THE ECONOMIC IMPACT OF TELECOMMUNICATIONS AND BROADBAND IN THE DEMOCRATIC REPUBLIC OF CONGO

February 2023

Columbia Institute for Tele-Information

ABOUT THE AUTHORS

Raúl Katz – PhD in Political Science and Management Science, MS in Communications Technology and Policy, *Massachusetts Institute of Technology* (United States), Maîtrise and Licence in Communication Sciences, *University of Paris* (France), Maîtrise in Political Science, *University of Paris-Sorbonne* (France). Dr. Katz worked at Booz Allen & Hamilton for twenty years, as a Lead Partner in the Telecommunications Practice in the Americas and member of the firm's Leadership Team. After retiring from Booz Allen, he founded Telecom Advisory Services LLC in April of 2006. In addition to president of Telecom Advisory Services, Dr. Katz is Director of Business Strategy Research at the Columbia Institute for Tele-Information at Columbia Business School (New York) and Visiting Professor at the Graduate Program in the Telecommunications and Technology Management of the University of San Andres (Argentina), where he teaches courses on strategy for digital industries.

Juan Jung – PhD and MA in Economics, University of Barcelona (Spain), BA in Economics, University of the Republic (Uruguay). Dr. Jung is a Senior Economist at Telecom Advisory Services, specialized in the telecommunications and digital industries. His experience spans economic impact and regulatory assessment in the telecommunications sector. Before joining Telecom Advisory Services, Juan was Director of the Center of Telecommunication Studies of Latin America (cet.la) and Director of Public Policy at the Inter-American Association of Telecommunications Enterprises (ASIET). Dr. Jung is a professor at the Comillas Pontifical University (Madrid), where he teaches courses in macroeconomics and the digital economy. He has published articles in several academic journals including Telecommunications Policy, Information Economics and Policy, Journal of Regulatory Economics and Journal of Regional Science.

The following study was funded by Orange/MEA. The views expressed in the report are those of the authors and do not necessarily reflect the opinions of Orange.

Table of Contents

The Economic Impact of Telecommunications in the Democratic Republic of Congo

EXECUTIVE SUMMARY

The Democratic Republic of Congo (DRC) telecommunications sector generates a significant direct and indirect impact on the country's economy, representing 4.9% of 2021 GDP.

The contribution of mobile broadband telecommunications to GDP growth reached 29.71% between 2010 and 2021 in DRC.

- From a direct effect standpoint, the DRC's telecommunications service providers have generated in 2021 US$ 1,805 million in revenues; total industry revenues represent 3.2% of the country's Gross Domestic Product.
- On the other hand, the sector generates approximately 1,900 direct jobs and 2% of total salaries in the local workforce
- Beyond the direct effects, the DRC's mobile broadband industry has indirectly contributed US$ 946 million on average per year to the whole economy between 2010 and 2021 (1.7% of the 2021 GDP).
- Fixed broadband does not present a significant indirect impact, because of the limited number of subscribers.

Mobile telecommunications

- The DRC mobile telecommunications have achieved a penetration rate of 50% in 2021 according to the ARPTC, (24% in terms of mobile internet) enabling the delivery of multiple voice and data services (over the 2G, 3G and 4G networks).
- Combining direct and indirect effects, mobile telecommunications have an impact of US$ 2,731 million, which represent 4.9% of the DRC's GDP in 2021.
- The contribution of mobile broadband to GDP growth reached 29.71% between 2010 and 2021.

In particular, the sectors mostly impacted by telecommunications are trade (50% of the downstream effect), financial services (15%), transportation (11%), and business services sector (6%).

Implications

Given the economic importance of telecommunications, public policies and regulatory frameworks need to be defined in order to maximize investment in network deployment and modernization, particularly in mobile broadband.

