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The Economic Value of the App Economy in India

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We are very grateful to our project sponsor, Broadband India Forum (BIF), for giving us an opportunity to undertake research on the App economy that closely contributes to India's digital ambitions.

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Executive Summary

As the Gross Domestic Product (GDP) in India grows, the contribution from digital economies will increase. Within digital, as the smartphone penetration keeps increasing, the contribution from the apps will continue to burgeon. The purpose of this report is to estimate the value that apps bring to the economy at large by 2030. Our methodology can be summarized as follows:

- First, we look at the projections of yearly GDP of India till 2030 and calculate the growth rate year on year.
- Next, we look smartphones penetration in India and estimate the number of smartphones that are likely to be in India by 2030.
- We then look at the amount of money spent by a smartphone user in India per hour, currently. We assume that it grows at the rate of 2.5 times the GDP growth to project the amount of money spent per hour per smartphone as of 2030. This multiplier of 2.5 is obtained from the existing reports on the growth of digital economy.
- Finally, we estimate the number of hours spent by a smartphone user per day, all the way till 2030.
- Total money spent on app economy can be estimated by multiplying growth rate in hours spent on a smartphone per day with number of smartphones and amount of money spent per hour on a smartphone and 365.

Our main conclusion is that by 2030, the amount of money spent on apps is likely to be around USD 800 billion. Given that the Indian economy is expected to be around USD 6600 billion, the app spending is likely to be around 12% of the GDP. We further estimate that the growth in app economy is around 32%, more than four times the GDP growth. This is because app economy has a significantly larger multiplier in the form of smartphone users and economic growth.

Therefore, our estimates can be looked at as a lower bound of the impact of apps on the overall economy. Further, if the Indian Government increases its push towards digitization and more and more businesses shift towards apps, this number is likely to be significantly higher than what we estimate.

1. Introduction

The digital economy is growing 2.5 times faster than the global economy and constitutes 15.5% of it.[1] High speed Internet, digital infrastructure for public and government services, ability to leverage Internet resources for personal and professional growth and access to a wide variety of social and entertainment content are considered as core aspects of life. The extent of their availability to citizens reflects the digital "progress" and level of economic development of any nation.

India's aspiration to be a $5 trillion economy in the next few years is premised on a contribution of $1 trillion from the digital economy.[2] In 2020, the core digital sectors contributed to 7-8% of the GDP.[3] India's export of ICT related services is among the highest in the world. Core digital sectors could more than double in size by 2025 and each of the several newly digitising sectors could contribute $10 billion to $150 billion of economic value.[4] To exploit the opportunities offered by new digital applications that are expected to create up to 65 million jobs for Indians by 2025, it would require re-training and re-deployment of nearly 45 million workers.[5]

India's nearly 610 million smartphone users, of a total mobile subscriber base of nearly 1.2 billion in 2021, is growing steadily.[6] Data consumption in India has reached nearly 17 GB/month/user, growing at a CAGR of nearly 50% from 2017 to 2022, as the global average touched 15 GB/month.[7] According to a study by the Progressive Policy Institute[8], there were an estimated 1.674 million App Economy jobs as of August 2019 and are further increasing.

Besides the digitally-led growth in core sectors, the Indian Government is focusing on digitalization as a key instrument of its strategic thrust on development. With the emergence and establishment of a digital eco-system spurred by the increasing adoption of mobiles and smartphones and the availability of higher-speed telecom networks, the digital start-up system in India has seen a spurt in growth. India has the third largest start-up system with nearly 20% of them being digital. Of these, those that reach Unicorn status are largely in the digital domain. Of the IPOs in the last four years, the total issue size by value of those in the digital domain was 69% of the total issue size by value of all IPOs during this period (Appendix 1).

The Indian Government's role in creating the institutional infrastructure in the digital financial sector such as Unified Payment Interface (UPI), QR codes and Bharat Interface for Money (BHIM), supported by the start-up ecosystem that popularized digital payments, have been instrumental in the spread of digital financial transactions. These cover a wide variety of instruments (payments, bills, insurance, etc.) and institutions (banks, wallets, POS, etc). Development of the UPI interface has led to greater formalization of the

1 https://www.oxfordeconomics.com/resource/digital-spillover/

2 "Report on "India's Trillion Dollar Digital Opportunity" by Ministry of Electronics & IT, published on February 20, 2019; https://pib.gov.in/PressReleaseIframePage

3 https://economictimes.indiatimes.com/news/economy/indicators/government-working-to-increase-digital-economys-contribution-to-20-of-gdp-in-5-years/articleshow/78133091.cmsaccessed on December 5, 2019

4 https://www.mckinsey.com/~/media/mckinsey/business%20functions/mckinsey%20digital/our%20insights/digital%20india%20technology%20to%20transform%20a%2

5 ibid

6 Nielsen's India Internet Report 2023

7 Nokia MBiTIndex, www.nokia.com/sites/default/files/2021-02/Nokia-MBiT-2021.pdf

8 https://www.progressivepolicy.org/wp-content/uploads/2019/09/PPI_IndianAppEconomy_V3-1.pdf

economy, deepening of financial inclusion and lowered dependence on existing card-based systems (whose penetration in India was in any case very low). Wide adoption of UPI by apps has increased app-based usage, as earlier systems based on card payments would have had lower adoption rates due to the poor penetration of card-based systems in India.

Roll out of 5G and increased device sophistication will lead to greater growth of the app economy. With lower latency, much higher speeds, ultra reliability and massive machine to machine sensor networks support in 5G protocols, app adoption is likely to go up significantly. On the content side, increasing vernacular content and greater penetration in tier 2 and 3 cities as well as rural areas will accelerate the growth of the app economy. Increasing products and services through mobile and apps, including government services, will provide a further impetus.

In this context, it becomes imperative for policymakers to understand the extent of the app economy, its role in economic growth and its implications for policy.

2. What is the App Economy?

In this study, the App Economy refers to the range of economic activities surrounding mobile applications. These involve the development and sale of apps, in-app purchases, subscriptions, advertisements, public relations generated by free apps and the hardware devices and software on which apps are designed to run. Apps are generally available through the iOS or Google Play Store.

Apps have a variety of monetization mechanisms. Some apps are free to use (for example, Google search or map). Such apps utilize the data generated through customer transactions for targeted ads, sell such data to third parties or utilize it for other VAS. Other apps require payments for use in the mode of monthly or yearly subscriptions. Several apps allow for in-app purchases, creating a mechanism for additional revenue

generation. Ads that are shown to users is another source of revenue. Apps also create opportunities for talk shows, performances, merchandise, etc. in the real world. Besides creating business opportunities for web publishers and app developers, the app economy has created opportunities for professionals for mobile advertising, analytics and other related fields.

A wide variety of functionalities across a variety of domains provided by apps has led to their popularity. These have created new business models with alternate channels of consumption of content impacting advertising, entertainment, education and health. In general, Apps are increasingly contributing to the digital economy and are specifically contributing to the growth of the app economy.

An Ecosystem View of Mobile, Apps and Platforms

The App Ecosystem has the following elements:

1. Smartphone (manufacturers) on one side and content providers on the other
2. App stores
3. Advertisers
4. Users
5. App developers

This is shown in Appendix 2.

