and farming techniques. It seeks to tackle the pressing issue of outdated crop varieties and depleted soils due to insufficient agricultural skills, which send many coffee farmers into a downward spiral of economic disaster. RIAs are used to exchange knowledge and to collect data within the project, even in remote areas (Montagnon & Knuepple no date).

30 The most commonly used RIA within the initiative is WhatsApp and within that the group chat function. Source: Montagnon & Knuepple (no date).

4 Impact of social media on commerce in Vietnam

The present study explored the socioeconomic value of RIAs in detail. We delineate RIAs from social networks such as Facebook, Google+ or Twitter, because the latter's core concept revolves around posting messages, pictures, videos and other content, typically without a specific addressee or closed group of addressees in mind. Furthermore, most social networks offer specific sites to businesses with additional functions compared to standard user profiles. These additional functions can include purchase and payment processing or the possibility to present additional content. Furthermore, social networks offer branded and sponsored content as well as different ways to measure the impact and effectiveness of such content. Finally, since the content is usually available to all users on the social network, discussions and posts about the brand can be hugely informative for businesses marketing. Consequently, the present Chapter represents a digression from the remainder of the study.

With these functions, businesses can reach a wide audience on social networks. In Vietnam, for instance, 61% of the population use Facebook, 39% use Google+, 24% use Twitter, 13% use LinkedIn and 12% use Pinterest (We are social 2018). Around 18% use the domestic social network Zing Me (Sodano 2017).[31]

As outlined in the report, social commerce plays an important role in Vietnam. Given its audience reach, Facebook is the most widely used social commerce platform. With Facebook Business, the social network is helping local enterprises to successfully grow their business using Facebook ads and measurement tools. Making use of these new features, the phenomenon of influencer marketing has been increasing in recent years. Such influencers benefit from the quality of interaction that social networks enable. Thus, 71% of consumers are more likely to make a purchase based on a social media reference than over traditional marketing channels. Information received over social media platforms is generally perceived to be more trustworthy and valuable for both consumers and businesses.[32]

The evolution of the Saigon Flea Market in Vietnam is another example of local success on Facebook. The flea market opened in 2011 with around 20 vendors. Using Facebook to reach out to the community and to attract more customers, the Saigon Flea Market grew to more than 150 vendors and about 2,000 customers.[33] Another example is the Korean retailer Lotte, which sought to connect with Vietnamese customers. On Facebook, they were able to increase their conversion rate by 49%.[34]

However, it is not only local businesses that benefit from the quick and broad reach that is possible within social networks.

---

31 Own calculation based on Sodano (2017).
32 https://starngage.com/influencer-marketing-vietnam/.
33 https://facebook.morningconsultintelligence.com/countries/apac/#saigonfleamarket.
34 https://de-de.facebook.com/business/success/lotte-vietnam.

5 What next for RIAs in Vietnam?

Vietnam is one of the fastest-growing economies globally. Digitization has played a significant role for Vietnam's economic success. The ICT sector alone employs 780,925 people in Vietnam. A thriving app economy holds huge potential for future development and the importance of digitization will likely grow in the foreseeable future. This is particularly true in light of the growing importance of Industry 4.0 which will have a substantial impact on Vietnam's economy. Vietnam will have to invest in digital infrastructure and skills to sustain its economic success. As regards infrastructure, one of the key technologies that will enable Vietnam leapfrogging other nations is 5G. Its rapid deployment and uptake in Vietnam will critically depend on policies that can reduce the cost of deployment as well as set the right incentives framework for operators to provide connectivity even in rural areas. Next to innovative developments such as autonomous vehicles, digital health and smart cities, this infrastructure is also an enabler of the Internet of Things which will be essential in realizing Vietnam's Industry 4.0 strategy. Fulfilling these ambitious objectives will also require a substantial upgrade of digital skills among the Vietnamese workforce. This requirement is widely recognized in Vietnam and supported by both local and international actors. For instance, the Vietnam Chamber of Commerce and Industry (VCCI) undertakes collaborations with various major international Internet firms that support local training for entrepreneurs, SMEs and their staff or focusing on the digital upskilling of women. Locally, among others, the Vietnam Farmer's Union (VNFU) intends to provide training to 30,000 farmers on how to find information on the internet, use basic productivity tools, and make use of agricultural apps until 2020 (ITU 2018).

Beyond excellent digital infrastructure and skills, to drive success the existing technology ecosystem requires a flexible and forward-looking policy approach. Overly prescriptive regulations cannot readily adapt to a fast-changing economic and digital environment. Prescriptive rules are likely to hamper growth by burdening local ICT companies, both large and small, as well as global digital companies alike. In fact, the impact on local businesses is probably larger as, especially with SMEs, there is a lack of resources to adapt innovative products and services to regulatory changes.

The group of applications explored in the present study – RIAs – are a particularly prominent example of these rapid innovation cycles. Globally, RIAs evolve very quickly adding new functions to reflect consumer demand. The local RIAs in Vietnam do not differ from this pattern. The most prominent and comprehensive example, in terms of the number of functions, is Zalo, which directly competes with other local RIAs such as BeeTalk, Mocha and VietTalk, as well as with global players like Facebook Messenger, iMessage, LINE, Threema, WeChat or WhatsApp.