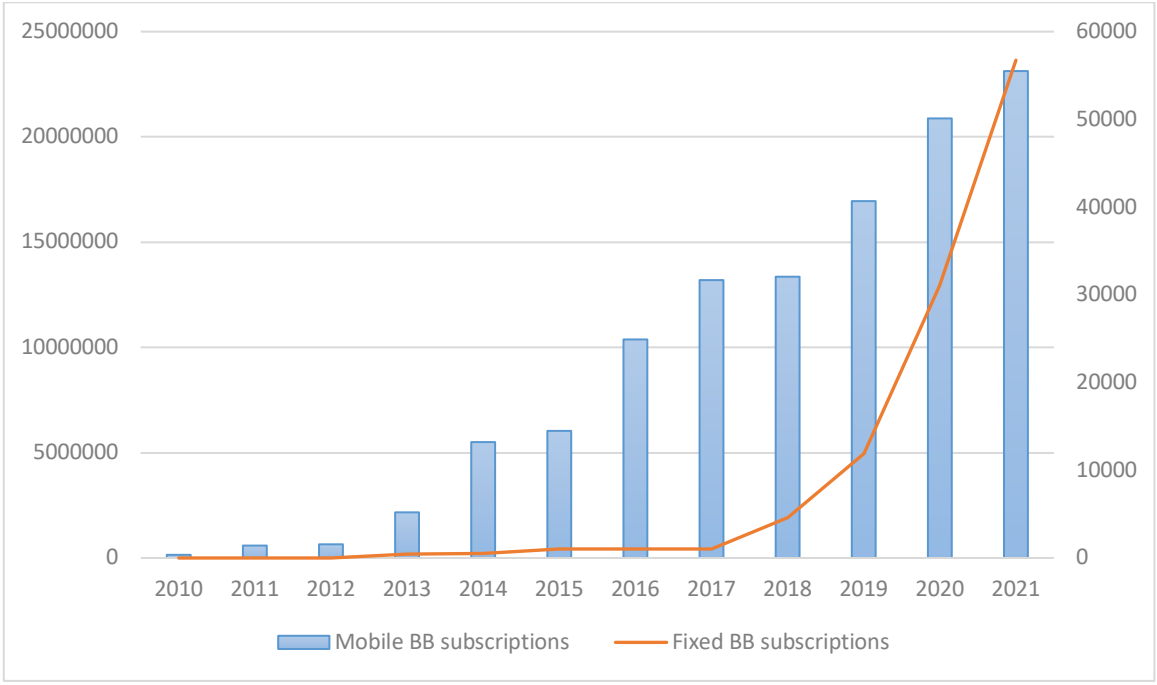
Policies related to taxation, the cost of accessing spectrum frequencies, and infrastructure sharing should allow telecommunications operators to continue their efforts to foster connectivity and the deployment of broadband services, in order to support economic growth.

1. THE DEVELOPMENT OF TELECOMMUNICATIONS IN THE DEMOCRATIC REPUBLIC OF CONGO (DRC) AND ITS ECONOMIC IMPORTANCE

The latest Mobile Telephony Observatory report (Q2 2022)[1] of the Autorité de Régulation de la Poste et des Télécommunications du Congo (ARPTC) highlights the recent advances of the telecommunications industry in the country, reaching 47.79 million wireless subscriptions by the second quarter of last year, of which 22.6 million represent mobile internet connections. Those figures represent a mobile voice and internet penetration levels of 50.20% and 23.77%, respectively. On the other hand, the International Telecommunications Union (ITU) reported 31,000 fixed broadband subscriptions at the end of 2020, which amounts to 0.3% of households.[2]

Figure 1 depicts the recent evolution in terms of subscriptions for fixed and mobile broadband services since 2010.

Figure 1
DRC: Subscriptions for broadband services (2010-2021)



Sources: ARPTC for mobile and ITU for fixed. 2021 data for fixed broadband was extrapolated based on the current trend as it has not been reported yet by the ITU.

As indicated in Figure 1, the DRC's telecommunications environment is essentially based on wireless technology. Despite a temporary slow-down in the growth of mobile broadband penetration in 2018, the technology has resumed a healthy annual growth rate

[1] ARPTC (2022). *Observatoire du marché de la téléphonie mobile Rapport du 2eme trimestre 2022*. downloadable at: https://arptc.gouv.cd/app/uploads/2022/11/Rapport-ARPTC-OBSERVATOIRE-T2-20221019-WA0027..pdf

[2] As reported by the ARPTC to the ITU and published in the ITU World Telecommunications ICT indicators database 2022.

of 10.7%. GSMA Intelligence reports that by 2030, mobile internet penetration will reach 49.99%.

In 2021, the country's mobile telecommunications industry reached revenue figures that accounted for 3.19% of the country's GDP[3], representing US$ 1,786 million. GSMA Intelligence reports that by 2030 annual revenues of the mobile telecommunications segment will reach US$ 2,220 million, providing evidence of the current and future relevance of this sector for the economy. On the other hand, the fixed broadband sector represents US$ 19 million.