Various revenue models have evolved for apps in different domains/verticals. These are:

1. Payment for Downloads:
    a. Subscription (Netflix, Amazon Prime)
    b. In-app Purchases (Amazon Prime, Games, Premium Content)
2. Advertisers
3. M-commerce: Only contribution of products/services that would otherwise not be consumed if these were not on apps (taxi ride hailing apps)

Appendix 3 gives a profile of India's Mobile App Industry by Verticals

Drivers and Enablers of the App Ecosystem

a. Hardware innovation is expanding the potential of apps
b. Apps and networks are independent but complementary
c. Digital platforms are proliferating
d. Indian success in the mobile apps era. Indian app developers earn a sizeable share of global app revenues
e. Socio-economic factors leading to increasing adoption of smartphones
f. Government's investment in institutional digital infrastructure

g. Increasing Scope of Apps (Apps in all spheres: Education, health, fitness, social media, gaming)

h. Increasing Engagement:
   - shorter video formats
   - local language
   - voice search
   - AR/VR
   - Artificial Intelligence (Chatbots, Assistants etc.)

i. Increased spend on Apps:
   - Increasing incomes
   - Greater smartphone adoption
   - Falling telecom prices

App Development Revenue

The country that generated the most revenue from app development in 2019 was the United States. This figure stands at $602 million for the US in 2019. In comparison, the total revenue generated from app development in India in 2019 was $195 million. Appendix 4 gives a profile across USA, China, India, UK and Germany. India's app development market revenue is expected to reach US$ 1,662.4 million in 2022 and increase at a compounded annual growth rate (CAGR) of 9.2% to reach US$ 2,364.6 million in 2026.[9]

The Progressive Policy Institute (PPI) expects India to overtake the US as the country with the largest developer population by 2024. The growth of low-code/no-code app development, which requires low to no knowledge and application of coding languages, is further expected to boost growth in this market.

The App Ecosystem and its Contribution to the GDP

Besides the direct effect of the App Economy on the GDP, there are spill-over effects in the supply industries (computer hardware, telecommunication and ICT services). These are called the indirect effects. Further, tertiary effects due to subsequent effects in the economy arising out of increased incomes and spending in the supply chain industries are called induced effects.

An increase in sales in the App Economy not only gives rise to an increase in GDP but also creates a multiplier effect through indirect and induced effects. This is because the value through digitalization is not limited only to the sector in which this happens but influences both downstream and upstream sectors in the entire supply chain.

9 www.ibef.org/research/case-study/india-s-rapidly-evolving-app-development-market

3. Literature Review

There are only a few studies that study the economic contribution of apps especially in an Indian context. The key studies in this area are:

a. A 2017 study by ICRIER[10] estimated the contribution of the Internet and App Economy for 19 Indian states. It used Internet traffic from 2013 to 2016 in these states and estimated the Internet usage elasticity using instrumental variable regression by modelling the effect of capital, labour, and total and mobile Internet traffic on GDP. Estimates of the growth elasticities showed that a "10% increase in India's total Internet traffic, delivers on average a 3.3% increase in India's GDP, and a 10% increase in India's mobile Internet traffic, delivers on average a 1.3% increase in India's GDP".

b. A study by WIK Consultants[11] estimated the consumer surplus generated by apps in India in 2016. This was based on an analysis of 1019 survey questionnaires. The study used consumer surplus (difference between what consumers are willing and able to pay for and the actual price that they pay) as an economic measure of consumer benefit. The study examined the time saved in using the basic functionalities such as calling (both audio and video), texting, sending pictures and videos and group chats, in what the study called "Rich Internet Applications". This was multiplied by the average annual income in India to arrive at an annual consumer surplus of $98 billion for India in 2016 or equivalent to 4.3% of GDP that year.

c. "The App Economy in Europe – A review of the mobile app market and its contribution to the European Economy", done by Deloitte[12] in August 2022, is the most recent international study. Given the fast-paced evolution of this market, this is most relevant for our study.

   The study identified the various sources of contribution to the app economy as follows:

   Direct contributions consisting of:

   - Advertising revenue
   - Paid downloads, subscriptions, and in-app purchases:
   - Contract work
   - Mobile commerce (only to the extent that it enables supply of goods and services that would not be possible in the absence of an app, say ride hailing apps)

   Indirect contributions: consisting of supplier relations and spending by people employed in core app economy jobs and its suppliers.

   Indirect impacts are estimated using an Input-Output model and data for EU and UK. The model enables us to assess the additional value introduced by the app economy in the other sectors of the EU and the UK economy (beyond the sector where the direct revenue is generated).

10 Kathuria, R., Kedia, M., Varma, G. S., & Bagchi, K. (2017). Estimating the Value of New Generation Internet Based Applications in India (No. id: 12034). Available at https://ideas.repec.org/p/ess/wpaper/id12034.html

11 Arnold, R. (2017). The economic and societal value of rich interaction applications in India. available at http://www.zbw.eu/econis-archiv/bitstream/11159/2800/1/WIK-BIF_Report_-_The_Economic_and_Societal_Impact_of_RIAs_in_India.pdf

12 https://actonline.org/wp-content/uploads/220912_ACT-App-EU-Report.pdf

In the EU and UK, the total economic impact of the mobile app market in 2021, including in-app ads and the net contribution of online sales generated on mobile apps, represents € 210 b and € 86.5 bn in revenue, throughout all sectors of the economy respectively. This is equivalent to 0.7% of the EU gross domestic product and to 1.5% of the UK GDP in 2021.

d. A 2022/23 report by Oxford Economics[13], in which it worked closely with YouTube in the second quarter of 2022, measured the YouTube's economic, societal, and cultural impact across India. The study quantified the jobs and GDP outcomes generated by the platform and examined YouTube's ripple effects on adjacent industries and individuals' quality of life. The study was based on a survey of YouTube users and creators across the country as well as qualitative case studies. The study found that YouTube and its Ecosystem contributed nearly Rs 10,000 cr to India's GDP and supported more than 7,50,000 FTE jobs in 2021.

Summary

The ICRIER study recognized that Internet traffic did not accurately reflect usage but used it since data on usage of apps in terms of time or revenue generated was hardly available during the study period.

The WiK study examined consumer surplus of apps in terms of very basic functionalities. The study recognized that consumer surplus in provision of innovative services is not captured by the identified functionalities and to that extent underestimates the economic value generated through apps.

However, since the app economy is also considered the attention economy, assessments of economic value should take into account usage time and economic measure of value. We attempt to address this aspect in the current study. Our study is also driven by the significant changes in the internet usage in India and the launch of 5G that requires a relook at the value of the app economy.

4. Issues in Measuring Contribution to the App Economy through GDP

GDP is estimated based on market prices and quantities of goods and services transacted. Several apps are highly valuable due to their ability to greatly reduce search cost, enhance breadth of choices or provide innovative services/business models. Examples are Google search or maps, Amazon for purchase of physical and digital goods and Uber for taxi services. Since these apps are free, their contributions to GDP are not directly measured. This concern has been highlighted by several authors.[14] However, indirect measures such as consumer surplus or advertising revenues as value of utility have been used to measure these impacts.

13 A PLATFORM FOR INDIAN OPPORTUNITY: Assessing the economic, societal, and cultural impact of YouTube in India in 2021, https://www.oxfordeconomics.com/resource/a-platform-for-indian-opportunity-assessing-the-economic-societal-and-cultural-impact-of-youtube-in-india-in-2021/

14 Brynjolfsson, E and A Saunders (2009), "What the GDP gets wrong (Why managers should care)", MIT Sloan Management Review, 51(1): 95-98. Hulten, C R (2015), "Measuring the economy of the 21st century", NBER Reporter, 4: 1-7.

