WHITE PAPER
ON THE POST, TELECOMMUNICATIONS AND DIGITAL ECONOMY

AGENCE DE RÉGULATION DES POSTES ET DES COMMUNICATIONS ÉLECTRONIQUES

REPUBLIC OF CONGO

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Our vision

To make the Republic of the Congo one of the leading five countries in Africa in the Posts and Electronic Communications sector

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Director-General of ARPCE

A FEW WORDS FROM THE DIRECTOR-GENERAL

Commitments undertaken to develop telecoms infrastructures in the Republic of the Congo mean that in 2021 the President's goal: "To anchor the Republic of the Congo to the development of the digital economy" is gradually becoming a reality. New infrastructures have also been planned to meet the ever-increasing needs of users of Information and Communication Technologies (ICTs).

Today more than ever, the speed at which technological innovations and changes affecting all sectors of society are taking place makes it imperative to monitor technological and strategic developments in order to anticipate their impact on the various regulated markets. This is what prompted the drafting of the 'White Paper on the Post, Telecommunications and Digital Economy'.

This White Paper, proposed by the Agence de Régulation des Postes et des Communications Électroniques (ARPCE), the state market regulator for the post and electronic communications, presents a strategic analysis of the various issues and challenges brought about by the digital revolution.

By committing itself to a forward-looking and monitoring process through this White Paper and future publications, ARPCE is contributing to the creation of a digital society in the Republic of the Congo. ARPCE is also sharing elements of its analyses that could justify the strengthening of the regulatory framework in the telecoms and other related sectors in order to better respond to the convergence of technologies and markets brought about by the digital economy.

INTRODUCTION

Technological developments in the field of telecoms are constantly changing the way people live, as well as the way companies operate. Everything happens faster today, and the new doctrine is: "Here and Now." We have almost entered a period in world history where everything happens instantaneously. For example, the processing of financial transactions and the sending of dematerialised information is performed at incredibly high speeds, and the rate at which social networks, stock exchanges and financial institutions process financial flows also clearly demonstrates this.

Africa as a whole, and the Republic of the Congo in particular, is not on the sidelines when it comes to these technological advances in the telecoms sector. Its economy has already been partly digitised to the point where it is now inconceivable that governmental departments, legal entities and private individuals would be able to function without some access to the Internet. However, in addition to the Internet, one of the most significant developments in the Congolese economy and in Africa in general, is the growing importance of mobile financial services (MFSs), such as mobile money. What is the importance of mobile money in the Congolese economy today?

As mobile money is a financial service managed by mobile network operators (MNOs), the question arises as to what type of regulations should be imposed on these operators who are now becoming multi-service operators providing mobile telephony, Internet access and MFSs. Following on from this, could mobile network operators in Congo also develop mobile banking services? This is why the future of Information and Communication Technologies (ICTs) regulations must be taken seriously in Congo, and across the entire Economic and Monetary Community of Central Africa (CEMAC).

The future of Information and Communication Technologies (ICTs) regulations must be taken seriously in Congo.

This transformation of MNOs, which also reflects the development of the Congolese digital economy, will not proceed without risk as it will highlight the challenges and limitations of Congo's cyberspace with respect to its cybersecurity. Does the Congolese economy, which is undergoing digital transformations, such as "digital taxation", have the means and resources to tackle cybercrime, for example?

With regard to the development of the Internet, it will have impacts on various regulated market segments, but also on the type of licences that will have to be favoured, as well as the technical impacts linked to the use of telecoms infrastructures. However, infrastructure is key to ensuring that operators' networks function properly and, in turn, contribute to the development of the digital economy.

Are the telecoms and postal infrastructures sufficiently reliable to support, in the long term, Congo's strategy for developing the digital economy that is promoted by the Government? Wouldn't this strategy, which includes combating the digital divide, be hampered by basic infrastructure failings (roads, electricity, etc.)? And what about 5G which is ten (10) times faster than 4G, is it compatible with the overall level of development in Congo given that even in industrialised countries its deployment is still being questioned?

In the context of reducing its carbon footprint, is energy transition appropriate in the ICT sector in Congo? In other words, are there any laws in place to monitor the activities of telecoms operators?

In terms of regulation, the Congo has a legal and institutional framework that has contributed to the current development of the postal and telecoms sectors, which has been further strengthened with new laws and acts. But will this be enough to regulate the complexity of the digital economy?

EXECUTIVE SUMMARY

The Republic of the Congo's strategy for the development of the digital economy aims to promote fair access to digital infrastructures and services. Since 2009, Congo has also reformed its electronic communications, postal and digital economy sectors by adopting a legal and institutional framework for their regulation.

With the deregulation of the postal and telecoms sectors, new players have emerged making it possible to develop modern infrastructures, particularly in the telecoms sector, which has helped to provide services to a large proportion of the Congolese population. Despite notable progress made in developing its telecoms infrastructures, Congo still has many challenges to overcome, such as its road network, which although measuring 23,234 km only had 3,111 km of tarmacked roads in 2017. Despite the commissioning of new hydroelectric dams and thermal power stations, the electricity network recorded an average of 25 power outages per month in 2017. As a result, telecoms and postal operators cannot always roll out their services everywhere they would like due to constraints that are beyond their control. This is one of the reasons why the legislator has created two universal funds to address the issue of 'white areas' (areas with no or limited coverage): one fund for the postal sector and one for the electronic communications sector. Will these funds be able to address the fundamental problems associated with building basic infrastructure?

The further development of the telecoms sector will also require adapting the National Frequency Allocation Plan so that the deployment of new technologies can meaningfully contribute to reducing the digital divide in Congo. For example, the 700 MHz, 800 MHz and 3,300 to 3,800 MHz frequency bands have already been reserved for the 5G network.

Second-, third- and fourth-generation technologies are available in Congo thanks to the Airtel and MTN mobile network operators (MNOs). In 2020, 62% of mobile phone subscribers were still using the 2G network while 21% were using 3G, and 17% 4G. The weighted tariffs for voice calls (on-net) fell by 60% between 2013 and 2020, while the megabyte price (for accessing the Internet) dropped by 94%.

The tariffs were 25.17 FCFA/min for calls, and 2.08 FCFA/Mb in 2020. Due to its industrial make-up, Congo uses technologies and equipment that it neither designs nor manufactures. Therefore, upstream it bears the importation costs, while downstream it is subject to the consequences of imports on telecoms tariffs. This means that the tariffs for services offered by telecoms operators in Congo are higher than those in industrialised countries.

Digital inclusion also involves modernising the postal sector by taking advantage of technological innovations in the telecoms sector. The modern postal addressing system used in all the country's cities should contribute to the development of this sector. In the interior of the country, postal infrastructures could become relays for digital inclusion if they could be linked to telecoms infrastructures.

Congo's digital economy development strategy is based on three pillars: e-government, e-citizen and e-business. Congolese taxpayers are also encouraged to use electronic payment methods, such as mobile money, which is accessible on 2G mobile phones. However, digital taxation is still in its infancy in Congo, although the following milestones have been achieved: electronic stamps, dematerialised tax stamps, digital hubs, electronic payments, electronic customs formalities, etc.

In 2018, the rate of access to banking services in Congo was estimated to be almost 33%, i.e. over 827,088 customers (banks + the MUCODEC microfinance network). The provision of mobile money services offered by MNOs demonstrates that it is possible to provide banking services — albeit in a different way — to categories of the population that were hitherto excluded from the traditional banking system. However, digital banking is still struggling to take off, partly due to Congo's economic structure. In fact, the majority of economic players still use paper banknotes and coins, especially in the informal economy.

In 2017, the informal economy generated over 3,000 billion FCFA, yet this sector still does not have access to certain aspects of the formal economy, such as traditional banks. This is one of the reasons why mobile money has generated such interest. It allows users — rich and poor — to store, receive and transfer money, as well as making purchases via their mobile phones, which have been transformed into veritable electronic wallets. There are also issues linked to the interoperability of the technical platforms used for these online transfers, as well as to the management of personal data, which must be taken into consideration in the transformation of the telecoms ecosystem.

The shift from mobile telephony (voice + SMS + mobile Internet) to mobile financial services (MFSs) demonstrates that MNOs have been able to diversify their activities, but it also raises the question on how digital and MFSs can be best regulated. At the same time, some MNOs are seriously considering the need to separate their mobile telephony and Internet Service Provider (ISP) businesses from their mobile or digital financial services. Therefore, their regulation could become increasingly complex due, among other things, to the important role they play in Congo's economy. In 2020, the demand deposits of MTN and Airtel accounted for around 60% of those of the eleven (11) banking institutions authorised to operate in Congo. At this rate, the value of demand deposits managed by MNOs is likely to exceed that of traditional banks.

The continued growth of the Internet market clearly raises questions about the technical development of networks, the type of licences to be issued, and the possible revenues that can be expected by the State, as well as aspects related to the economic regulation of these markets. For example, the growth in data traffic will lead to an increased use of frequencies on the access network. Migrating MNOs' traffic to very high-speed (VHS) transport networks via fibre optic backbones (FO) will lead

to a decrease in the use of microwave links. Provision should also be made for the virtual disappearance of interconnection costs for national networks as a result of their migration to "all-IP", as well as the possible elimination of inter-community roaming costs due to the roll-out of lower-cost community roaming, and the convergence of networks towards "all-IP".