While initial consumer research results indicate that RIAs serve as a like-for-like substitute for traditional telecommunications services in some consumption situations, their novel functions make a significant difference from a consumer's perspective in

others. Most importantly, as we have also shown in the present report various RIA functions enable levels of immediacy and intimacy different from traditional telecommunications services (Arnold, Schneider, & Hildebrandt 2016). Thus, the prevalent usage situation of RIAs is complementary to traditional telecommunications services. Consequently, to account for the new competitive landscape, policymakers should consider levelling down existing regulations on telecommunication service providers rather than imposing the same rules on RIAs.

If overly prescriptive regulation precludes the Vietnamese market from certain functions, then there may be particular impact on local applications' potential to compete on a global level. Furthermore, since the added value of RIAs for consumers is strongly linked to their functions, such a prescriptive regulatory environment may equally preclude Vietnamese consumers from benefiting from such functions. This calls for a light touch regulation for all RIAs, domestic and global to help promote innovation and support consumers in market.

The present study showed that this added value for the consumer can be captured in the consumer surplus. This amounts to US$145 for every RIA user. In total, that represents US$6.4 billion for Vietnam. This figure is conservative as it only captures the main functions of RIAs and cannot fully account for the fact that, for many consumers, smartphones in combination with RIAs are the first infrastructure that that enabled the sending of rich communication content across long distances at affordable prices.

Our analysis further showed that there is a substantial contribution of RIAs to GDP in Vietnam. In total, it amounts to an economic impact of US$39 billion in Vietnam for the 16-year period from 2000 to 2015. The impact of telecommunications and the internet were US$33 billion and US$49 billion, respectively, over the same period of time.

While our estimates for the consumer surplus and RIAs' impact on GDP provide a quantification of the impact of RIAs in Vietnam, the examples collected in the qualitative analysis of this report breathe life into the numbers. Local businesses use RIAs to connect to their customers. In fact, in Vietnam more notably than in most other countries, social commerce is particularly important to the economy and RIAs have been instrumental in this trend. Without the direct and rich interaction between seller and customer, social commerce would probably not have gained the same importance in the country. As part of the quick interaction that RIAs offer to businesses and their customers, it is particularly noteworthy that due to the flexibility that RIAs offer, they appear to enable female entrepreneurs in Vietnam. This impact is possible due to the ubiquity of social networks in Vietnam, which enable the broad reach that is essential when marketing one's products and services.

Beyond e-commerce, this study showed some positive effects of RIAs in the healthcare system, tourism and agriculture. With further innovations in RIAs, one can expect their impact to grow over the next years. Thus, in order for RIAs to continuing to grow the

internet economy in Vietnam, policies that encourage innovation need to be at the center of policymakers' attention. This will foster local growth, business opportunities and jobs.

Specific examples of policies that may discourage innovations in RIAs as well as the ICT sector as a whole include, but are not limited to the following. A ban or overly strict regulations on advertising may reduce investment incentives for local as well as global players. In fact, advertising plays an important role for a wide range of internet business models including various RIAs. Limiting advertising will also limit consumer choice in Vietnam. Specific taxation of digital services or specific business models enabled by the internet is equally counterproductive as it creates obstacles in particular for new entrants. If the tax systems requires a revision in light of structural changes to the economy triggered by digitization, these should be reflected in a holistic approach to adapt the system rather than developing specific requirements for digital economy related services. Local content one key success factor for digital services around the world. It is also one of the key drivers for local entrants to the markets as this report shows in the case of RIAs. Zalo and other local applications are successful because they are tailored to the need of local consumers. If globally active digital firms want to be successful in the long-term, they also need to cater to local preferences. The importance of consumer choice is further enhanced by modern digital services that allow for personalization and on-demand delivery. Consequently, the reality of today's consumer behavior and demand call for new and flexible regulatory approaches such as co-regulation instead of traditional broadcasting regulations and licensing requirements. Co-regulation approaches will help address local concerns while at the same time, allow for innovation in the local content creation market.

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 of 0.34%
Sridhar & Sridhar (2007)	Regression on panel data from 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 for 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 of 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% in the following year.

Authors	Methodology	Dependent variable	Key explanatory variable (and covariates)	Range of impact on GDP
Rafert & Mate (2017)	Regression of panel data from 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. 2017a)	Regression on panel data from 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 while for internet usage the increase is 0.041%
ICRIER (2017)	Regression on panel data from 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

VARIABLES	(1) telecom Log(GDPpc)	(2) internet 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)
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. (2017a), p.35.
Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

The table above 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 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 the 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.[35] 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.[36] The internet index covers indicators that capture internet usage.[37] 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.

---

35 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.

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

37 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.

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).