5. Methodology

In order to assess the value of the app economy, we used the following steps:

1. Use the publicly available data on the GDP of India till 2030. Exhibit 1 provides the details of the GDP data of India till 2030.

2. Compute the growth rate of the Indian GDP till 2030. Growth rate is calculated using the standard definition. GDP growth in a given year is the GDP of the given year minus the GDP of the previous year divided by GDP of the previous year. According to the reports published in the popular press, the digital economy is growing at the rate of 2.5 times more than the growth of the economy. Exhibit 2 provides the growth rate of the digital market in India till 2030.

3. According to TechCrunch[15], an average user spent $.03 per hour on apps in India in 2016. We assume that the growth rate of the app economy depends on factors like number of smartphone users, duration of usage of a smartphone and the hourly spent on a smartphone by a user. We assume that the $0.03 spent by a smartphone user per hour in 2016 grows at the same rate as the growth in the digital economy. This hourly spend includes money spent on mobile commerce, app store and in-app advertising.

   Using that growth rate, we project per hour per user spent on apps in India till 2030. Notice that since many businesses are increasingly shifting to apps for several functions including payments, the growth rate of money spent on the app economy is likely to be significantly more than the growth rate of the digital economy. However, for being conservative, we assume that the growth rate of the user spend is the same as the growth rate of the digital economy. Exhibit 3 presents the growth of per hour per user spent on apps in India.

4. Estimate the number of smartphones in India until 2030. We use 2021 smartphone users as a base and determine the growth rate from the data given in the database - Statista. We do not use the projections of smartphone users directly from Statista because comparison between Statista's projections for 2021 far exceed the actual users in reality. Therefore, while we use the growth rates reported in Statista, we use the actual users in 2021.[16] Exhibit 4 shows the penetration of smartphones in India both in absolute numbers and as a fraction of total population. (We use the number of smartphone users as app users as the relevant parameter. While apps are available also on tablets, laptops and desktop, their usage in relation to smartphone is very little. This is evident from the small difference in the number of Internet users (932.2 mn in 2022)[17] versus number of smartphone users (931.3 mn).[18] (Note: In order to get consistency in results, we have used the same source of data: Statista. Data across different sources varies significantly).

5. The next step involves estimating the number of hours spent by a user on smartphones. Current estimates suggest that the time that a smartphone user spends on the phone is around 5.8 hours.[19] We assume that this number is likely to steadily grow to 6.5 hours by 2030.

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15 https://techcrunch.com/2017/06/27/app-economy-to-grow-to-6-3-trillion-in-2021-user-base-to-nearly-double-to-6-3-billion

16 Nielsen's Bharat 2.0 Study

17 https://www.statista.com/statistics/255146/number-of-internet-users-in-india/

18 https://www.statista.com/statistics/467163/forecast-of-smartphone-users-in-india/

19 India's Gen Z spends an average of 8 hours per day online. https://www.nokia.com/about-us/news/releases/2022/03/15/india-recorded-highest-growth-in-mobile-broadband-data-in-2021/

6. The final step involves multiplying the number of smartphone users with the amount of money spent on apps per hour, number of hours spent using smartphones per day multiplied by the number of days in a year (365). Exhibit 5 presents the amount of money spent on app economy every year till 2030.

Annual projections over time: $t \in \{2016, 2017 \cdots, 2030\}$	**Symbols**
GDP projections ($)	G_t
GDP growth rate (%)	e_t
User spent on app per hour ($)	s_t
Growth rate of user spent per hour (%)	r_t=2.5 e_t
Population	P_t
Smartphone users	u_t
App usage per day (hours)	d_t
Value of the app economy ($)	v_t

Since our estimates rely heavily on the amount of money spent by a smartphone user per hour, we verify this number through other approaches as well. Based on our current approach, we are able to predict that the amount of money spent by a smartphone user per hour in 2030 is approximately USD 0.35. For a comparison, in 2016, while an average Indian smartphone user spent $0.03 per hour, the American counterparts were close to $2.5 per hour. Globally, this was around $0.80 per hour per user in 2016. Given these 2016 numbers, our projections for 2030 are conservative.

Techcrunch[20] estimates that in 2021 this number is $0.12, whereas we estimated it to be $0.06. Given these numbers, our projections for 2030 are significantly conservative. Further, the number of smartphone users in India in 2030 is estimated to be around a billion in 2030. This is around 64% of the total projected population. Given that the current smartphone penetration is already around 61% of the overall population, our estimate of 64% as of 2030 is also a conservative estimate.

At the same time, as of 2023, average time spent by a user on smartphones is more than five hours. Our projections show that this number is likely to increase to six and a half hours by 2030, which is also on the conservative side.

Using the above numbers we calculate the total money spent by the users on apps is given by the formula: $v_t = 365 u_t d_t s_t$, where u_t is the number of smartphone users, d_t is time spent by a user on a smartphone per day, and s_t is the money spent per user per hour. Based on this, we project that the likely spending on apps in India in 2030 is around USD 792 billion. Given that the Indian GDP is likely to be around USD 6.6 trillion in 2030, the app economy is expected to be around 12% of the GDP. In comparison, currently that number is around 3%.

20 App Annie Analytics firm analysis, https://techcrunch.com/2017/06/27/app-economy-to-grow-to-6-3-trillion-in-2021-user-base-to-nearly-double-to-6-3-billion/

6. Conclusion

- The estimates of the contribution of the App Economy for 2022 at 3% of GDP need to be seen in the light of similar estimates for the EU and the UK. These were at 0.75 and 1.50% respectively as of 2021. For India, our model estimates this value at 2.0%. The higher number in relation to the EU and UK could be due to the greater mobile payment adoption in terms of number of transactions. Nearly 85% of the total digital transactions in India (that include credit and debit cards, Internet banking, etc.) are mobile payments.
- In the UK, the total transaction value in digital payments is expected to reach $439.30 bn in 2023.[21] The value for India was more than $1.5 trillion in December 2022.[22] This highlights the value of the public financial digital infrastructure facilitated by UPI, Aadhaar, Jan-Dhan Accounts and mobiles. The institutional infrastructure comprising the NPCI, UIDAI and PPPs have been instrumental in the creation of this infrastructure. Innovations such as UPI lite that are not totally dependent on Internet availability will further accelerate app adoption that may have been affected by poor Internet connectivity and expected to accelerate as GDP, smartphone penetration, etc. grows.
- Our analysis shows that the App economy contribution to GDP has a CAGR of nearly 32%, (over 2020-2030) almost 4 times that of the GDP growth rate during the same period. Given this multiplier effect, the Government's role would be to help lower the cost of smartphones through supporting indigenous manufacturing, reviewing tax on imports and accelerating chip manufacturing (medium-term). The PLI is an example of such a support that has facilitated smartphone production in India.
- Our approach is based on the amount of money spent by the user on smartphone apps rather than surrogate measures of Internet traffic or any other infrastructure measure such as speeds, etc. This reflects the framing of the app economy as the attention economy.

  There are other factors related to the app economy that contribute to the economy. For instance, jobs created for app development, ancillary services that spring from there, etc. Our study does not directly capture those.