Table 1
DRC Telecommunications Industry Annual Revenues (2021)

Segment	Revenues (in US$)
Fixed broadband	**$ 19 million**
Mobile telecommunications	**$ 1,786 million**
Total telecommunications	**$ 1,805 million**

Sources: ARPTC; ITU; Telecom Advisory Services analysis

On a side note, the mobile industry presents a healthy level of competition. With a market shared by four operators (Africell: 9.38%, Airtel: 27.69%, Orange: 29.41%, Vodacom: 33.52%), the Herfindahl Hirschman Index measuring market concentration as of the end of 2022 is 2,794.[4]

The importance of the sector for the country can also be validated when examining the number of jobs it generates. In 2018, the last year reported by the International Telecommunication Union, the sector directly employed 1,880 workers[5]. In addition, according to the Input/output Matrix developed for this study, the telecommunications sector represents 1.99% of total salaries in the country.

2. ECONOMIC CONTRIBUTION OF MOBILE BROADBAND TO DRC'S ECONOMY

The economic effects of mobile broadband are proportional to the development of the wireless internet market with its corresponding maturity level[6]. The contribution of mobile internet services to economic growth is driven first by the sector direct performance. It comprises the impact of the capital investments linked to the deployment

[3] Sources : ARPTC (mobile revenue), ITU (to approximate fixed revenue) and IMF (GDP 2021)
[4] Source: GSMA Intelligence. Note, the ARPTC reports an HHI of >2,500.
[5] Source: ITU
[6] Gruber, H., & Koutroumpis, P. (2011). Mobile Telecommunications and the impact on Economic Development. *Telecommunications Policy*, *67*, 278-286. Kathuria, R., Uppal, M., Mamta (2009). *An Econometric Analysis of the Impact of Mobile*, The Vodafone Policy Paper Series (9), pp. 5-20. Shiu, A., & Lam, P. (2008, June 25). Relationships between Economic Growth, Telecommunications Development and Productivity Growth: Evidence around the World. In *Africa-Asia-Australasia Regional Conference of the International Telecommunications Society*. Retrieved from http://www.apeaweb.org/confer/hk10/papers/shiu_alice.pdf. Waverman, L., Meschi, M., Fuss, M. (2005). "The impact of telecoms on economic growth in developing countries", The Vodafone Policy paper Series (2), pp. 10-23.

of networks and services, combined with the revenues generated by selling mobile broadband services. These are called the direct effects.

In addition, the industry generates positive externalities derived from private and enterprise use of services (*spill-over or indirect effects*). According to this last effect, by allowing a more efficient functioning of the economy and providing services to the population, telecommunications networks and services contribute to overall value creation. The analysis of spill-over effects of mobile broadband on the economy is measured through a structural econometric model, composed of an aggregated production function, a demand function, a supply function, and an infrastructure function (see Appendix for complete details).

2.1 Contribution of mobile broadband to DRC's economic growth between 2010 and 2021

- According to the econometric model developed for this study with time series for the country (Table A-1 in the Appendix), a 10% increase in unique mobile internet subscriber's penetration yields 1.13% of GDP growth.

- Based on this coefficient, mobile broadband has contributed annually an average of US$ 946 million to DRC's economic growth per year between 2010 and 2021 (see Table 2 for full details).

Table 2
Mobile broadband contribution to DRC's economic growth 2010-2021

Item	Factor	Value	Source and / or estimation formula
1	Annual contribution of unique mobile internet subscriber's penetration to GDP growth (for a 10% increase in additional penetration).	1.13%	Coefficient resulting from structural model (see Appendix in Table A-1)
2	Unique mobile internet subscriber penetration, 4Q 2021	12.38%	GSMA Intelligence
3	Unique mobile internet subscriber penetration, 4Q 2010	1.15%	GSMA Intelligence
4	Compound Annual Growth Rate (CAGR) of mobile internet unique subscribers' penetration	24.11%	(Unique mobile subscribers' penetration 2021/2010) ^ (1/11 years)-1
5	Annual impact of mobile broadband on GDP	2.72%	(Annual impact/10) * (CAGR Unique mobile subscribers' penetration)
6	CAGR GDP (2010-2021)	9.17%	(GDP 2021/GDP 2010) ^ (1/11 years)-1
7	Percent contribution of mobile broadband to GDP growth	29.71%	Annual impact of mobile broadband on GDP / CAGR GDP (2021-2010)
8	Incremental GDP growth (2021/2010)	35,012 M	GDP 2021- GDP 2010
9	Total impact of mobile broadband on incremental GDP growth	$ 10,404 M	Incremental GDP (2021/2010) * % contribution of mobile broadband to GDP growth
10	Annual impact of mobile broadband on GDP	$ 946 M	Total impact /11 years