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 as given by equation 2:

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

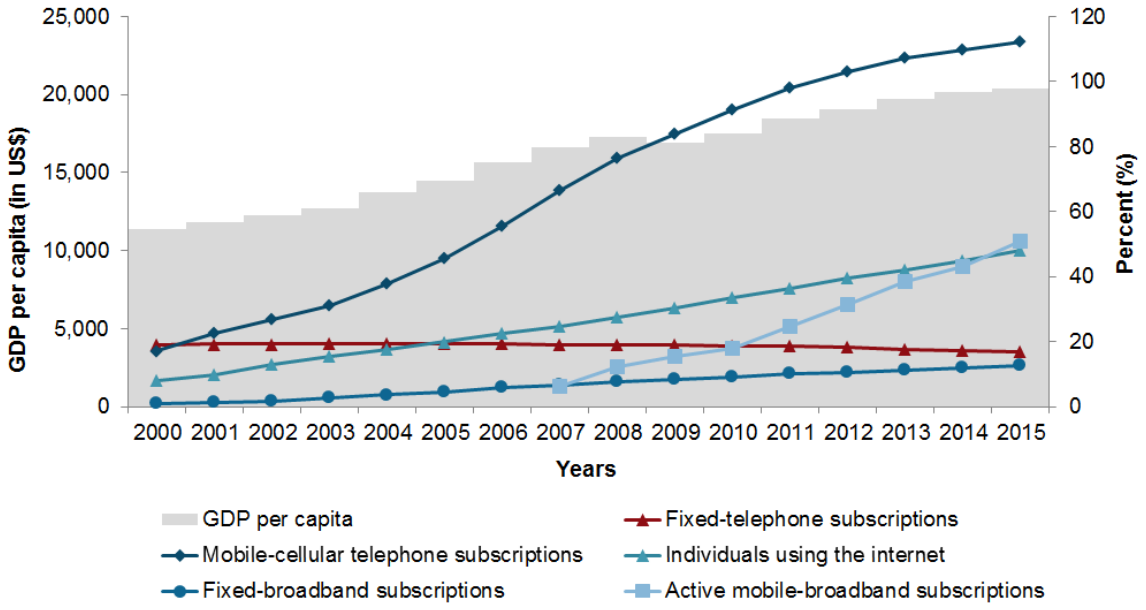
In equation 2, $\log(GDPpc_{jt})$ is the dependent variable referring to the PPP-adjusted level of GDP per capita (common logarithm of economic output) for country *j* in year *t*. β_0, β_1 and β_2 are the parameters to be estimated. The independent variables are $\log(K_{jt}/L_{jt})$ as the common logarithm 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 $GDPpc_{jt}$ 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 Table A2-1 above.

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 the telecommunications and internet sectors

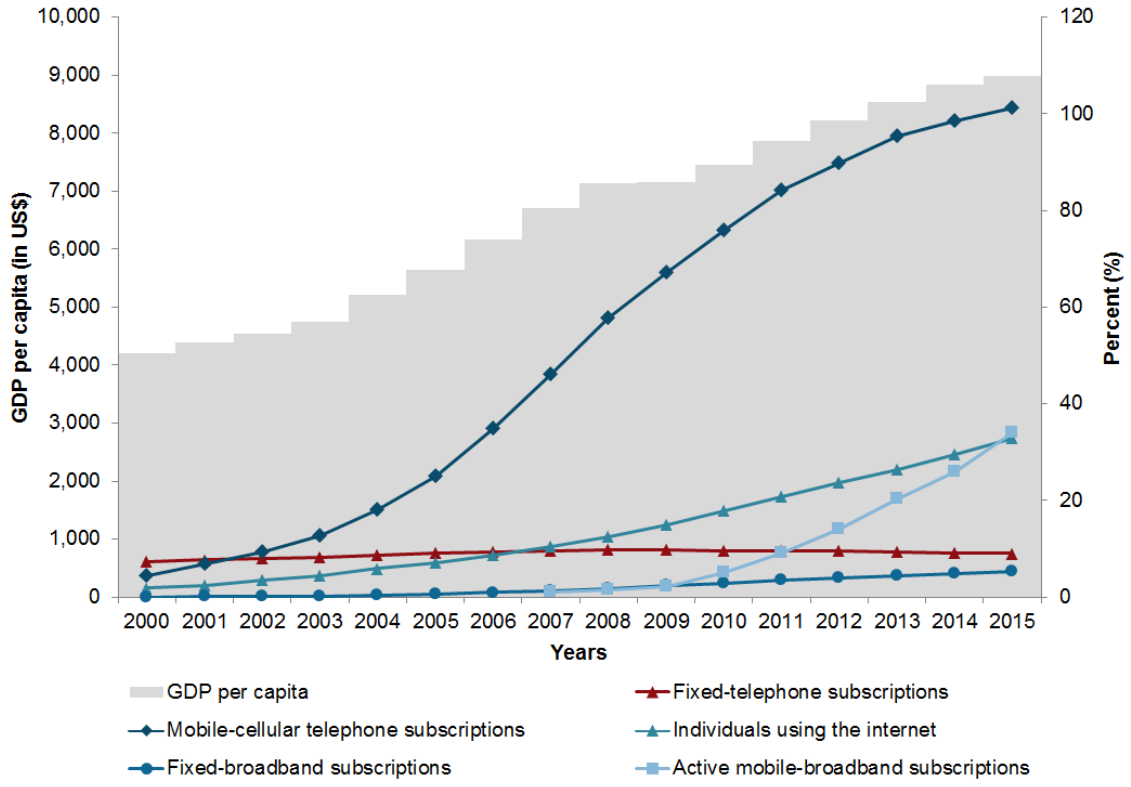


Source: Arnold et al. (2017a), p. 69.