  Whenever in doubt, we have used conservative estimates. Therefore, while we project that the overall size is around USD 800 Billion, the actual impact is likely to be much larger. Further, these apps, spends are likely to have multiplier effects in digital as well as other sectors. For the lack of data, we have not estimated these impacts.
- Digital push by the Indian Government is likely to increase the contribution further. In addition, penetration of 5G is likely to accelerate the adoption and usage of apps.

21 https://www.statista.com/outlook/dmo/fintech/digital-payments/united-kingdom#:~:text=Digital%20Payments%20%2D%20United%20Kingdom&text=Total%20transaction%20value%20in%20the,US%24741.30bn%20by%202027

22 https://www.news18.com/business/indias-digital-payments-in-december-more-than-total-of-us-uk-germany-and-france-ashwini-vaishnaw-6877435.html

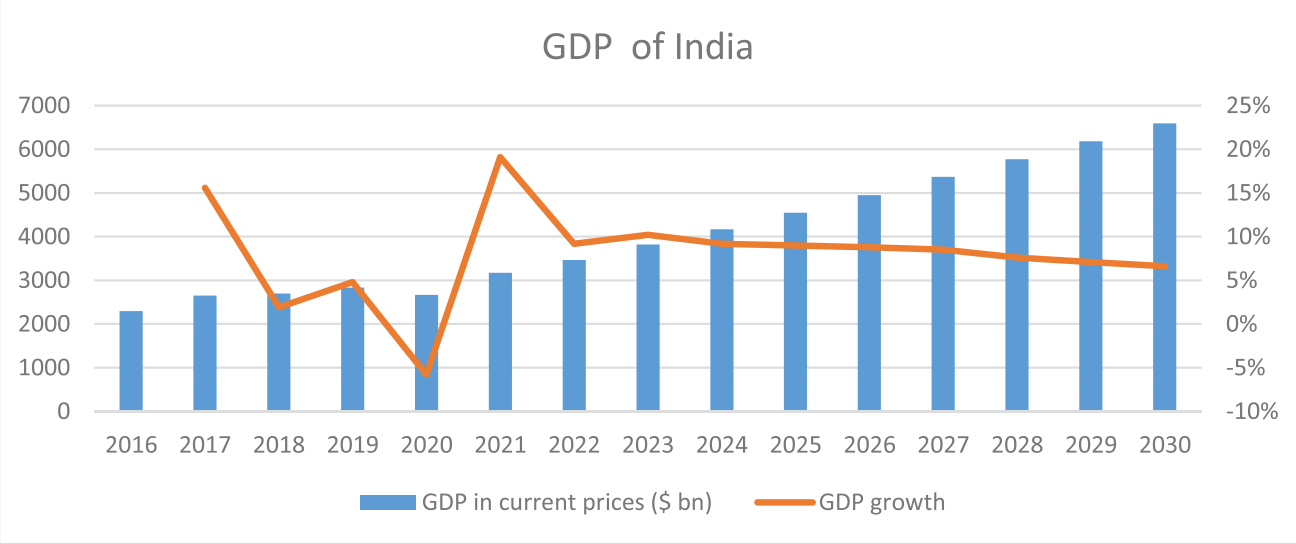
Exhibit 1: GDP Projections and GDP Growth Rate of India till 2030

Year	GDP in current prices G_t ($ bn)	GDP growth e_t (%)
	(1)	*(2)*
2016	2294.1	
2017	2651.5	16
2018	2702.9	2
2019	2831.6	5
2020	2667.7	-6
2021	3176.3	19
2022	3468.5	9
2023	3820.6	10
2024	4170.2	9
2025	4547.2	9
2026	4947.4	9
2027	5365.5	9
2028	5771.7	8
2029	6180.9	7
2030	6590.0	7

Source: Column 1 Statista [23]

Column 2 Author's Analysis

Note: Year 2020, COVID pandemic had shrinking economy so negative growth rate.



23 https://www.statista.com/statistics/263771/gross-domestic-product-gdp-in-india/

Exhibit 2: Growth Rate of the Digital Economy in India till 2030

Year	GDP Growth e_t (%)	Growth Rate of Digital Economy r_t=2.5 e_t (%)
	(1)	*(2)*
2017	15.6	39.0
2018	1.9	4.8
2019	4.8	12.0
2020	-5.8	-14.5
2021	19.1	47.8
2022	9.2	23.0
2023	10.2	25.5
2024	9.2	23.0
2025	9.0	22.5
2026	8.8	22.0
2027	8.5	21.3
2028	7.6	19.0
2029	7.1	17.8
2030	6.6	16.5

Source: Author's Analysis

Note: *Compute the growth rate of the Indian GDP till 2030. Growth rate is calculated using the standard definition. GDP growth in a given year is the GDP of the given year minus the GDP of the previous year divided by GDP of the previous year. According to the reports published in the popular press, the digital economy is growing at the rate of 2.5 times more than the growth of the economy. It provides the growth rate of the digital market in India till 2030*

Exhibit 3: The Growth Rate of Dollars Spent per Hour per User on Apps in India

Year	Growth Rate of User Spend per Hour r_t=2.5 e_t (%)	Dollars Spent per Person per Hour s_t ($)
2016		0.03
2017	0.39	0.04
2018	0.05	0.04
2019	0.12	0.05
2020	-0.15	0.04
2021	0.48	0.06
2022	0.23	0.08
2023	0.26	0.10
2024	0.23	0.12
2025	0.23	0.14
2026	0.22	0.18
2027	0.21	0.21
2028	0.19	0.25
2029	0.18	0.30
2030	0.17	0.35

Source: Author's Analysis

Note: *For column 2, we have taken that $0.03 was spent by a smartphone user per hour in 2016.[24]We assume that this grows at the same rate as the growth in the digital economy. This hourly spend includes money spent on mobile commerce, app store and in-app advertising.*

24 https://techcrunch.com/2017/06/27/app-economy-to-grow-to-6-3-trillion-in-2021-user-base-to-nearly-double-to-6-3-billion

Exhibit 4: Penetration of Smartphones in India

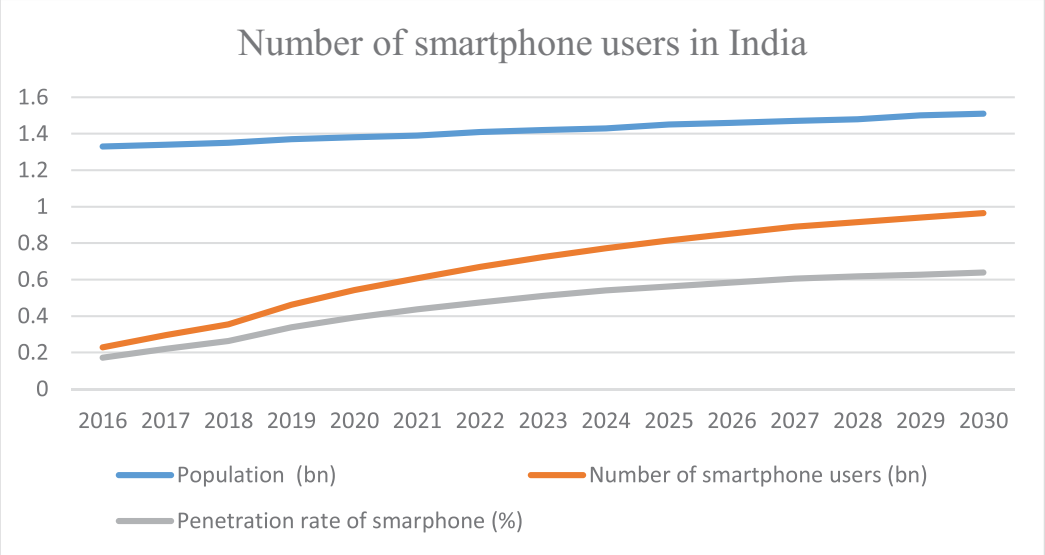
Year	Population *(bn)* P_t	Number of smartphone users *(bn)* u_t	Penetration rate of smartphones *(%)*
	(1)	*(2)*	*(3)*
2016	1.33	0.23	0.17
2017	1.34	0.29	0.22
2018	1.35	0.36	0.26
2019	1.37	0.46	0.34
2020	1.38	0.54	0.39
2021	1.39	0.61	0.44
2022	1.41	0.67	0.48
2023	1.42	0.72	0.51
2024	1.43	0.77	0.54
2025	1.45	0.82	0.56
2026	1.46	0.85	0.58
2027	1.47	0.89	0.61
2028	1.48	0.92	0.62
2029	1.50	0.94	0.63
2030	1.51	0.96	0.64