Source: Telecom Advisory Services analysis

2.2. Lack of contribution of fixed broadband to DRC's economy

As indicated above, fixed broadband connectivity is marginal in the DRC. The number of fixed broadband subscriptions reached 31,000 in 2020 according to the ITU (or 0.3% of households), a figure we expect to grow up to 56,750 in 2021 based on recent trends (reaching 0.5% of households). In this context, we are including fixed broadband revenue as a direct impact (US$ 19 M), but we understand it is not possible to assess any indirect economic contribution of this service based on its limited adoption.

2.3. Contribution of telecommunications to the DRC's 2021 GDP

In total, telecommunications contribute 4.86% of the Democratic Republic of Congo 2021 GDP, broken down as follows:

- 3.16% represents the mobile gross revenues (US$ 1,786 million[7]) as a percentage of the country's 2021 GDP (US$ 56,553 million[8])
- 0.03% represents the revenues associated to fixed broadband (US$ 19 million[9]), as a percentage of 2021 GDP.
- 1.67% is the indirect contribution of mobile broadband (US$ 946 million) as a percentage of 2021 GDP.

Table 3
Direct and indirect contribution of telecommunications to the DRC's economic growth

Indicator	Million US$ (2021)	As % of GDP
Direct contribution - Mobile	$ 1,785,656,547	3.16%
Direct contribution - Fixed	$ 19,271,836	0.03%
Indirect contribution – Mobile Broadband	$ 945,801,362	1.67%
Total contribution	$ 2,750,729,745	4.86%

Source: Telecom Advisory Services analysis

These estimates are consistent with those registered in an Input / Output matrix developed for DRC (see below). According to Table 3, the total mobile impact ($2,750 million) divided by total direct contribution ($ 1,785 million + $ 19 million) is 1.53, while the multiplier calculated for the telecommunications sector according to the Input / Output matrix is 1.48.[10]

3. TOTAL IMPACT OF TELECOMMUNICATIONS ON THE DRC'S 2021 GDP and breakdown by economic sectors

[7] ARPTC
[8] IMF
[9] Calculated subtracting mobile revenue from overall revenue extrapolated from ITU data
[10] The multiplier for the I/O table is calculated by assuming the impact of USD 1 of input in the telecommunications sector over the total economy.

In sum, when considering the aggregate industry revenues and the spill-over indirect effects on the rest of the Democratic Republic of Congo economy, telecommunications have an impact of 4.86% on DRC's GDP.

In terms of its sector impact, the increase in economic contributions from broadband (from Table 2), amounts to US$ 946 million. According to DRC´s Input / Output matrix[11], this amount would have a downstream impact in the following sectors (see Table 4).

Table 4
Sector impact on the DRC's GDP increase in telecommunications output

Sector	Percentage of the impact	Sector weight on GDP (*)	Amount (US$ million)	Amount (% GDP)
Agriculture	5.01%	48.59%	$ 47.35	0.08%
Textiles and apparel	1.31%	1.34%	$ 12.40	0.02%
Wood, paper, petroleum, rubber, and plastic products	3.61%	2.11%	$ 34.12	0.06%
Metal products	0.15%	1.42%	$ 1.43	0.00%
Machinery and equipment	0.54%	0.41%	$ 5.11	0.01%
Electricity, gas, and water	6.16%	3.36%	$ 58.25	0.10%
Construction	0.19%	2.16%	$ 1.83	0.00%
Trade	50.35%	6.19%	$ 476.25	0.84%
Transportation	10.72%	4.12%	$ 101.42	0.18%
Financial services	14.64%	5.51%	$ 138.50	0.24%
Business services	6.24%	2.57%	$ 59.00	0.10%
Other services	1.07%	22.21%	$ 10.14	0.02%
Total	100.00%	100.00%	$ 945.80	1.67%

(*) Excluding communication sector
Source: Telecom Advisory Services Analysis; Global Trade Analysis Project Database (GTAP)

As the data on Table 4 indicates, the most important downstream effects of telecommunications on the DRC's GDP are concentrated in the trade sector (50.35% of the downstream effect). In addition, significant downstream effects can be detected in financial services (14.64%), transportation (10.72%), and business service sector (6.24%).