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.

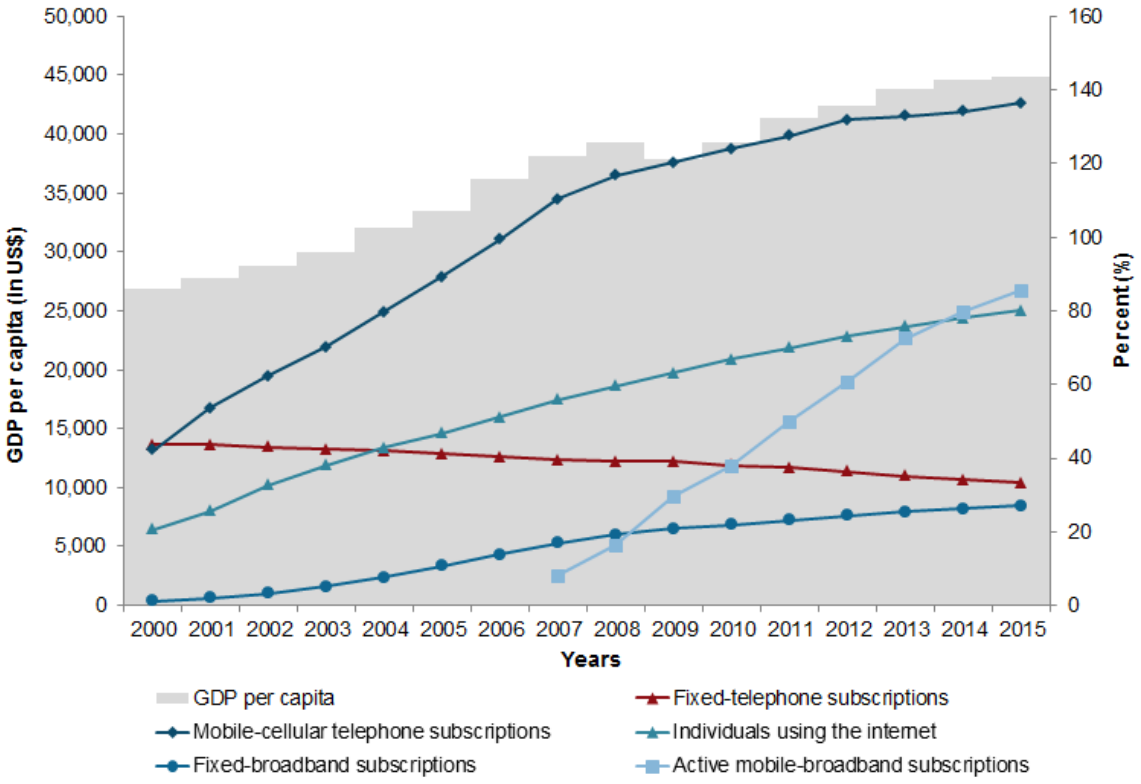
The global average impact of these technologies ignores the differences at the micro-level. As a result, looking at the difference between developing and developed countries reveals more insights about the relative economic impact of RIAs. The following two figures show the development of the indicators,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

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



Source: Arnold et al. (2017a), p. 70.

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



Source: Arnold et al. (2017a), p. 71.

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 highlighting the importance of the role of economic development in mobile broadband infrastructure. As a result, there is a higher relative value creation in 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 for 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 Vietnam

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 additional 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. (2017a) 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 first of all estimate the impact of telecommunication usage on GDP and the impact of internet usage on GDP as a proxy for the "full internet experience". The impact of RIAs had to lie somewhere between these two. The impact of telecommunication usage and internet usage were estimated using a fixed-effects Cobb–Douglas production function framework using panel data from 164 countries from a 16-year period between 2000 and 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).[38]

To derive the economic value of NGIBAs in India, ICRIER (2017) conducted an approach different from Arnold et al. (2017a). 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 average GDP 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 NGIBAs of a minimum of US$20.4 billion in India in 2015–2016.