Source: Column 1, Population Pyramid [25]

Column 2, India Internet Report 2023, base value

Column 3, Author's Analysis

Note: *We use 2021 smartphone users as a base, and determine the growth rate from the data given in the database, Statista. We do not use the projections of smartphone users directly from Statista because the comparison between Statista's projections for 2023 far exceeds the actual users in reality.*



25 https://www.populationpyramid.net/india/2030/

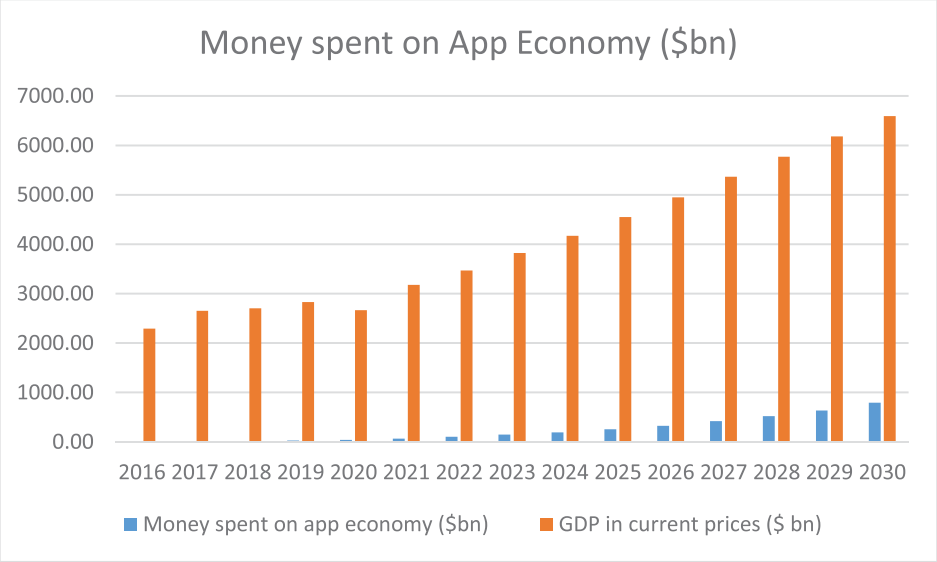
Exhibit 5: The Amount of Money Spent on the App Economy

Year	GDP at Current Prices G_t ($ Bn)	Money Spent on the App Economy v_t ($bn)	Money Spent on App Economy as % of GDP
	(1)	(2)	(3)
2016	2294.12		
2017	2651.47	3.77	0.001
2018	2702.93	6.57	0.002
2019	2831.55	30.56	0.011
2020	2667.67	38.07	0.014
2021	3176.30	64.34	0.020
2022	3468.50	105.87	0.031
2023	3820.57	145.46	0.038
2024	4170.22	193.16	0.046
2025	4547.16	253.09	0.056
2026	4947.39	326.98	0.066
2027	5365.50	419.30	0.078
2028	5771.69	519.50	0.090
2029	6180.86	637.19	0.103
2030	6590.03	791.98	0.120

Source: Column 1, Statista [26]

Column 2-3, Author's Analysis

Note: *we calculate the total money spent by the users on apps is given by the formula:* $v_t = 365 u_t d_t s_t$ *where* u_t *is the number of smartphone users,* d_t *is time spent by a user on a smartphone per day, and* s_t *is the money spent per user per hour*



26 https://www.statista.com/statistics/263771/gross-domestic-product-gdp-in-india/

Appendix 1: **Profile of IPO in India for 2018-22**

Year	IPO Name	Issue Size (*Rs cr*)	App Availability through App Stores	Link
	(1)	*(2)*	*(3)*	*(4)*
			(Yes/No)	
2022	Harsha Engineer	755	No	
2022	TMB	792	Yes	https://play.google.com/store/apps/details?id=com.tmb.mbank&authuser=0
2022	Dreamfolks Serv	562	Yes	https://play.google.com/store/apps/details?id=in.dreamfolks&authuser=0
2022	Syrma SGS	840	No	
2022	Aether Ind	808	Yes	https://play.google.com/store/apps/details?id=com.aether.airis&authuser=0
2022	eMudhra	413	Yes	https://play.google.com/store/apps/details?id=com.emudhra.emudhraCustomer&authuser=0
2022	Ethos	472	No	
2022	Venus Pipes	165	No	
2022	Delhivery	5235	Yes	https://play.google.com/store/apps/details?id=com.delhiveryConsigneeApp&authuser=0
2022	Prudent Advisor	539	Yes	https://play.google.com/store/apps/details?id=pru.fintools&authuser=0
2022	LIC India	21000	Yes	https://play.google.com/store/apps/details?id=com.lic.liccustomer&authuser=0
2022	Rainbow Child	1596	Yes	https://play.google.com/store/apps/details?id=com.sparctechnologies.rainbow&authuser=0
2022	Campus Active	1400	No	
2022	Hariom Pipe	130	No	
2022	Veranda Learn	200	Yes	https://play.google.com/store/apps/details?id=com.verandalearning&authuser=0
2022	Uma Exports	60	No	
2022	Vedant Fashions	3149	Yes	https://play.google.com/store/apps/details?id=com.revalsys.manyavarappv1&authuser=0

Year	IPO Name	Issue Size (*Rs cr*)	App Availability through App Stores	Link
	(1)	*(2)*	*(3)*	*(4)*
			(Yes/No)	
2022	Adani Wilmar	3600	Yes	https://play.google.com/store/apps/details?id=com.fortuneonline.app&authuser=0
2022	AGS Transact	717	Yes	https://play.google.com/store/apps/details?id=agsindia.cure&authuser=0
2021	CMS Info System	1100	Yes	https://play.google.com/store/apps/details?id=com.cms.cmsconnect&authuser=0
2021	Supriya Lifesci	700	No	
2021	HP Adhesives	126	No	
2021	Data Patterns	601	No	
2021	Metro Brands	1377	No	
2021	C. E. Info Syst	1040	Yes	https://play.google.com/store/apps/details?id=com.mmi.maps&authuser=0
2021	Shriram Prop	600	Yes	https://play.google.com/store/apps/details?id=com.shriramcm&authuser=0
2021	Rategain Travel	1354	No	
2021	Anand Rathi	660	Yes	https://play.google.com/store/apps/details?id=rs.webrest.ar&authuser=0
2021	Tega Industries	619	No	
2021	Star Health	7318	Yes	https://play.google.com/store/apps/details?id=com.star.customer_app&authuser=0
2021	Tarsons Product	1030	No	
2021	Latent View	622	No	
2021	One 97 Paytm	18916	Yes	https://play.google.com/store/apps/details?id=net.one97.paytm&authuser=0
2021	Sapphire Foods	2073	No	
2021	SJS Enterprises	817	No	
2021	PB Fintech	6274	Yes	https://play.google.com/store/apps/details?id=com.policybazaar&authuser=0
2021	Sigachi Ind	0	No	