The legislator should also consider promoting technology neutral spectrum licences that would allow operators to replace old equipment in a frequency band with new equipment that meets a more advanced standard. This reallocation would allow the migration from 3G to 4G or from 4G to 5G with the least possible administrative burden.

The security of Congolese cyberspace must become a major priority for the public authorities. It would involve prioritising training and qualifications in cutting-edge professions associated with the development of the digital economy, as well as finally setting up the National Agency for Information Systems Security (ANSSI). The digital economy exposes all countries to the threat of cybercrime, as MTN and Airtel in Uganda experienced in October 2020 when their digital financial services system was hacked resulting in a loss of 3.2 million USD.

With regard to 5G in Congo, frequency bands have already been allocated to meet the future demand for licences. But is this technology absolutely necessary when so much remains to be done with regard to constructing basic infrastructure? Are very frequent power outages compatible with the Internet of Things (IoT) whose highly sensitive devices could be damaged due to the poor quality of the electricity supply? Moreover, mobile operators still have not managed to convert all their 2G subscribers to 3G, let alone 2G/3G subscribers to 4G. However, there are some industrial sectors in Congo where a limited roll-out of 5G may be necessary, particularly in the oil and mining sectors.

The manner in which ICTs are currently regulated is beginning to show its shortcomings. The digital economy requires a range of multifaceted skills, and its regulation must be coupled with expertise in banking and financial regulation. The Bank of Central African States (BEAC) is already planning to standardise mobile financial services payment accounts by giving them the same 27-character IBAN structure as traditional bank accounts. This will contribute to increasing the interoperability of financial transactions from mobile networks to banking networks (and vice versa), as well as promoting the development of mobile banking.

Therefore, a co-regulation of MFSs seems unavoidable between the telecoms and banking sectors. This assumes that the roles of the various parties are clearly set out in a regulatory text that takes into account the various aspects (legal, technical, commercial, competition, user protection, etc.) inherent in each sector (telephony and banking/finance).

In the CEMAC zone, all monetary creation projects must obtain prior authorisation from BEAC; this is also the case for electronic money on mobile networks. Cryptocurrencies, which are also considered as electronic money,

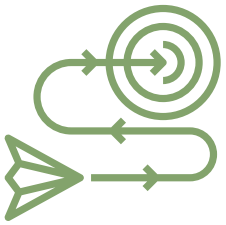
rely on blockchain technology that is not compatible with any centralisation of operations and, as a result of this, cryptocurrencies do not meet one of BEAC's core requirements. This is why this co-regulation will have to include blockchain technology, Big Data and Artificial Intelligence in order to reflect community realities. Furthermore, the transformation of certain ICT agencies into digital authorities able to regulate the aforementioned issues, in addition to those related to the security of information systems, is an idea that is gaining currency in other countries.

Electronic communications actors in Congo must also comply with the country's environmental regulations on safeguarding its fauna, flora and air quality. In addition to the ecological transition, there is the also the concept of energy transition, i.e. replacing fossil fuels with renewable or green energies.

The Congolese government has not yet passed any laws on energy transition. The Congolese economy is largely based on hydrocarbons, including natural gas, which is now being used to rapidly increase the country's energy (electricity) output. Natural gas is the primary source of electricity generation in Congo. When mobile operators' sites are powered by electricity provided by the national distributor, they not only save money but also help to reduce Congo's carbon footprint by reducing or eliminating the use of diesel-powered generators. If the electricity distribution network could cover a very large part of Congo, the costs related to operators' services, especially mobile telephony and infrastructure, would fall proportionally.

I

NATIONAL STRATEGY FOR THE DEVELOPMENT OF THE DIGITAL ECONOMY IN THE REPUBLIC OF THE CONGO



The Government of the Republic of the Congo adopted a strategy for the development of the digital economy, which was approved by Decree No. 2019-150 of 17 June 2019. The Ministry of the Post, Telecommunications and Digital Economy is responsible for its implementation.

This strategy must promote equitable access to digital infrastructures and services for businesses and citizens alike, and involves the development of activities that create added value (local digital content, etc.), as well as the digitalisation of public services (civil status documents, digital payments, etc.). It also contains provisions for the security and physical protection of digital infrastructures, as well as the privacy of users.

The legal framework and the development of telecoms infrastructures are two of the essential pillars that underpin this strategy for reducing the digital divide in Congo. A third pillar focuses on training human resources. This strategy provides for primary and secondary schools to familiarise learners with the use, jobs and challenges of Information and Communication Technologies (ICTs). This means modernising the education system by promoting the use of the digital school bag and distance learning.

In the medium and long term, higher education and research institutes dedicated to digital technologies should be created so that the local workforce is ready to face the challenges of the technological changes taking place in the telecoms sector.

II

LEGAL FRAMEWORK

Since 2009, the Republic of the Congo has been reforming its electronic communications, postal and digital economy sectors by adopting a legal and institutional framework for their regulation.

Table 1: Laws governing the postal, telecoms and digital economy sectors

Year	Laws
2009	Law n° 9-2009 of 25 November 2009 on the regulation of the electronic communications sector.
	Law n° 10-2009 of 25 November 2009 on the regulation of the postal sector.
	Law n° 11-2009 of 25 November 2009 on the creation of the Agence de Régulation des Postes et des Communications Électroniques (ARPCE), the state market regulator for the post and electronic communications sectors.
2019	Law n° 29-2019 of 10 October 2019 on data protection.
	Law n° 30-2019 of 10 October 2019 on the creation of the Agence Nationale de Sécurité des Systèmes d'Information (ANSSI), the National Agency for Information Systems Security.
	Law n° 37-2019 of 12 December 2019 on electronic transactions.
2020	Law n° 26-2020 of 5 June 2020 on cybersecurity.
	Law n° 27-2020 of 5 June 2020 on combating cybercrime.

These laws have been reinforced through implementing decrees (see table below).

Table 2: Decrees governing the postal, telecoms and digital economy sectors

Year	Decrees
2009	Decree n° 2009– 476 of 24 December 2009 on the creation of the Direction Générale des Postes et Télécommunications, the Directorate General of Posts and Telecommunications or DGPT.
2010	Decree n° 2010-554 of 26 July 2010 on the identification of subscribers to landline and mobile telephony services, and retention of electronic communications data.
2011	Decree n° 2011-734 of 7 December 2011 setting out the conditions for the establishment and operation of very high-speed electronic communication networks and services.
2015	Decree n° 2015-242 of 4 February 2015 setting out the terms and conditions for regulating the tariffs of electronic communications services.
	Decree n° 2015-243 of 4 February 2015 on the interconnection of public telecoms networks.
	Decree n° 2015-244 of 4 February 2015 setting out the terms and conditions for the management of the national numbering plan and the usage conditions of the numbering resources.
	Decree n° 2015-245 of 4 February 2015 setting out the conditions for the installation and operation of networks and postal services.
	Decree n° 2015-254 of 19 February 2015 setting out the terms and conditions for approving terminals and radio equipment, compliance verification, and the technical control of imports of electronic communication equipment.
	Decree n° 2015-253 of 19 February 2015 on the approval of the national radio frequency band allocation plan.
	Decree n° 2015-255 of 19 February 2015 setting out the conditions for the establishment and operation of electronic communication networks and services, and the distribution of equipment.
2018	Decree n° 2018-111 of 21 March 2018 on the organisation of the Ministry of Posts, Telecommunications and Digital Economy.
	Decree n° 2018-112 of 21 March 2018 on the responsibilities and organisation of the Directorate General for the Development of the Digital Economy.
2019	Decree n° 2019-123 of 3 May 2019 setting out the terms and conditions for the management of the universal access and service fund for electronic communications (FASUCE).
	Decree n° 2019-172 of 1 July 2019 setting out the terms and conditions for using the radio frequency spectrum.


PALAIS DU PARLEMENT

III

INSTITUTIONAL FRAMEWORK

The Ministry of the Post, Telecommunications and Digital Economy is responsible for implementing the Government's general policy in the sectors within its remit. This was limited to the postal and telecoms sectors until April 2016[1] when this Ministry merged with the Ministry for the Digital Economy in August 2017[2].

The development of telecoms technologies and associated services has led the Government to strengthen its regulation and control of the postal, electronic communications and digital economy sectors. The design of information systems, the security (soft and hard) of communication networks and the protection of data of natural and legal persons are all challenges that must be overcome if the Republic of the Congo is to become a meaningful digital State or society. The following institutions (among others) are tasked with addressing these challenges.

- **Agence Nationale de Sécurité des Systèmes d'Information (ANSSI), the National Agency for Information Systems Security**

  ANSSI is a public-sector administrative institution with a legal status and financial autonomy. On behalf of the government, it controls and monitors activities related to the security of information systems and electronic communication networks in order to protect Congo's cyberspace.