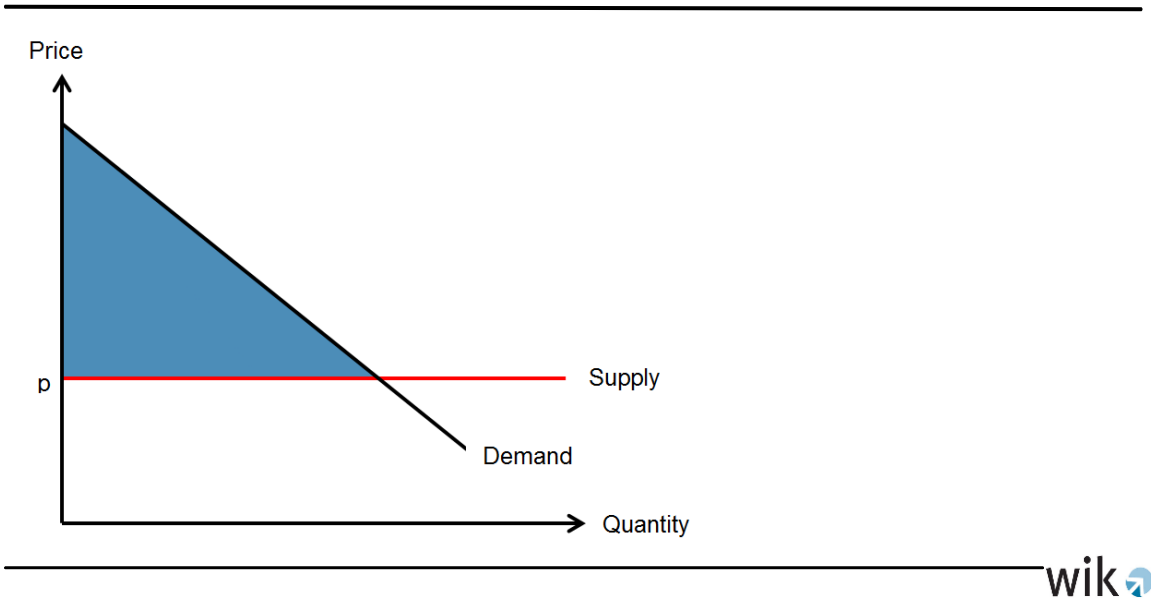
Focusing on the consumer surplus as a way of estimating the economic impact of RIAs is, to the best of our knowledge, a rather new approach. It is also rarely applied for similar analysis of related subjects like the internet economy as a whole. McKinsey & Company (2010) estimated the consumer surplus 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

38 For detailed information see Annex 2.

in Europe. However, as far as we are aware, approaches directly addressing the consumer surplus of RIAs are missing from the literature.

Traditionally, 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 that 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.

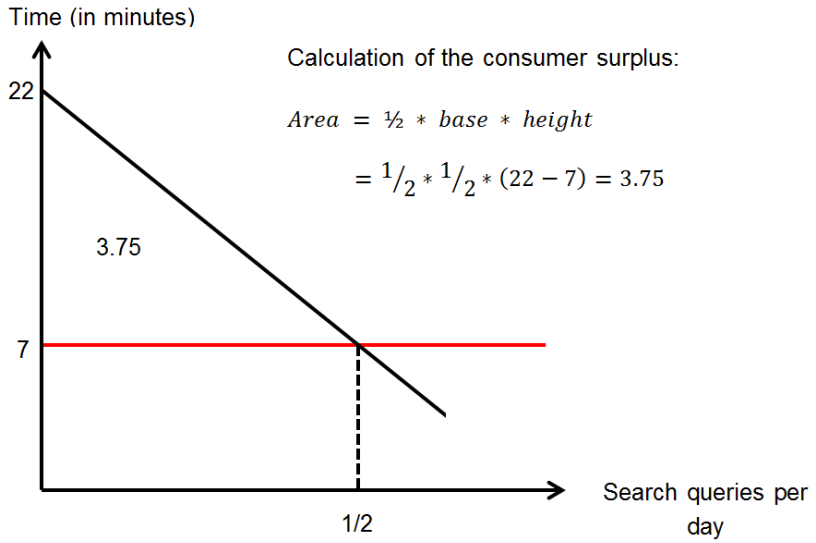
Figure A3-1: Graphical representation of consumer surplus estimation



Source: Arnold et al. (2017b), p. 32. The authors' 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 calculating 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.

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



Source: Arnold & Schiffer (2011).

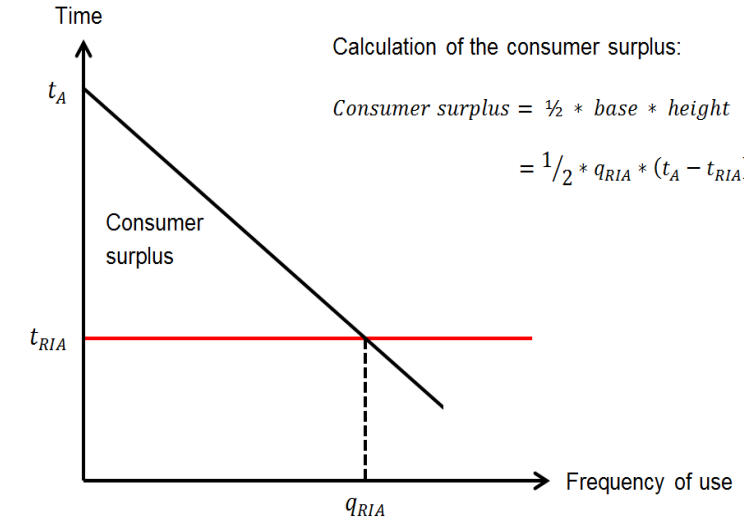
Arnold & Schiffer (2011).find that a typical user might save around 3.75 minutes per day. Assigning that time to the average wage in America, the consumer surplus accounts for almost US$500 per user annually.[39]