Year	IPO Name	Issue Size (*Rs cr*)	App Availability through App Stores	Link
	(1)	*(2)*	*(3)*	*(4)*
			(Yes/No)	
2021	Fino Payments	1209	Yes	https://play.google.com/store/apps/details?id=com.finopaymentbank.mobile&authuser=0
2021	FSN E-Co Nykaa	5375	Yes	https://play.google.com/store/apps/details?id=com.fsn.nykaa&authuser=0
2021	ABSL AMC	2768	Yes	https://play.google.com/store/apps/details?id=com.adityabirlacapital.abconeapp
2021	Paras Defence	181	No	
2021	Sansera Eng	1282	Yes	https://play.google.com/store/apps/details?id=com.sanseraproject
2021	Vijaya Diagnost	1895	Yes	https://play.google.com/store/apps/details?id=com.healthsignz.consumer.vijayadiagnostics
2021	AMI Organics	572	No	
2021	APTUS VALUE	2790	Yes	https://play.google.com/store/apps/details?id=com.svs.aptus.housing.customerapp.customer_app_flutter
2021	CHEMPLAST SANMA	3930	No	
2021	Nuvoco Vistas	5089	Yes	https://play.google.com/store/apps/details?id=com.drn.nuvoco
2021	CarTrade Tech	2998	Yes	https://play.google.com/store/apps/details?id=com.cartrade.car
2021	Windlas Biotech	406	No	
2021	Devyani Int	1858	No	
2021	Krsnaa Diagnost	1222	Yes	https://play.google.com/store/apps/details?id=krsnaa.patient
2021	Exxaro Tiles	161	Yes	https://play.google.com/store/apps/details?id=com.nivida.exxaro
2021	Rolex Rings	732	No	
2021	Glenmark Life	1513	Yes	https://play.google.com/store/apps/details?id=com.omt.glenmark
2021	Tatva Chintan	500	No	
2021	Zomato	9375	Yes	https://play.google.com/store/apps/details?id=com.application.zomato

Year	IPO Name	Issue Size (*Rs cr*)	App Availability through App Stores	Link
	(1)	*(2)*	*(3)*	*(4)*
			(Yes/No)	
2021	Clean Science	1546	No	
2021	G R Infra	963	No	
2021	India Pesticide	800	No	
2021	Krishna Inst.	2146	Yes	https://play.google.com/store/apps/details?id=com.kims.crm
2021	Dodla Dairy	521	Yes	https://play.google.com/store/apps/details?id=ssg.dodladairy1
2021	Sona BLW	5550	Yes	https://play.google.com/store/apps/details?id=app.sonacomstar.prod
2021	Shyam Metalics	909	No	
2021	PowerGrid InvIT	7735	Yes	https://play.google.com/store/apps/details?id=com.powergridindia.pgcil_intranet_app
2021	Macrotech Dev	2500	No	
2021	Barbeque Nat	454	Yes	https://play.google.com/store/apps/details?id=com.jamhub.barbeque
2021	Nazara	583	Yes	https://play.google.com/store/apps/details?id=com.nazara.tinylabproductions.mpsr
2021	Kalyan Jeweller	1175	Yes	https://play.google.com/store/apps/details?id=com.hungama.kalyanjewellers1
2021	Suryoday Small	582	Yes	https://play.google.com/store/apps/details?id=com.suryoday.MB
2021	Craftsman	824	No	
2021	Laxmi Organic	600	No	
2021	Anupam Rasayan	760	No	
2021	Easy Trip	510	Yes	https://play.google.com/store/apps/details?id=com.easemytrip.android
2021	MTAR Tech	596	No	
2021	Heranba	60	No	

Year	IPO Name	Issue Size (*Rs cr*)	App Availability through App Stores	Link
	(1)	*(2)*	*(3)*	*(4)*
			(Yes/No)	
2021	Railtel	819	Yes	https://play.google.com/store/apps/details?id=com.railtel.railwirewifi
2021	Nureca	100	yes	https://play.google.com/store/apps/details?id=com.nurecausa.drtrustscaleconnect&gl=US
2021	Stove Kraft	413	No	
2021	home first finance company	1154	Yes	https://play.google.com/store/apps/details?id=com.iexceed.hffc&gl=US
2021	Indigo Paints	1171	No	
2021	IRFC	4633	No	
2021	Antony Waste	301	No	
2020	Bectors Food	541	No	
2020	Restaurant Bran	797	yes	https://play.google.com/store/apps/details?id=com.rbi.rinsights&gl=US
2020	Gland Pharma Ltd.	6480	No	
2020	Equitas Bank	518	yes	https://play.google.com/store/apps/details?id=com.iexceed.equitas.consumer&gl=US
2020	Mazagon Dock	444	No	
2020	UTI AMC	2160	yes	https://play.google.com/store/apps/details?id=com.utimutualfunds.utimutualfund
2020	Angel One	600	yes	https://play.google.com/store/search?q=Angel%20One&c=apps
2020	Chemcon Special	318	No	
2020	CAMS	2244	yes	https://play.google.com/store/apps/details?id=com.KCamsApp
2020	Route	600	No	
2020	Happiest Minds	702	No	IT company

Year	IPO Name	Issue Size (*Rs cr*)	App Availability through App Stores	Link
	(1)	*(2)*	*(3)*	*(4)*
			(Yes/No)	
2020	Rossari	496	No	
2020	SBI Card	10286	Yes	https://play.google.com/store/search?q=SBI%20card&c=apps&gl=US
2019	Prince Pipes	500	No	
2019	Ujjivan Small	750	Yes	https://play.google.com/store/search?q=ujjivan+small+finance+bank&c=apps&gl=US
2019	CSB Bank	410	Yes	https://play.google.com/store/apps/details?id=com.maktechserve.csbmobileplus
2019	IRCTC	635	Yes	https://play.google.com/store/apps/details?id=cris.org.in.prs.ima&gl=US
2019	Sterling Wilson	3125	No	
2019	Indiamart Inter	474	yes	https://play.google.com/store/apps/details?id=com.indiamart.m
2019	Neogen	132	No	
2019	Metropolis	1200	No	need to recheck
2019	Rail Vikas	431	No	
2019	Embassy Office	4750	No	
2019	MSTC	214	yes	https://play.google.com/store/apps/details?id=com.mstc.auction&gl=US
2019	Chalet Hotels	1629	No	
2019	Xelpmoc Design	23	No	Data Science company
2018	AAVAS Financier	1729	yes	https://play.google.com/store/apps/details?id=com.aavas.homeloan
2018	CreditAccess Gr	1126	No	
2018	TCNS Clothing C	1122	No	
2018	RITES	454	No	