4 IMPLICATIONS

The strong contribution of telecommunications to DRC's economy is a function of two factors:

1. The sector dynamism: the telecommunications sector is growing, generating in turn direct and indirect jobs. In fact, mobile operators trigger a significant number of local suppliers, distributions agents, and providers of various services, which enhance the local value added to the economy.

[11] The I/O matrix was developed from the Global Trade Analysis Project Database (GTAP) by extrapolating the tendencies calculated between the 2011 and 2014 GTAP matrices.

2. The positive externalities (« Spill-over effects »): telecommunications networks and services result in a more efficient functioning of the economy particularly in terms of:
   - Productivity gains in existing sectors (such as tourism, exports, manufacturing) as well as social services, such as education and public administration.
   - Innovation incentives, leading to the creation of new businesses in the digital economy (applications, software platforms, local content).
   - Integration of isolated regions, leading to further development of economic activities.
   - Better coordination among economic agents through improved knowledge of inputs market prices, better coordination between economic agents resulting in low transaction costs, enhanced ability to negotiate selling prices, inventory management and delivery tracking.
   - Improvement and extension of domestic economic exchanges, as well as at the regional and global scale.

Public policies and regulatory framework

- Given the economic importance of telecommunications, public policies and regulatory frameworks need to be defined to maximize investment in network deployment and modernization, particularly in mobile broadband.
- Policies related to taxation, the cost of accessing spectrum frequencies, and infrastructure sharing should allow telecommunications operators to continue their efforts to foster connectivity and the deployment of broadband services, to support economic growth.

Appendix – Table A-1. Econometric model to measure impact on DRC's economic growth

Aggregate production function: $GDPpcit=a_1K_{it}+a_2L_{it}+a_3Mbb\_Pen_{it}+ e_{it}$
Demand function: $Mbb\_Pen_{it}= b_1GDPpc_{it}+b_2Mbb\_Price_{it}+ b_3HHI_{it}+e_{it}$
Supply function: $Mob\_Rev_{it}=c_1MbbPr_{it}+c_2GDPpc_{it}+c_3HHI_{it}+\varepsilon_{3it}$
Infrastructure function: $\Delta Mbb\_Pen_{it}=d_1Mob\_Rev_{it}+\varepsilon_{4it}$

Aggregate prod. function	Log (GDPpc)
Log (Mobile BB unique subscriber penetration)	0.113*** [0.033]
Log (Gross Fixed Capital Formation)	0.101** [0.047]
Log (Labor)	0.305 [0.334]
Demand function	Log (Mobile BB unique subscriber penetration)
Log (GDPpc)	4.146*** [1.065]
Log (ARPU)	0.057 [0.366]
Log (HHI)	0.473 [0.686]
Supply function	Log (Mobile Revenue)
Log (GDPpc)	3.042*** [0.171]
Log (ARPU)	0.456*** [0.098]
Log (HHI)	0.043 [0.289]
Infrastructure function	Mobile unique subscriber adoption growth
Log (Mobile Revenue)	0.140 [0.096]
Observations	47
Years	2010-2021
R-Squared first equation	0.81

*Note: ***, ** significant at 1% and 5%, respectively.*
Source: Telecom Advisory Services analysis

Table A-2. Variables Description and Source

Variable	Source	Description
GDP	International Monetary Fund	Data converted to quarterly frequency by assuming constant CAGR within each year.
Gross Fixed Capital Formation	World Bank World Development Indicators	Gross Fixed Capital Formation. Data converted to quarterly frequency.
Labor	World Bank World Development Indicators	Labor force. Data converted to quarterly frequency.
Mobile Broadband unique subscribers' penetration	GSMA Intelligence	Mobile broadband unique subscribers as a share of the population
Population	GSMA Intelligence	Total population
ARPU	GSMA Intelligence	Average revenue per connection
HHI	GSMA Intelligence	Industrial concentration index for overall mobile services
Revenue	GSMA Intelligence	Revenue from mobile services