Arnold et al. (2017b) adopted a similar approach to estimate the consumer surplus created by RIAs in India. The authors' conducted a survey among Indian internet users to explore the alternatives that consumers would use for each functionality of RIAs 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) sending videos, (5) sending pictures, and (6) group chat. After indicating the frequency of use for each functionality, participants were asked about the potential alternatives. A predefined 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. This questioning provided information about how much time consumers would be able to save by using RIAs when compared to the (traditional) alternatives if RIAs were unavailable to them.

39 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.

The approach of the calculation of the consumer surplus is graphically illustrated in Figure A3-3. Here, t_{RIA} denotes the time spent using an 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.

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



Source: Arnold et al. (2017b), p. 34. The authors' own representation based on Arnold & Schiffer (2011).

The total weekly time savings for each functionality was than 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.

To investigate the consumer surplus of RIAs in Vietnam, we adopted the same approach as Arnold et al. (2017b). The same survey was conducted among Vietnamese internet users in June 2018 for the analysis. In total, we received 1,000 usable questionnaires from a representative online panel. After adjusting the data for outliers we yield the following time savings, corresponding to the considered core functionalities, which are listed below in Table A3-1.

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	1.1 minutes
RIA video calls	Regular call Visit Letter Regular SMS Other	1.6 minutes
RIA texts	Regular call Visit Letter Regular SMS Other	2.9 minutes
RIA pictures	Visit Letter Regular SMS Other	6.2 minutes
RIA video	Letter Other	18.0 minutes
RIA group chat	Regular call Visit Letter Regular SMS Other	4.0 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.

In total, the consumer surplus created by RIAs in Vietnam amounts to US$6.4 billion (VND145.0 trillion) in 2018. To arrive at this result, the time saved was valued based on the average income in Vietnam (VND60.792 million). RIA users in Vietnam are saving almost 242 minutes per week due to RIAs.

Annex 4: RIAs in the WIK database

2go
Ace
Air Chat
AireTalk
Airplane Messenger
Alien chat
ananse.im
Avaamo
Badoo
BBM
Beam
BeepTool
BeeTalk
Bigo
BiP
Bit Chat
Bleep
Blend
BM Chat
Briar
Bridgefy
Brosix
BubCon
Care Messenger
Catfiz
Charge Messenger
Chat
Chat offline
ChatCall
Chatcrypt
Chatscene
Chattr
Chiffry Secure Messenger
chomp SMS
class messenger
clear messenger
cloudveil
Coco
Community Msg
Confide
Conversations
Crypto messenger
Cryptocat
Dasher
Discord
Disney MIX
Dooray
Dust
eBuddy
Ekiga
ELEET
Facebook Messenger
Facetime
fairchat
Fire Message
FireChat
Fleep
Fling
Flock
Flows
Gadu-Gadu
GeckoLife
GiggleMail
Glide
Google Allo
Google Hangouts
GroupMe
HeyTell
Hi
Hike
HipChat
Hipe
Hoccer
Hood
Howfar
IBM Connections Chat
ICQ
iMessage
imo
Instagram
invi
Jaxtr Mobile
JioChat
Jongla
Jott
JusTalk
KakaoTalk
Kids in Touch
Kik
KingsChat
Koda Chat
kontalk
LemeTalk
LIFE
Line
Linphone
lively Messenger
localoca
Lookup
loopytime
Loud-Hailer
lovoo
Lua HIPAA
Maaii
Maily
Mara Online
Matrix
Meet4U
MeetMe
MessageBird
Messenger privé
Mico
micro focus
migme
mocha
Monster Messenger
mysms
NearPeer
Nepali
n-gage
NickEgo
Nimbuzz
OfflineChat

Ogo
Omlet Chat
ooVoo
Page Messenger
Paktor
Palringo
Paltalk
parent
Pelichat
Pinch
Pinngle
PLAYMessenger
PoaApp
Postman
qeep
QIP
QQ
Rawr
razer comms
react
Reel
Roovet Messenger
Rush
Satellite
Saya
Secure Text
Sendboo
Signal
Silent Phone
SIMSme
Skype
Slack
Snapchat
Softros LAN
SOMA
Sqoolz Connect
stashcat
Surespot
Talkatone
talkbox
Talkray
TamTam
Tango
TeamSpeak
Telegram
Telepathy
Text Me
TextFree
TextPlus
textra SMS
The Serval Mesh
thismo
Threema
tigertext
Tinder
Tinychat
Tox
Trillian
Twnel Messenger
Uniheld
Unseen Messenger
UppTalk
Verizon Messages
Vero
Viber
vidogram
viettalk
Vista
Vk.com Messenger
VMC Next Messenger
vobee
Vojer
Voxer
Vsee
Wakie Community
Waplog
Watts App
Wave 'Off The Grid' Chat
WeChat
WhatsApp
WhatsApp Business
Whispeer
Wickr
Wire
Xmpp Messenger
Yahoo! Messenger
YeeCall
YikYak
Yo
Yzer Chat
Zalo
zangi
Zap Zap
Zello
Zello Work
Zipt
ZombieChat

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 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

A.T. Kearney. 2016. The ASEAN Digital Revolution.