- **Centre d'Informatique et de Recherche de l'Armée et de la Sécurité (CIRAS), the Army and Security IT and Research Centre**

  Among other things, CIRAS participates in the design and development of Congo's policy on Information and Communication Technologies (ICT), and helps design and implement the national IT projects of the ministries in charge of national defence and security.

- **Agence de Régulation des Postes et des Communications Électroniques (ARPCE), the State Market Regulator for the Post and Electronic Communications Sectors**

  ARPCE is a public-sector administrative institution with a legal status and financial autonomy. Its mission is to regulate, monitor and evaluate the regulated sectors in accordance with the laws and regulations relating to the postal and electronic communications sectors.

1 See decree n° 2016-168 of 30 April 2016 on the appointment of members of the Government.
2 See decree n° 2017-373 of 22 August 2017 on the appointment of members of the Government.

- **Agence Congolaise des Systèmes d'Information (ACSI), the Congolese Information Systems Agency**

  ACSI is a public-sector administrative institution with a legal status and financial autonomy. Its mission is to develop and implement appropriate information systems in line with the specific needs of the Government.

- **Direction Générale des Postes et Télécommunications (DGPT), the Directorate General of Posts and Telecommunications**

  DGPT's mission is to help formulate, implement and execute the Governments policy in the postal and telecoms sectors. Working with ARPCE, DGPT also develops regulations for the regulated sectors.

- **Direction Générale du Développement de l'Économie Numérique (DGDEN), the Directorate General for the Development of the Digital Economy**

  DGDEN develops and implements (among other things) the national policy for the development of the digital economy. It then adapts this into strategies and action plans.

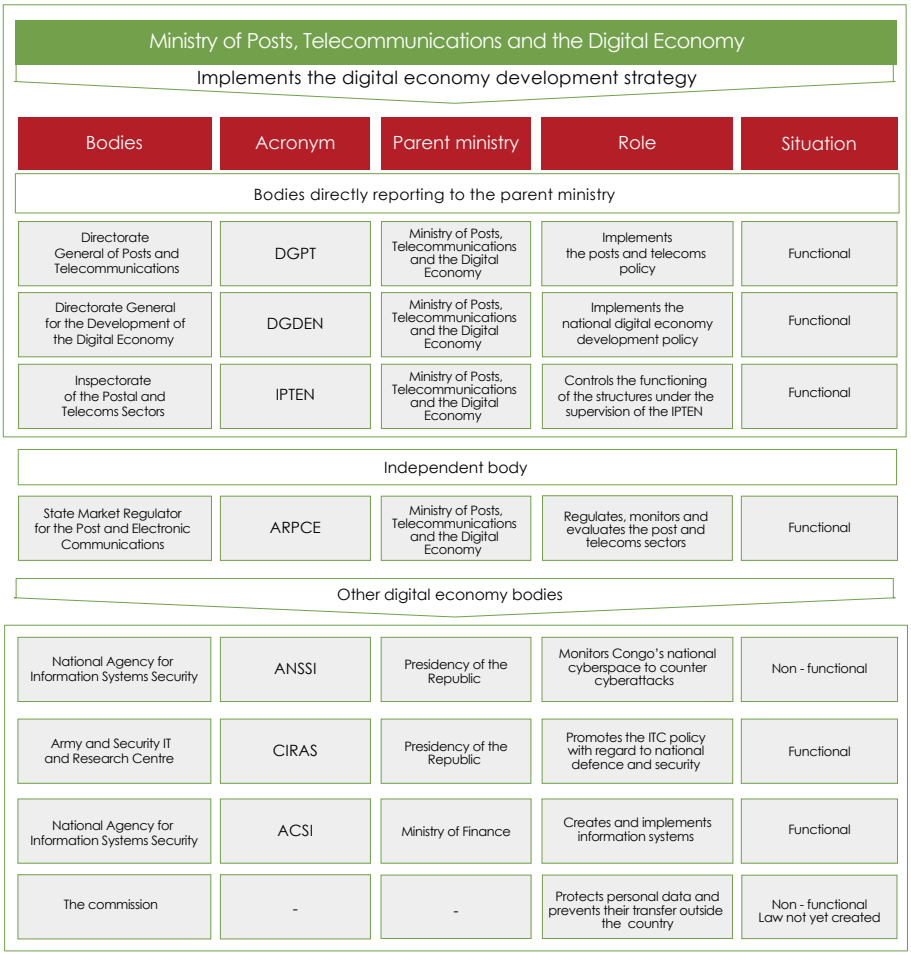
- **Inspection des Postes, des Télécommunications et du Numérique (IPTEN), the Inspectorate of the Postal and Telecoms Sectors**

  IPTEN is responsible for permanently assessing, through audits and/or controls, the functioning of the postal, telecoms and digital divisions and departments attached to the parent ministry.

- **The Commission**

  The Commission, which is responsible for data protection, monitors the processing of personal data of natural and legal persons, including the transfer of this data to and from third-party countries. The powers granted to the Commission are set out in Law n° 29-2019 of 10 October 2019 on data protection.

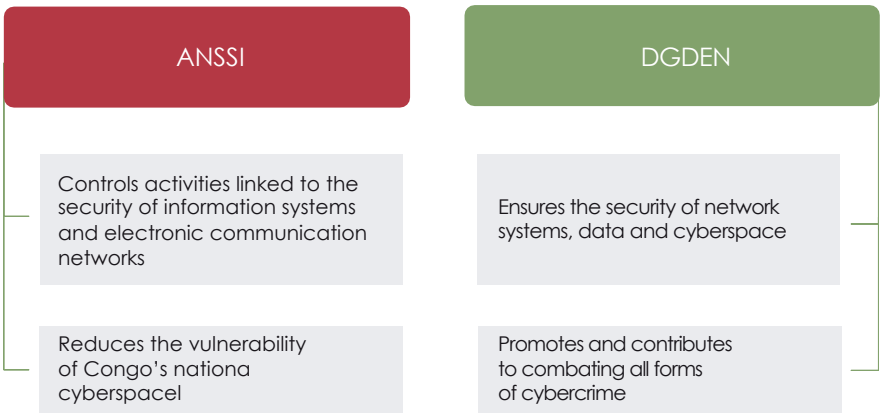
Figure 1: Telecoms and digital economy regulatory bodies



This map of the governmental bodies responsible for the telecoms sector and the digital economy shows that two of the bodies (ANSSI and the Commission) are not yet operational. They are both important bodies; one is concerned with the security of all information systems in national cyberspace, and the other with the protection of sensitive or personal data of users of electronic communications services.

There is also some overlap of responsibilities between bodies that are already operating or that are expected to operate within the electronic communications and digital economy ecosystem. This is the case of ANSSI and DGDEN with regard to the role of protecting Congo's cyberspace. The governance of Congo's national cyberspace would benefit if these roles were more clearly defined.

Figure 2: A comparison of the roles played by ANSSI and DGDEN



IV

POSTAL AND TELECOMS INFRASTRUCTURES

The public postal sector lost much of its former efficiency for a variety of reasons including the socio-political unrest of 1997, which led to the destruction of some of its infrastructure; this was exacerbated by the advent of the Internet and email, and the proliferation of cybercafés prior to mobile Internet. With the deregulation of the postal and telecoms sectors, new players emerged making it possible to develop modern infrastructures, particularly in the telecoms sector, which has helped to reach a large part of the Congolese population.

4.1. Postal infrastructures

Prior to 1997, the state-run postal network comprised 111 public post offices. After the political unrest of 1997, the Office National des Postes et Télécommunications (ONPT) only had 42 post offices across Congo. Sixty-nine (69) post offices were closed and reduced the national postal network to only 37.8% of its pre-war level. Brazzaville and Pointe-Noire/Kouilou account for 54.7% of the entire postal network belonging to the Société des Postes et de l'Épargne du Congo (SOPECO).

Table 3: SOPECO postal network

Administrative regions		Post Offices before 1997	Post Offices after 1997	Difference
1	Brazzaville	22	14	8
2	Pointe-Noire/Kouilou	21	9	12
3	Cuvette	10	5	5
4	Plateaux	8	4	4
5	Bouenza	8	3	5
6	Sangha	4	2	2
7	Lékoumou	4	1	3
8	Niari	12	1	11
9	Pool	11	1	10
10	Cuvette Ouest	6	1	5
11	Likouala	5	1	4
	Total	**111**	**42**	**69**

Source: Sopeco

Fifteen (15) private postal operators are authorised to operate in Congo. These operators have set up a network of 56 branches (or points of presence) in nine *administrative regions*. Brazzaville and Pointe-Noire are the departure and arrival points for all private postal operators in the country.

Table 4: Map of private postal operators

	Administrative regions	Presence of Operators by Administrative region
1	Brazzaville	15
2	Pointe-Noire	15
3	Niari	5
4	Bouenza	3
5	Sangha	1
6	Lékoumou	1
7	Pool	1
8	Cuvette	1
9	Likouala	1

Source: ARPCE

4.2. Telecoms infrastructures

The development strategy for the digital economy is reliant, to a large extent, on deploying telecoms infrastructures throughout the Congo. The strategy relies on the existing infrastructures of telecoms operators, the national fibre optic backbone and interconnecting this backbone to other countries, including the border countries.