Year	IPO Name	Issue Size (*Rs cr*)	App Availability through App Stores	Link
	(1)	*(2)*	*(3)*	*(4)*
			(Yes/No)	
2018	Fine Organics	598	No	
2018	Indostar Capita	1844	No	
2018	ICICI Securitie	4016	Yes	https://play.google.com/store/apps/details?id=com.icicisecurity&gl=US
2018	Mishra Dhatu Ni	438	No	
2018	Hindustan Aeron	4229	No	
2018	Bandhan Bank	4473	Yes	https://play.google.com/store/search?q=bandhan%20bank&c=apps&gl=US
2018	Bharat Dynamics	961	No	
2018	HG Infra Engg	458	No	
2018	Aster DM Health	980	No	
2018	Galaxy Surfacta	937	No	
2018	Amber Enterpris	600	No	
2018	Newgen Software	425	No	

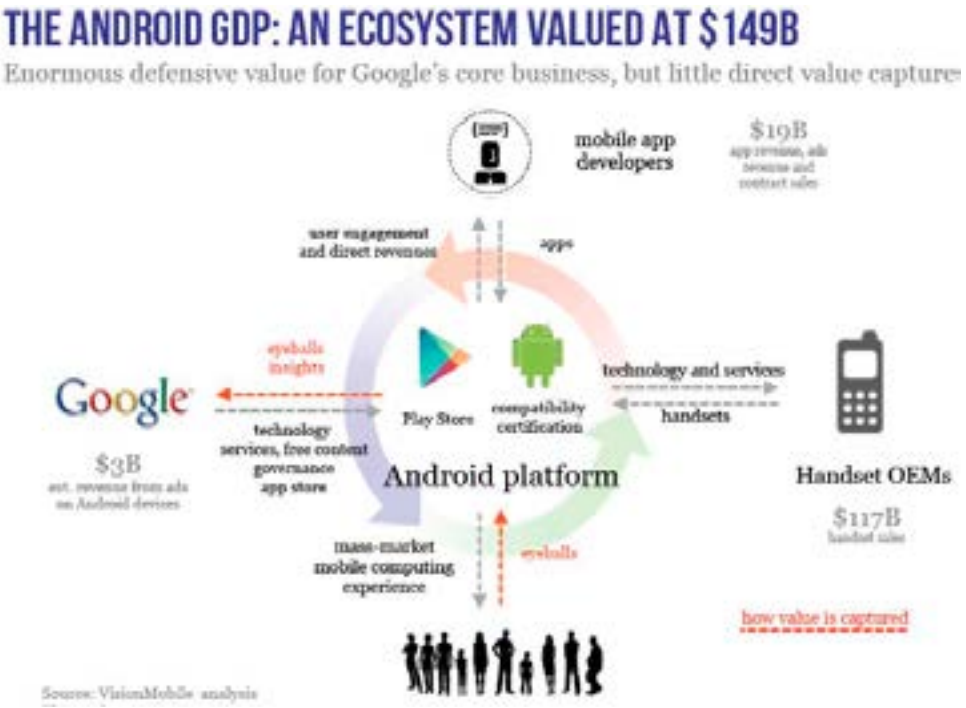
Source: Column 1-2 MoneyControl [27]

Column 3,4 App stores

27 https://www.moneycontrol.com/ipo/

Appendix 2: An Ecosystem View of Mobile, Apps and Platforms

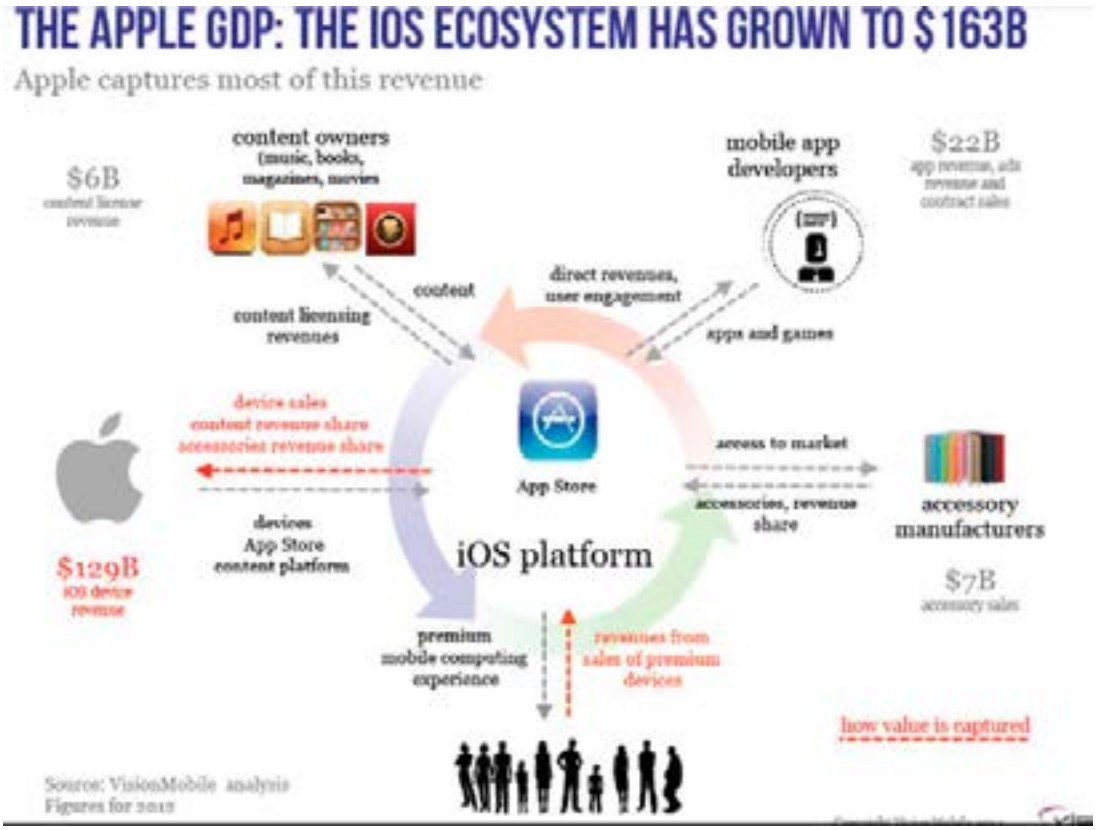
Source: Dazeinfo [28]