Anh, Nguyen Hoang, Hoang Truong Giang, Du Vu Hoang Tuan, & Hoang Bao Tram. 2016. A Review of Women's Entrepreneurship in Vietnam Taking into Account Socio-Cultural Norms and the Institutional Ecosystem - Working Paper No. 11/2016. World Trade Institute.

Appota. 2017. Vietnam Mobile Report Q2-2017. Ha Noi City: Appota.

Arnold, René, Christian Hildebrandt, Peter Kroon, & Serpil Taş. 2017a. The Economic and Societal Value of Rich Interaction Applications (RIAs). Bad Honnef: Wissenschaftliches Institut für Infrastruktur und Kommunikationsdienste (WIK).

Arnold, René, Christian Hildebrandt, Peter Kroon, & Serpil Taş. 2017b. The Economic and Societal Value of Rich Interaction Applications in India. Bad Honnef: Wissenschaftliches Institut für Infrastruktur und Kommunikationsdienste (WIK).

Arnold, René, Christian Hildebrandt, & Martin Waldburger. 2016. "Der Markt für Over-The-Top Dienste in Deutschland." *WIK-Diskussionsbeitrag Nr. 409, Bad Honnef*.

Arnold, René, & Marleen Schiffer. 2011. Faktor Google- Wie deutsche Unternehmen Google einsetzen. Study by IW Cologne.

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, Arlington, VA, 30th September to 1st October.

Arnold, René, & Serpil Taş. forthcoming. The Economic and Societal Value of Rich Interaction Applications in Brazil. Bad Honnef: Wissenschaftliches Institut für Infrastruktur und Kommunikationsdienste (WIK).

Asia Pacific Foundation of Canada. 2017. 2017 Survey of Entrepreneurs and MSMEs in Vietnam - Building the capacity of MSMEs through technology and innovation. Vancouver, BC: Asia Pacific Foundation of Canada.

Asian Development Bank. 2018. Asian Development Outlook (ADO) 2018: How Technology Affects Jobs. Manila: Asian Development Bank.

Bain & Company. 2017. Digital Economy in Southeast Asia - Current Outlook and Beyond.

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.

Cameron, A., T. Pham, & J. Atherton. 2018. Vietnam Today - first report of the Vietnam's Future Digital Economy Project. Canberra: CSIRO.

Chakravorti, Bhaskar, Ajay Bhalla, & Ravi Shankar Chaturvedi. 2017. "60 Countries' Digital Competitiveness, Indexed." Harvard Business Review Accessed 06/25/2018. https://hbr.org/2017/07/60-countries-digital-competitiveness-indexed.

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.

Czernich, Nina, Oliver Falck, Tobias Kretschmer, & Ludger Woessmann. 2011. "Broadband Infrastructure and Economic Growth." *Economic Journal* 121 (552):505-532.

Damuri, Yose Rizal, Vidhyandika Djati Perkasa, Fajar B. Hirawan, & Dandy Rafitrandi. 2018. Rich-Interactive-Applications (RIA) in Indonesia: Value to the Society and

the Importance of an Enabling Regulatory Framework. Center for Strategic and International Studies (CSIS) & Asia Internet Coalition (AIC).

DellaFera, C Anthony, Mark W Eichin, Robert S French, David C Jedlinsky, John T Kohl, & William E Sommerfeld. 1988. "The Zephyr Notification Service." USENIX Winter.

Ecomobi. 2017. "Vietnam - Digital Landscape 2017."

Farhadi, M., R. Ismail, & M. Fooladi. 2012. "Information and Communication Technology Use and Economic Growth." *PLOS One* 7 (11):1-7.

Fornefeld, Martin, Gilles Delaunay, & Dieter Elixmann. 2008. The Impact of Broadband on Growth and Productivity - A study on behalf of the European Commission. Düsseldorf: MICUS Management Consulting GmbH.

Gill, Vijay. 2005. Analysis of Design Decisions in a 10G Backbone.

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.

Hemmendinger, David. 2014. "Messaging in the early SDC time-sharing system." *IEEE Annals of the History of Computing* 36 (1):52-57.

ICRIER. 2017. "Estimating the Value of New Generation Internet Based Applications in India."

IFC. 2014. E- and M-Commerce and Payment Sector Development in Vietnam: A survey of e- and m-commerce providers and users and how payments and logistics services can support market development. Washington, D.C.: International Finance Corporation - World Bank Group.