■ WACS (West Africa Cable System)

This is the main submarine fibre optic link for international traffic in Congo. Connecting Congo to the WACS was entirely funded by the Government.

■ Matombi Landing Station

The WACS cable landing point is located in Matombi (15 km from Pointe-Noire) and is connected to the Cable Landing Station (CLS) situated a few kilometres from the landing point.

■ Fibre optic backbone

The fibre optic backbone connects Pointe-Noire, Dolisie, Brazzaville, Oyo and Ouesso. Fibre optic connections and straps extend this backbone to other areas, including the Ngo-Djambala, Loudima-Sibiti and Oyo-Boundji routes.

Énergie Électrique du Congo (E^2C), formerly the Société Nationale d'Electricité (National Electricity Company), also has a fibre optic backbone that runs from Pointe-Noire to Brazzaville, and from Brazzaville to Owando.

There are also plans to extend the backbone between Owando, Makoua and Ouesso. Between the Liouesso power plant and Ouesso, there is another fibre optic link that belongs to E²C.

Urban and metropolitan fibre optic loops

Urban fibre optic loops have been built in Pointe-Noire and Brazzaville by private operators (MTN and Airtel), and by the national operator, Congo Télécom. E²C has also built urban fibre optic loops in Brazzaville and Pointe-Noire, which are linked to their own backbone.

Cross-border microwave links

Prior to the introduction of fibre optic technology in Congo, cross-border microwave links were in operation with the Democratic Republic of the Congo, Angola and Gabon.

Cross-border fibre optic links

There is an 8-kilometre river fibre optic link between the Republic of the Congo and the Democratic Republic of the Congo. The Republic of the Congo has also been linked to Gabon since 2017 as part of the Central Africa Backbone or CAB project. The construction work to create the connection between Congo and Cameroon within the framework of the CAB project is ongoing. There are also plans to build a fibre optic interconnection link with the Central African Republic.

Satellite networks

Prior to the introduction of fibre optics, telecoms infrastructures in Congo relied on satellite earth stations (VSAT or Very-Small-Aperture Terminals). These stations are still used by certain companies as a back-up in the event of a break in the fibre optic link.

Data Centres

Brazzaville has three (3) Data Centres that belong to ARPCE, the Ministry of Finance and MTN Congo; MTN's Data Centre is open to the public. There is one (1) Data Centre in Pointe-Noire owned by OFIS, which is also open to the public, making a total of four (4) Data Centres in Congo. ARPCE's Data Centre houses Congo's Internet eXchange Point (CGIX).

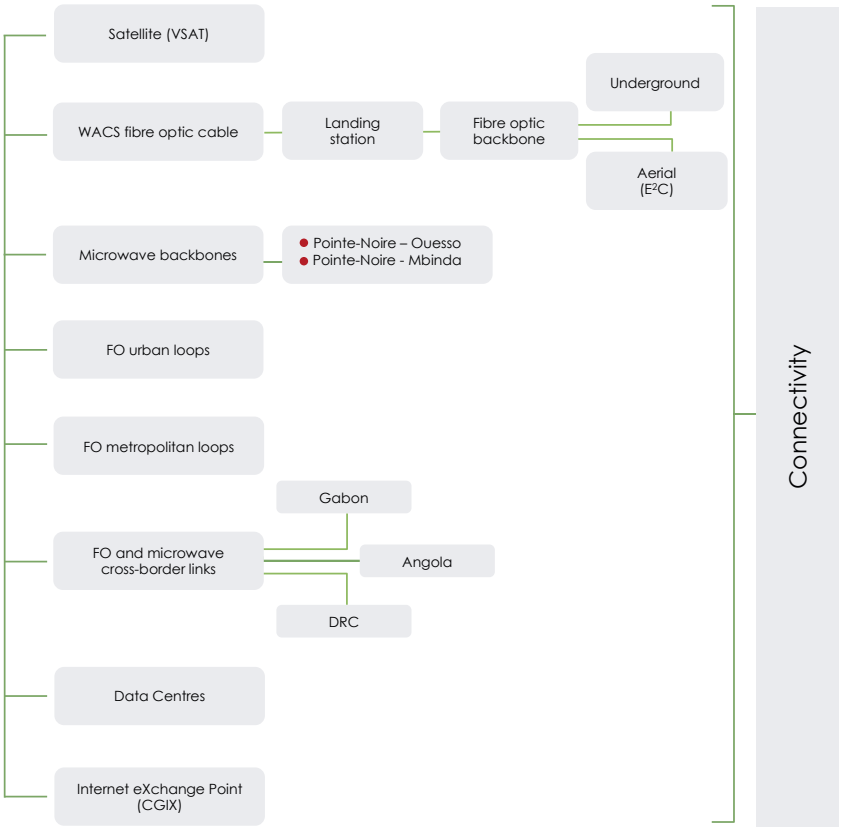
Internet eXchange Point (IXP)

Peering refers to an agreement between two or more Internet Service Provider (ISPs) operating in a common geographical area that decide to interconnect their Internet Protocol (IP) networks in order to exchange customer traffic free of charge. The interconnection occurs on a platform called an Internet Exchange Point (IXP). Congo's IXP or CGIX was commissioned in 2013.

CGIX members have interconnected their respective networks in order to pool their bandwidth capacity so that traffic exchanges between local

operators no longer rely on platforms hosted outside Congo. This has the advantage of boosting the volume of data exchanged locally, reducing latency and promoting lower Internet access prices for end users. CGIX had six members in 2013 but this dropped to four in 2019. However, the popularisation and optimisation of CGIX should be a priority for its manager as it is an undeniable asset for the development of Congo's digital economy.

Figure 3 : Telecoms and digital economy infrastructures



The strategy for the development of the digital economy is, for the time being, based on these electronic communications infrastructures, which enable the various stakeholders in the telecoms sector to offer innovative services, such as money transfers, payments via mobile networks, access to the Internet and social networks, etc.

4.3. Condition of the postal and telecoms infrastructures

In the postal sector, 37.8% of the infrastructure of the national postal operator that was destroyed still needs to be brought back into use. Existing infrastructures could also be improved so that the Post Office can fulfil its public service mission.

In the telecoms sector, certain infrastructures are not operational at all. This is the case for the Congo-Gabon CAB link, for example. Therefore, in the event of a problem with the WACS, Congo cannot use the cables landing in Gabon (i.e. Sat-3 and ACE). In June 2017 and January 2020, breaks in the WACS severely disrupted Internet provision in Congo forcing those companies that could afford it to use VSAT technology.

The fibre optic backbone has experienced quite a few problems. In fact, a section of the terrestrial backbone requires renovation, as do certain fibre optic rings in Pointe-Noire and Brazzaville.

However, despite the aforementioned issues, the progress that has been made in the provision of electronic communications services is undeniable. While mobile phones are still the most common way of connecting to the Internet, operators such as Congo Télécom and GVA (Group Vivendi Africa) offer, thanks to the current infrastructure and in particular the WACS cable, a fixed fibre optic connection to homes (FTTH)[3] and businesses (FTTO)[4].

3 FTTH: Fibre to the home.
4 FTTO: Fibre to the office.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V

TELECOMS AND POSTAL OPERATORS

The main owners or managers of telecoms infrastructures are the network operators (landlines and mobile). The postal network is essentially made up of collection and distribution agencies for letters and parcels.

5.1. Telecoms operators

National operator: Congo Télécom

Congo Télécom, the national operator, was formed following the dissolution of SOTELCO (Société des Télécommunications du Congo), which itself was created after the breakup of ONPT (Office National des Postes et Télécommunications). Therefore, Congo Télécom inherited the landline monopoly, and also acts as a mobile network operator (MNO). Unlike its competitors which use the GSM (Global System for Mobile Communication) standard, Congo Télécom opted to use the CDMA (Code Division Multiple Access) standard, which it was unable to deploy throughout the country at the same rate as the competition. Congo Télécom also benefits from four (4) fibre optic pairs on the optical backbone, which are deployed between Pointe-Noire and Brazzaville by E²C. Congo Télécom has around, 150,000 mobile subscribers.

Since April 2020, a new management team has taken over the running of Congo Telecom and it is hoped that it will play an even greater role in the telecoms and digital economy ecosystem in Congo.

Private operators: MTN and Airtel

Private MNOs, such as MTN Congo and Airtel Congo, have deployed the largest public access networks in the country. Between them they have over 5.6 million subscribers in every region of Congo. It should be noted that the use of multiple SIM cards is very high in Congo, i.e. nearly 37%.

There are still areas with no coverage known as 'white zones' where the residents are cut off from the rest of the country and the world. The Government has pledged to cover some of these areas through the Fonds d'Accès au Service Universel des Communications Électroniques (FASUCE), the Universal Electronic Communications Service Access Fund.

Infrastructure operators

Helios Tower, an infrastructure operator, bought almost all of Airtel's towers in 2015. It has also added to its existing equipment with the construction of new sites.