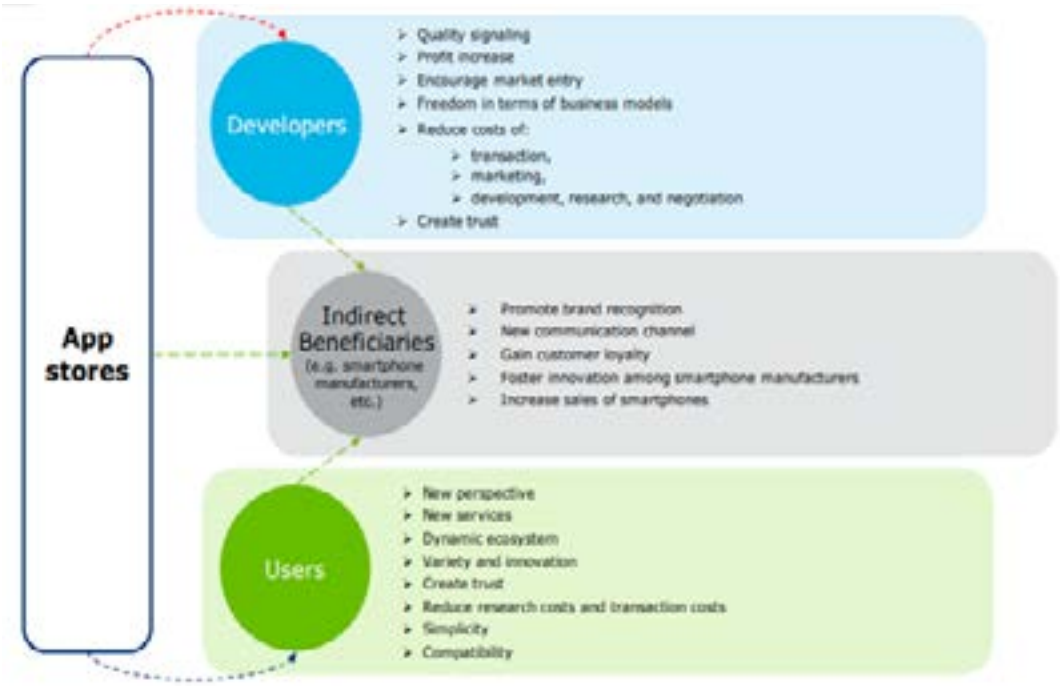
Source: VisionMobile Analysis[29]

28 https://telecominfo.wordpress.com/2012/03/02/the-mobile-app-ecosystem/ accessed on 20 Jan 2023

29 https://dazeinfo.com/2016/01/22/mobile-apps-vs-mobile-web-browser-usage-study/



Source: VisionMobile Analysis[30]

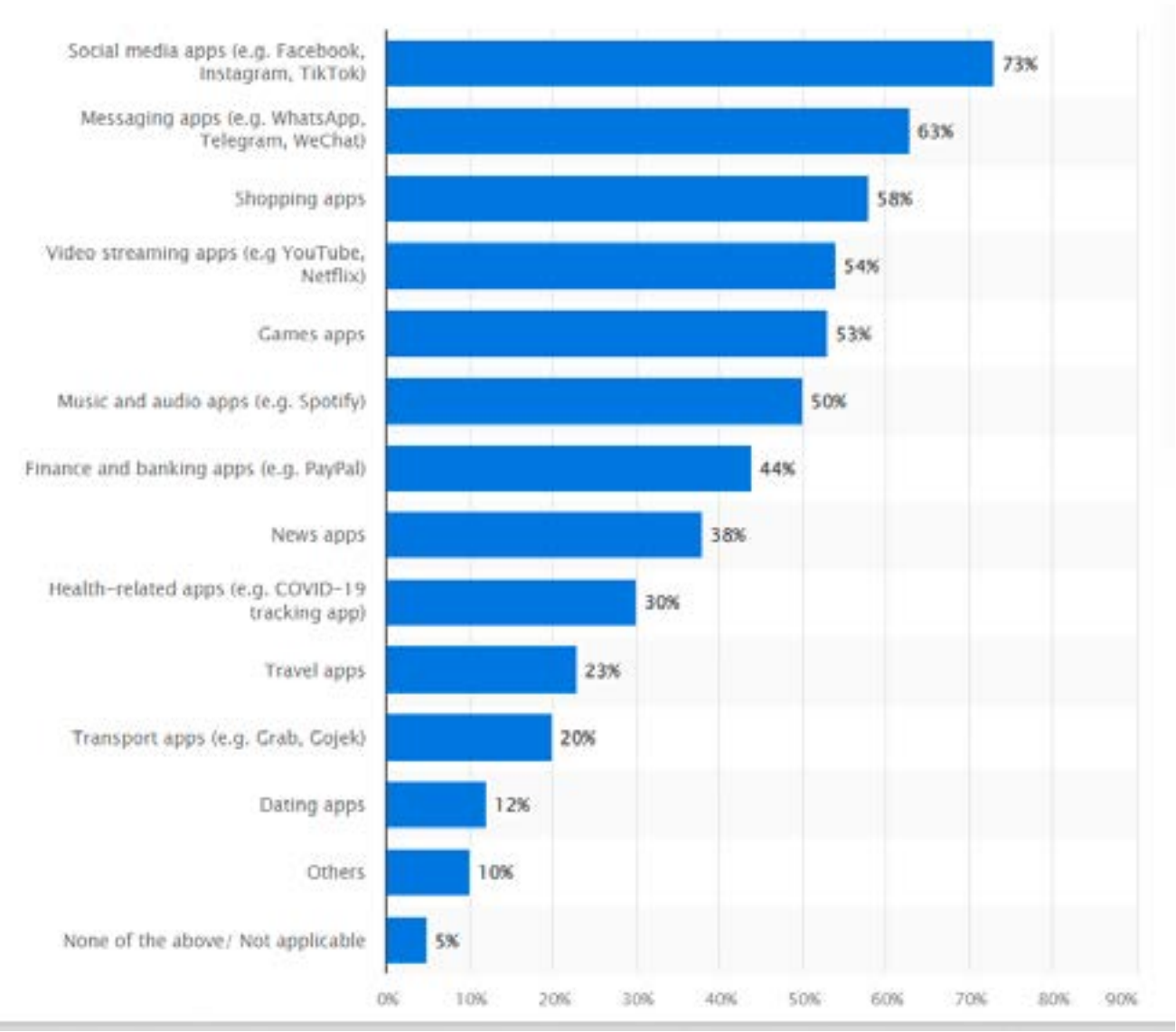


Source: Deloitte Analysis[31]

30 ibid

31 https://actonline.org/wp-content/uploads/220912_ACT-App-EU-Report.pdf accessed on 17 Jan 2023

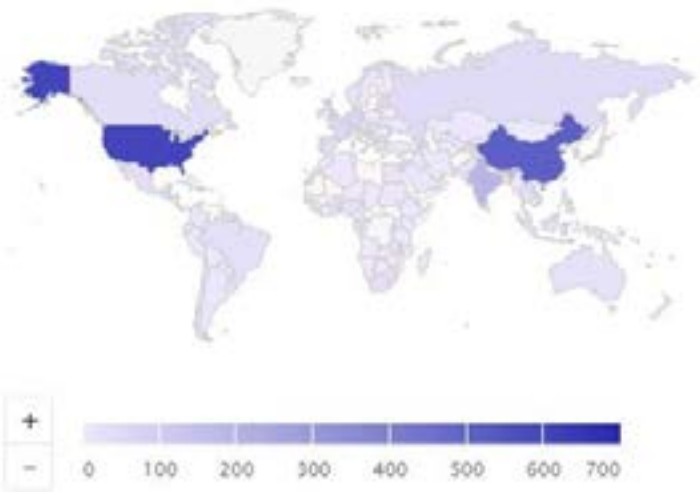
Appendix 3: Profile of India's Most Installed Mobile App by Verticals



Source: Statista[32]

32 https://www.statista.com/statistics/1280719/india-most-installed-mobile-apps-by-category/ accessed on 25 Jan 2023

Appendix 4: App Development Revenue across USA, China, India, UK, and Germany



Top 5	
United States	US$602m
China	US$513m
India	**US$195m**
United Kingdom	US$97m
Germany	US$71m

Source: Statista[33]

33 https://www.hyperlinkinfosystem.com/research/indian-app-development-industry-report-2020 accessed on 20 Dec 2023