ILO. 2011. Creation of an enabling environment for women entrepreneur in Vietnam: Mainstreaming gender issues in government policy on enterprise development. Geneva: International Labour Organisation.

ILO. 2016. ASEAN in Transformation: How technology is changing jobs and enterprises. Geneva: International Labour Organisation.

ITU. 2012. Impact of Broadband on the Economy. In *Broadband Series*.

ITU. 2015. Economic Impact of Broadband Infrastructure and Services - Global Review of Evidence. International Telecommunications Union.

ITU. 2017. Yearbook of Statistics 2017 - Telecommunication/ICT Indicators 2007-2016. Geneva: International Telecommunication Union.

ITU. 2018. Digital Skills Toolkit. Geneva: International Telecommunications Union.

James, Michael L., C. Edward Wotring, & Edward J. Forrest. 1995. "An Exploratory Study of the Perceived Benefits of Electronic Bulletin Board Use and their Impact on other Communication Activities." *Journal of Broadcasting & Electronic Media* 39 (1):30-50.

Jones, Stephanie, & Rafael Masters. 2016. Opening up to International Investment and Diversification – a case study of Vietnam. Working Paper No. 2016/7. Maastricht: Maastricht School of Management and Ho Chi Minh University of Technology.

Koutroumpis, Pantelis. 2009. "The econmic impact of broadband on growth: A simultaneous approach." *Telecommunications Policy* 33 (9):471-485.

Mandel, Michael, & Elliott Long. 2018. The App Economy in Vietnam, 2017. Washington, D.C.: Progressive Policy Institute.

Marvin, Rob. 2015. "Vietnam's Tech Boom - A look inside Southeast Asia's Silicon Valley. ." *PC Magazine*, October 2015.

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*.

McNabb, Marion Elizabeth. 2016. "Introducing mobile technologies to strengthen the national continuing medical education program in Vietnam." Boston University.

Montagnon, Christophe, & Danielle Knuepple. no date. Ensuring the future of coffee - The WCR Global Coffee Monitoring Program.

Nguyen, Dat. 2018. "The rise of social network retailers in Vietnam." *VNExpress*, 18. May 2018. https://e.vnexpress.net/news/business/the-rise-of-social-network-retailers-in-vietnam-3752449.html.

Nguyen, Huy, & Marc Schiffbauer. 2015. Internet, Reorganization, and Firm Productivity in Vietnam. Background paper for the World Development Report 2016. Washington, D.C.

Nguyen, Thanh-Huong. 2017. "Vietnamese Mumpreneurs? Middle-class Mothers Negotiating Motherhood and Work in Northern Vietnam." Master, Centre for East and South-East Asian Studies, Lund University, Sweden.

Nylander, Johan. 2016. "Why Vietnam could be the next Silicon Valley." *Asia Times*, 09 December 2016.

PriceWaterhouseCoopers. 2016. They Say They Want a Revolution: Total Retail 2016.

Qiang, Christine Zhen-Wei, Carlo M. Rossotto, & Kaoru Kimura. 2009. "Economic Impacts of Broadband." In *Information and Communications for Development 2009 - Extending Reach and Increasing Impact*, edited by World Bank, 35-50. Washingtion, DC: World Bank.

Rafaeli, Sheizaf. 1984. "The Electronic Bulletin Board: A Computer-Driven Mass Medium." *Social Science Micro Review* 2 (3):123-136.

Rafert, Greg, & Rosamond Mate. 2017. The Global and Country-Level Economic Impacts of WhatsApp. Boston: Analysis Group.

Roeller, Lars-Hendrik, & Leonard Waverman. 2001. "Telecommunications Infrastructure and Economic Development: A Simultaneous Approach." *American Economic Review* 91 (4):909-923.

Sodano, Dustin. 2017. Global Social Media Stat Pack - Platforms, Users and Devices.

Sridhar, K. S., & V. Sridhar. 2007. "Telecommunications Infrastructure and Economic Growth: Evidence from Developing Countries." *Applied Econometrics and International Development* 7 (2):37-61.

Van Vleck, Tom. 2012. "Electronic Mail and Text Messaging in CTSS, 1965-1973." *IEEE Annals of the History of Computing* 34 (1):4-6.

We are social. 2018. Digital in 2018 in Vietnam - Essential insights into internet, social media, mobile and ecommerce use across Vietnam.

Woetzel, Jonathan, Oliver Tonby, Fraser Thompson, Penny Burtt, & Gillian Lee. 2014. Southeast Asia at the crossroads: Three paths to prosperity. McKinsey Global Institute.

WomenBizPH. 2017. ASEAN Women Entrepreneurs' Network Creating an ASEAN Business Connection. Manila: Women's Business Council Philippines.

World Bank. 2016. World Development Report 2016: Digital Dividends. Washington, D.C.

Zhu, Lei, Orhan Kara, Hung M Chu, & Anthony Chu. 2015. "Female Entrepreneurship: Evidence from Vietnam." *Journal of Business and Entrepreneurship* 26 (3):103-128.