The ROFA Network is a transmission network infrastructure operator (fibre optics and microwave links) that has deployed cross-border links between Brazzaville and Kinshasa, and between Pointe-Noire and Malongo (in Angola). GBMCO offers transmission services using microwave links.

5.2. Postal operators

The landscape of the postal sector is identical to the telecoms landscape, i.e. there is one national operator and several private operators.

National operator: SOPECO

In 2001, the dissolution of ONPT gave rise to SOPECO (Société des Postes et de l'Epargne du Congo, the Congo Postal and Savings Company), which retained ONPT's postal assets. In 2009, the law regulating the postal sector ended SOPECO's monopoly on the transportation and delivery of postal items. SOPECO, also known as La Poste, offers the following services: ordinary mail, provision of post office boxes at the post office and money-transfer services.

Private operators

Out of the fifteen (15) private postal operators operating legally in the country, DHL International is by far the best organised and most successful. Its turnover represents over 88% of the entire market. Bolloré Logistics is in second place with over 7% of the market. Between them, these two operators have over 95% (turnover) of the postal market.


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VI

BASIC INFRASTRUCTURES: PILLARS OF THE TELECOMS AND POSTAL SECTORS

Despite notable progress in developing its telecoms infrastructures, Congo still has many challenges to overcome with regard to basic infrastructure. It is widely recognised that a well-constructed and maintained road network, and a reliable electricity supply are among the prerequisites for a country's development.

National road network

The National Development Plan (NDP) 2018-2022[5] states that the Congolese road network measures 23,234 km, but that only 3,111 km of the network was tarmacked in 2017 (i.e. 13% in total). The NDP also revealed that a lack of adequate road maintenance is still an ongoing problem.

The state of the road network has a significant impact on the development of the telecoms and postal sectors. In order for landline and mobile network operators to link up as many places as possible, they must be able to transport very heavy equipment, such as towers, with the minimum difficulty. Many areas are very difficult to access because of the poor state of the roads. Some areas are completely cut off and telecoms operators have little or no incentive to hook them up to their networks. And what is true for the telecoms sector is also true for the postal sector. It is difficult for postal operators to deliver letters and parcels when the roads to these areas are either non-existent or in a very poor state of repair.

National electricity grid

The nominal electrical power capacity in Congo is around 800 MW. However, Congo's hydro-electrical potential has been estimated at over 22,000 MW (22 GW), not including its considerable natural gas reserves. Despite the commissioning of new hydroelectric dams and thermal power stations, the electricity network logged an average of 25 outages per month in 2017[6].

This situation means that telecoms operators have to hook up their relay antennas (base stations) to generators so that they can remain operational 24/7. The rate of access to electricity in Congo is 44%.[7]

5 See the National Development Plan (NDP)- Operational Appendix N°1 PPAP 2018-2022, p.158.
6 Ditto, p.158
7 Ditto, p.161

It is mainly cities and urban centres that are supplied with electricity. Also, the operating costs of mobile network operators and infrastructure operators are heavily affected by the logistics of purchasing, transporting and storing fuel to ensure continuous telecoms services, particularly in rural and semi-urban areas. These operators have had to invest in alternative or hybrid equipment (solar panels) to reduce their operating costs, although these remain high.

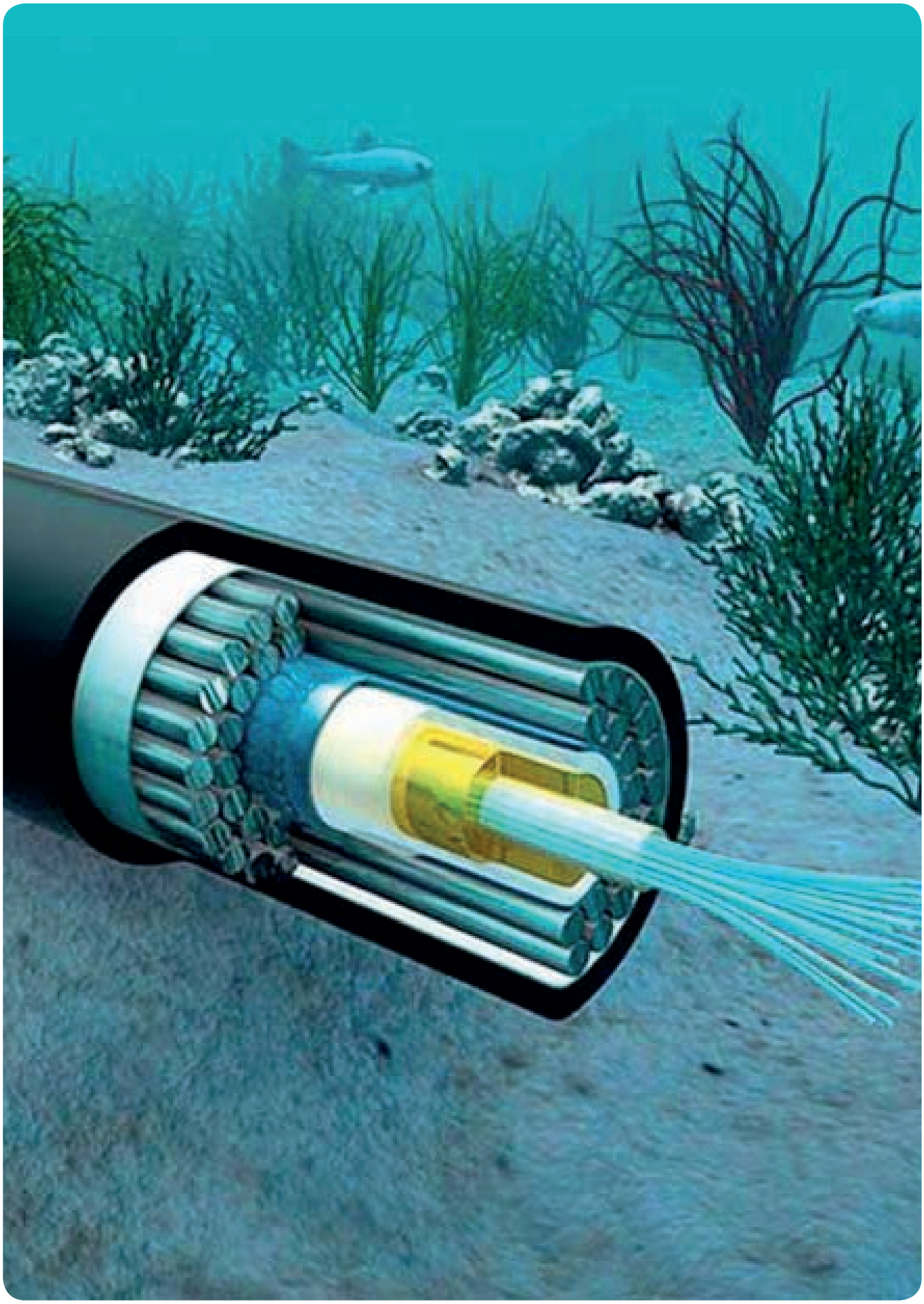
Figure 4: State of the road network and electricity generation in Congo

Hydroelectric potential	Nominal power	Electricity access rate	Power outages
22 000 MW	794 MW	44%	25 outages per month on average

Road network	Tarmacked roads	Percentage	Maintenance (NDP)
23,234 km	3,111 km	13%	Recurrent problem

Source: National Development Plan (NDP) 2018-2022

As mentioned above, telecoms and postal operators cannot always roll out services everywhere they would like. They are limited by constraints that only the State can overcome; they cannot take on the role of the State and can only act within the means at their disposal. Aware that postal and telecoms operators can not cover these unprofitable areas, the legislator has created two universal funds to cover the so-called white areas: one fund for the postal sector and one for the electronic communications sector. Will these funds be able to address the fundamental problems associated with building basic infrastructures?



VII

TRANSFORMATION OF THE TELECOMS ECOSYSTEM

The evolution of the telecoms sector requires an adaptation of the National Frequency Allocation Plan so that the deployment of new technologies can fully contribute to reducing the digital divide in Congo. Digital inclusion also involves modernising the postal sector, which must take advantage of technological innovations in the telecoms sector. Taking a broader vision would make it possible to plan for the digital transformation of certain public services and government departments in order to facilitate administrative procedures and formalities for businesses and citizens. This is why the Government has encouraged the development of mobile money, although this raises the question of how digital and mobile financial services should be best regulated. There are also issues linked to the interoperability of the technical platforms used for digital transfers, as well as the management of personal data, which must be taken into consideration in the transformation of the telecoms ecosystem.

7.1. National Frequency Allocation Plan

The radio frequency spectrum: an essential resource

In order to deploy broadband technologies on mobile networks, radio spectrum resources are absolutely indispensable. Without them, access terminals (phones, tablets, etc.) cannot access operators' networks. To sum up, every mobile telephony network is supported by an access network, which cannot be deployed without the availability of a frequency.

The rapid evolution of technologies and Congo's National Frequency Allocation Plan

The National Frequency Allocation Plan dates from 2015 and is currently being updated in line with recommendations put forward by the World Radiocommunication Conference held in December 2019 (WRC-19). For example, the 700 MHz, 800 MHz and 3,300 to 3,800 MHz frequency bands have already been reserved for the 5G network[8]. The 2.5 GHz band has also been allocated for the deployment of broadband technologies other than 5G. For example, WRC-15 and -19 discussed and identified additional bands for HAPS (High Altitude Platform Systems) to be included in the National Frequency Allocation Plan for radio frequency bands in the 47 GHz

8 Congo has been chosen as a 5G test market by the United Nations Economic Commission for Africa (UNECA).

band. HAPS will enable broadband connectivity and promote affordable telecoms services in poorly served communities (rural, remote, mountainous and desert areas) so that as many Congolese citizens as possible can benefit from access to Information and Communication Technologies (ICTs).

Technological developments do not necessarily require adapting the National Frequency Allocation Plan but rather fragmenting certain sub-bands that are adapted to new technologies. ARPCE begun work on this by revising the plan to reflect new technological requirements.

■ Impact of technological developments on the sharing of infrastructures

The development of new telecoms technologies will have an impact on how infrastructures are shared. Transport networks will be put under great pressure from 5G and broadband technologies. The fact that networks are shifting to all-IP raises questions about the security of networks, whose vulnerability could be exacerbated due to operators sharing infrastructures.

■ Impact of technological developments on public safety and security

Frequency bands are allocated by service in the National Frequency Allocation Plan. The security and safety services do not share the same frequency bands as public operators. It is up to the authorised services to acquire new equipment in order to adapt their monitoring and surveillance systems. If they do not do this, their systems will become obsolete and will not be able to develop effective strategies to combat cybercrime. Indeed, one of the major concerns surrounding digital transformation is network security and protecting personal data. In order to do this, Congo must have a plan coupled with the necessary technical and human resources to safeguard cybersecurity.

7.2. Reducing the digital divide

The digital divide can be defined as the gaps or inequalities that exist between people (natural and/or legal) in the same country with respect to accessing and using Information and Communication Technologies (ICTs), and the Internet in particular. Reducing the digital divide means facilitating access to and encouraging the use of ICTs by as many people as possible in different areas of everyday life.

■ Telecoms infrastructures

The National Frequency Allocation Plan and the development of the telecoms infrastructure are prerequisites for the development of a digital society. Congo already has some infrastructure in place that can help to reduce the divide that exists between those people who can access ICTs and those who cannot. The State, the public operator and private mobile network operators (MNOs) have been able to connect Congo to the submarine WACS (the West African Cable System), as well as laying a north-south fibre optic backbone with junctions leading to other administrative regions.

Is having telecoms infrastructures enough for Congo to successfully bring about its digital transformation? Policies and strategies related to the provision of universal postal and electronic communications services would seem to indicate otherwise, and highlight structural deficiencies.

Universal services and basic infrastructure: what are the challenges in terms of costs?

The difficulties associated with accessing certain areas led to the Government creating the Universal Electronic Communications Service Access Fund (FASUCE) in order to link up as many 'white areas'[9] as possible to the MNOs' networks. This Fund facilitates access to various electronic communications services (voice, Internet, mobile financial services, etc.) for people living in remote or isolated areas. In total, thirty-three (33) new areas with around 75,000 inhabitants were connected in 2020. Over 44% of people living in these newly connected areas (thanks to the FASUCE fund) reside in Likouala and Niari. In 2021, the FASUCE fund will be used to connect another thirty or so new areas.

Figure 5: Areas connected in 2020 to the MNOs' networks thanks to the FASUCE fund

FASUCE

Administrative regions	Connected localities	Inhabitants
Niari	3	16,850
Likouala	4	16,159
Cuvette Ouest	1	9,779
Pool	1	7,700
Plateaux	4	6,525
Kouilou	5	6,450
Sangha	6	5,405
Cuvette	6	4,939
Bouenza	3	1,000
Total	**33**	**74,807**

The role of the State in the construction of basic infrastructure is vital if all Congolese citizens are to reap the benefits brought about by ICTs.

Source: FASUCE

Linking these areas was carried out under extremely difficult conditions, notably due to the lack of decent roads. And the problems do not disappear once these areas are hooked up to the operators' network.

Access difficulties generally do not improve, making it very difficult to supply sites with fuel (for relay antennas) or to maintain them in the event of serious damage requiring the intervention of a specialist team. The lack and poor quality of basic infrastructures, such as roads and energy (electricity), has an impact on running costs in rural and isolated areas. This is what justifies, quite rightly, that operators do not want to set up there.

9 Geographical areas that are not connected to the access network of a landline or mobile telephony operator or an Internet Service Provider (ISP).

These costs could be significantly reduced if these areas were connected to the national electricity grid, and accessibility was improved by roads suitable for motor vehicles. Providing access to electronic and postal communication services to the greatest number of Congolese citizens does not depend solely on the operators working in these sectors. The State must also play a role by building basic infrastructure, if all Congolese citizens are to enjoy the benefits brought about by ICTs.

However, the operational performance of sites in 'white areas' should be similar to that of urban and rural sites so that the quality of services on offer is almost identical. For the moment, FASUCE-funded sites offer the following services: voice and data (2G/EDGE), SMS, USSD (e.g. for mobile money). Mobile network operators (MTN and Airtel) have been granted 3G and 4G licences. Due to this situation, it is feared that a digital imbalance will be created between profitable areas that are well covered by mobile operators' networks and those served by the FASUCE where the 2G network prevails, at least for the moment

Access devices

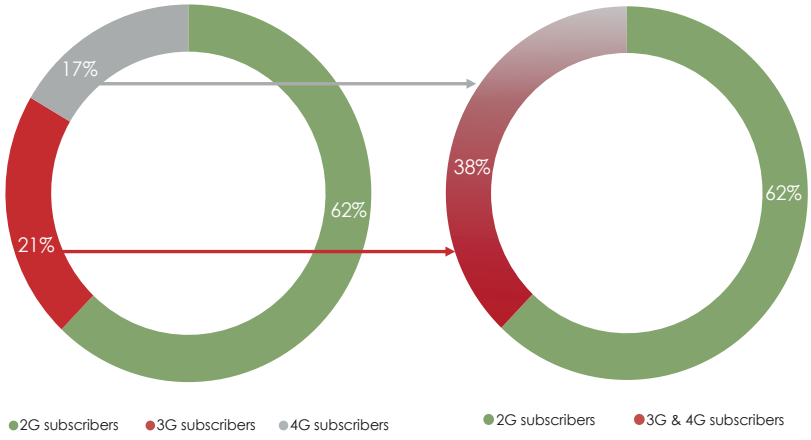
The Government hopes to speed up the digital transition by removing import duties on access devices (mobile phones, tablets, laptops, etc.). This government scheme aims to reduce the digital divide by lowering the price of access devices. Lower prices could increase the use of services offered by electronic communications and digital economy operators, thus improving digital inclusion rates.

The purchasing power in Congo incites users to acquire second-generation mobile phones (and other devices) for an average estimated price of 6,000 FCFA. It costs between 25,000 and 35,000 FCFA to purchase a basic smartphone compared to 100,000 to 150,000 FCFA to buy a relatively advanced one.

Access technologies

Second-, third- and fourth-generation technologies are available in Congo thanks to the Airtel and MTN mobile operators. In 2020, 62% of mobile phone subscribers were still using the 2G network, while 21% were using 3G and 17% 4G technology. The 3G and 4G networks combined account for 38% of subscribers.

Graph 1: Breakdown of mobile phone subscribers by type of technology

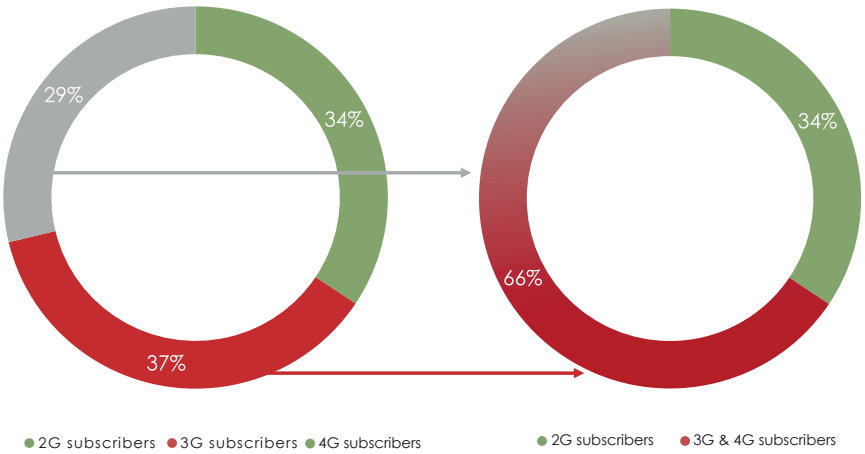


Source: ARPCE

MTN's 2G subscribers increased by 25% between 2019 and 2020, while Airtel's decreased by 0.1%. The strong increase in 2G subscribers on MTN's network is linked to the development of financial services on the mobile network, such as mobile money. This is the most likely reason that many mobile subscribers have also signed up for a mobile money account; a sector in which MTN was the leader in 2020 with a 70% market share[10]. This is all the more likely as 2G networks easily support mobile financial services through the use of USSD codes.

The use of USSD (Unstructured Supplementary Service Data) codes makes it possible to access mobile money services from 2G phones. The user enters a code including the star (*) and hash (#) keys to access the menu. These keys are compatible with 2G and 3G/4G technologies, and will also work with 5G. Therefore, users will not need a smartphone to access the mobile financial services offered by Airtel Money and MTN Mobile Money.

Graph 2: Breakdown of mobile Internet subscribers by type of technology



Source: ARPCE

10 Market share of active subscribers that make transactions over mobile networks.

In 2020, 37% of subscribers were connected to the Internet or OTT[11] via the 3G network and 29% via 4G. These two networks account for 66% of Internet connections compared to 34% for the 2G network.

To sum up, the majority of mobile operators' subscribers use 2G networks for voice and mobile money services. This trend can be correlated to the affordable prices of second-generation mobile phones. However, most subscribers use 3G and 4G networks to connect to the mobile Internet or access OTT services. The regulation of mobile operators' USSD platforms is a key issue in the development of the digital economy and is regulated by ARPCE, the state market regulator for the post and electronic communications.

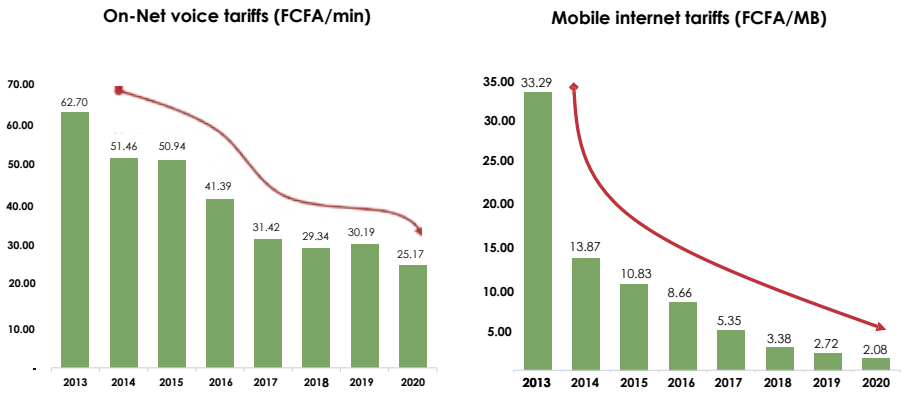
Satellites: an alternative to fibre optic

Satellite technologies, which are continuing to develop, could provide an alternative to carrying out the expensive work required to install fibre optical networks, especially in areas that are very difficult to access and that are not served by telecoms operators. Access to satellite broadband could provide a solution for the people living in these remote areas, even if the speeds are lower than those provided by fibre optic networks. If nothing else, at least the conditions would be in place for isolated and remote populations to benefit from the development of the digital economy and the resulting socio-economic advantages.

Lowering the costs of electronic communications

The costs of telecoms can be a barrier to the development of the digital economy. Since 2013, mobile operators, who are also licensed as Internet Service Providers (ISPs), have been lowering their prices. The weighted tariffs for voice calls (on-net) fell by 60% between 2013 and 2020. The price of a megabyte (to access the Internet) dropped by 94%.

Graph 3: Reduction in telecoms prices



Source: ARPCE

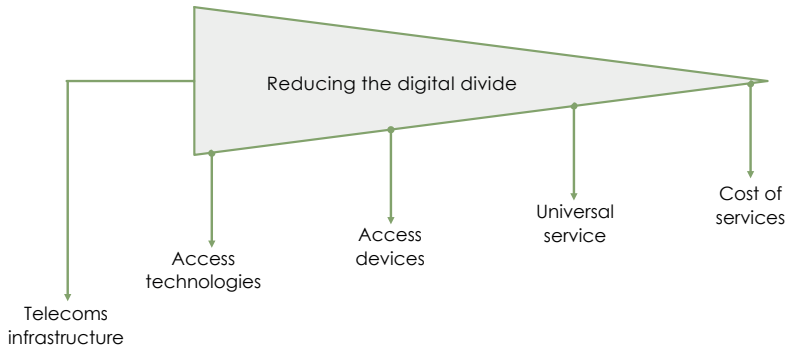
11 OTT = Over the Top. This refers to the use (by the end user) of services developed by Internet companies (WhatsApp, Telegram, Facebook, etc.) that use mobile network operators' networks. Users can only access these services if they have purchased an Internet data plan from an operator.

The downward trend in telecoms prices is expected to continue in 2021 and beyond. In addition to access devices, the cost of accessing telecoms services is another key factor of the digitalisation of Congolese society. However, the regulation of fixed broadband and ultra-broadband Internet still needs to be strengthened to make the digitalisation initiative as comprehensive as possible.

Reducing the digital divide to lead to greater digital inclusion depends, to a large extent, on the quality of the telecoms infrastructures Congo has deployed and that it will continue to deploy through private operators and the historical operator.

With the notable exception of 5G, which is still in its infancy around the world, access technologies mainly rely on (in terms of user numbers) 2G networks for voice, and 3G/4G for mobile Internet. 'White areas' will be progressively covered thanks to the universal service policy (while also taking into account the aforementioned limits) and efforts to lower electronic communication prices will be ongoing.

Figure 6: Steps to digital inclusion



7.3. Role of the postal sector in the digital economy

The modernisation of the postal sector is both a necessity and an opportunity for the public authorities thanks to its socio-economic potential. With the growth of the digital economy, the Congolese Post Office could play a major role in the development of e-commerce among other things. For this to happen, its facilities (including those that need to be modernised) would become digital service centres where people, especially in rural areas, could access both digital and traditional postal services.

In order for e-commerce to develop, there must be State-level agreements between the historical operator, and the customs, maritime and airport authorities to facilitate international purchases made by individuals and companies in Congo. However, as e-commerce is not only about imports, exporting goods from Congo to other countries should also be facilitated through a more efficient logistics ecosystem. To sum up, there is an urgent need to reinvent the postal sector with help from the public authorities.

In urban areas

The modern postal addressing system used in all the country's cities should contribute to the development of the postal sector. Without an accurate address, postal delivery workers cannot deliver letters or parcels directly to the addressee. This situation is made worse by the fact that postal operators are obliged, with the notable exception of businesses that are well-established and easy to locate, to call addressees and ask them to come and collect the letters, parcels or other goods they have received. In order to provide postal services, mobile phone numbers are essential for getting in touch with customers.

To a certain extent, mobile phone numbers have replaced physical addresses in Congo. This is proof — if proof were still needed — of the importance of mobile telephony uses that are adapted to the local context. Hence the importance of the permanent availability of the network of mobile operators and Congo Télécom. In order for the Post Office to be as efficient as possible in the digital era and for it to meet the needs of the population, the public authorities should continue rolling out the modern addressing system in the districts of Congolese towns. However, the postal sector is not on the sidelines when it comes to the development of the digital economy as demonstrated by SOPECO (La Poste), which offers domestic and international money transfers. Sending and receiving money requires the use of electronic communications networks and access to the Internet; and that raises the question on how competitive can SOPECO be in a deregulated environment.

The ability to track parcels and letters should be encouraged in the postal sector so that users can locate them, i.e. from the sending point to the arrival point using their mobile phones or other devices. This tracking service could also be done on an app. However, a tracking app of this nature would incur Internet access costs paid by the end user. Perhaps, like mobile money, it would be simpler to develop a system using the GSM network and SMS alerts (digital notifications) so that postal service users do not have to purchase an Internet data plan.

In rural areas

Postal infrastructures could become vectors of digital inclusion in the hinterland, if they could be linked to telecoms infrastructures. They could also contribute to the digital transformation of rural and semi-urban areas. In the long term, this would justify the setting up of a universal service fund provided for in the law regulating the postal sector[12].

Rural areas need to be accessible — by road, rivers and air — for postal services providers to access them. Roads, in particular, are key in order for the postal sector to be inclusive in its traditional form, i.e. in addition to any digital innovations. If they cannot be tarmacked then drivable roads in good conditions are required. If not, several areas will remain cut off and

12 Law n° 10-2009 of 25 November 2009 on the regulation of the postal sector. This fund is separate from the electronic communications fund, whose purpose is to connect 'white areas' to telecoms networks.

their residents will not be able to receive letters, parcels and so forth within reasonable time frames. Why would a private operator bother to deliver post to an area where the road is impassable?

Moreover, many rural areas are still not yet connected to the national energy provider, Énergie Électrique du Congo (E²C), yet the development of the digital economy is very much reliant on a permanent supply of electricity in cities and rural areas. A regular supply of electricity could contribute to the development of postal services to transport money to rural areas. However, with the development and undeniable success of mobile money, La Poste could face strong competition from mobile operators unless it and the telecoms operators join forces in a win-win partnership that is yet to be specified.

7.4. Digital transformation of the Congolese economy

Congo's digital economy strategy is based on three pillars: e-government, e-citizen and e-business, as well as other digital services, such as e-commerce, e-learning, e-education, etc.

■ e-government

e-government (electronic or digital government) means the use of ICTs by the government to provide high-quality services to citizens and legal entities in a timely manner. e-government also consists of improving digital interactions between various State bodies in order to streamline the flow of data and information in order to improve public services.

■ e-citizen

An e-citizen is any person who uses ICTs to access various administrative bodies online. For example, e-citizens would be able to pay for and then track the progress of a passport or national identity card or NIU (Unique Identification Number) application, etc. online or via a mobile operators' network.

For this to happen the various administrative bodies would have to have information systems able to process e-citizen requests. One service that has been made available to Congolese citizens for several years is being able to access the results of academic examinations (baccalaureate, vocational qualifications, etc.).

■ e-business

e-business (not to be confused with e-commerce) refers to the commercial and/or administrative formalities of a company or an administration that wants to use the features and resources of electronic communications networks (including the Internet) to facilitate the access, exchange and management of dematerialised information between stakeholders operating in the same ecosystem (governments, administrative bodies,

companies, citizens, etc.). For these interactions to take place between the various actors, data security and authentication protocols need to be in place.

e-commerce

e-commerce (electronic or digital commerce) refers to the buying and selling of goods, services or information via electronic communication networks. Websites are still the most effective way of doing business online as, when properly set up, they allow the buyer to transfer funds electronically through bank cards, mobile money, etc.

e-learning

e-learning (electronic or digital learning) refers to the provision of online training and education using digital resources that allows users to log in and learn at their convenience. In other terms, e-learning takes place online (on the Internet) via an access device (laptop, tablet, etc.). e-learning is a good option for professionals, self-taught learners, students, etc.

e-education

e-ducation (electronic or digital education) consists of teaching (teachers) and learning (pupils/students) using ICTs (Internet and access devices) while also maintaining an academic dimension to the educational content with specific time slots during which teachers and pupils/students interact face-to-face, but also online if and when circumstances require. Curricula are pre-loaded onto computers or tablets, or are stored in the Cloud. e-education makes it possible to put lessons online that are usually delivered face-to-face in classrooms or in university lecture theatres; this is the difference between e-learning.

e-health

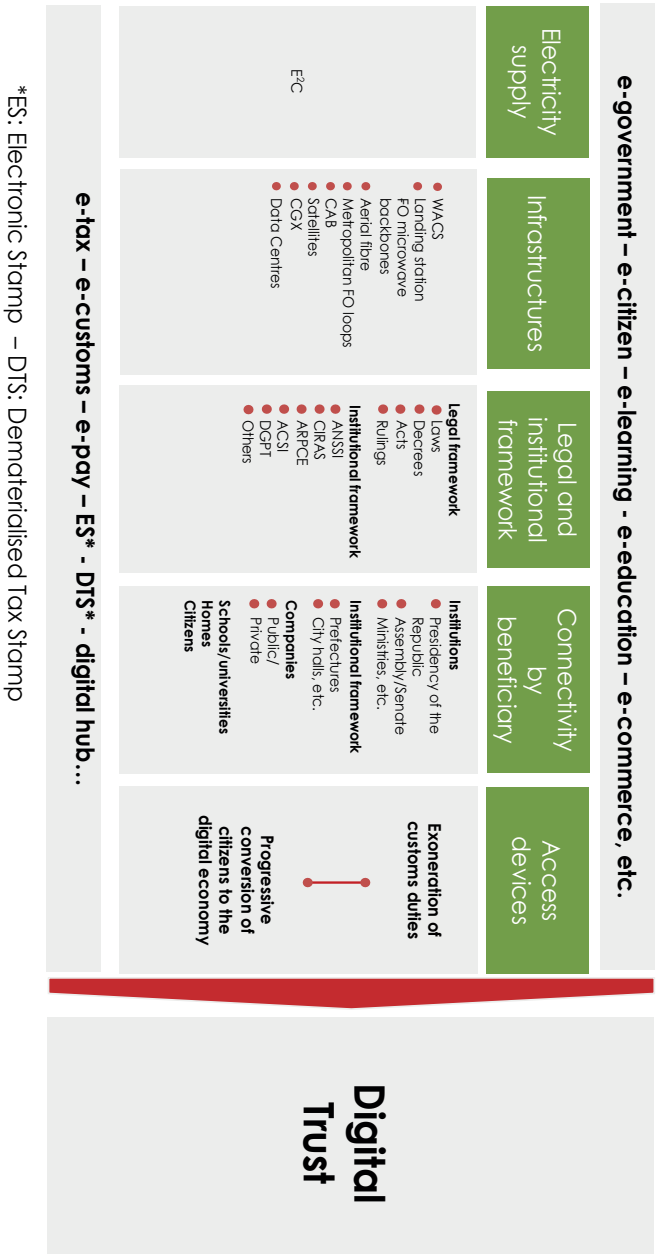
e-health (electronic or digital healthcare) refers to the use of ITCs in health-related activities. It is dependent on the Internet, smartphone apps and connected objects. e-health includes telehealth (preventive medicine and e-prescriptions), telemedicine (remotely administered medical procedures), and m-health (digital apps for smartphones and connected objects, such as health-monitoring bracelets), etc. For this to happen, health centres (hospitals, clinics, etc.) would have to be equipped with adequate telecoms infrastructures.

The above list, although not exhaustive, shows that the digital society (economy, public services, etc.) cannot develop without proper telecoms infrastructures. Connectivity (Internet and intranet) is absolutely key to digital transformation, and largely depends on a reliable, high-quality supply of energy. And in the case of Congo, this means that the digital economy ecosystem would be powered with energy from E²C.

e-education, for example, will only be sustainable if schools are connected to the E²C network as Internet connectivity depends on it. Moreover, all classrooms would have to have a sufficient number of power outlets for computers, overhead projectors, modems, etc., and the effectiveness of e-education would also depend on classroom size. Is e-education even compatible with overcrowded classrooms? Should the layout and design of classrooms be overhauled and adapted to accommodate smaller numbers of learners?

If the digital school bag became a reality in the Congolese education system, it would mean that every learner would need a digital tablet, which would require regular recharging. Many learners do not always have access to electricity in their homes, and this situation is more common in rural areas. The fear is that a "digital imbalance" would be created between better-off and less well-off learners.

Figure 7: Ecosystem of the digital economy



Digitalising the tax administration is one way in which Congo's digital economy could be developed. Certain digital platforms have already been interconnected (and others are planned) for the collection and monitoring of tax and duties. Moreover, Congolese taxpayers are encouraged to use electronic payments (including mobile money); this can be illustrated in some of the following advances:

- The Electronic Stamp (ES) is a fee charged in the digital economy sector by the legislator which makes it compulsory to pay bills by mobile money or direct debit. The ES is now part of a conventional invoice:
- The Dematerialised Tax Stamp (DTS), as its name suggests, is an electronic stamp that replaces the paper one. The DTS has a range of advantages, such as ensuring the unlimited availability of electronic stamp stocks with different face values, improved revenue security and full traceability along the entire value chain, as well as interaction options with other platforms e.g. e-tax. The Ministry of Finance and Budgets, the Public Treasury and the General Directorate of Taxes and Domains (DGIFN) are the main actors in this ecosystem.
- The Digital Hub was created by the legislator to enable the real-time monitoring of electronic transactions carried out by banks, microfinance institutions and mobile money operators in Congo and the wider CEMAC zone.
- e-tax (electronic tax) is a platform that aims to contribute to the modernisation of the Congolese tax authority in order to make it more efficient. It allows the taxpayer to access his/her tax file held by the tax authorities in real time. The taxpayer can perform different operations and administrative formalities online, including paying income tax, and other taxes and duties.
- e-pay (electronic payment) is a platform or gateway proposed by the Ministry of Finance and Budgets. It encompasses various payment methods, such as mobile money, online bank transfers, debit/credit card payments (Visa, Mastercard), etc.
- e-customs (electronic customs) is the electronic services portal of the Congolese customs authorities and offers many online services to facilitate customs declarations, as well as electronic payments via e-pay. In addition, there is an electronic tracking system (GPS) for containers and goods declared in transit to ensure that they arrive safely at their destination.

The aim of these various government initiatives is to encourage e-citizens and e-businesses to pay duties and taxes using modern payment methods whose main advantages are as follows:

- dematerialisation of administrative and commercial payments;
- traceability of payments in real time;
- improved public finances;
- optimal management of tax revenues;
- extended tax base.

The digital transformation of the Congolese economy is only just beginning and will continue to grow in the coming years. The development possibilities created by electronic communications in all areas could contribute to a shift from the informal to the formal economy. Electronic communications would make it easier to assess the domestic wealth generated by actors in the informal sector. Administrative procedures, if digitised and simplified, could encourage these actors to declare their activities with the tax authorities (and other bodies).

The simplification brought about by mobile operators with mobile money shows that it is possible to provide banking services, albeit in a different way, to certain categories of people who have been excluded from the traditional banking system. The ease in which it is possible to open a mobile money account, as well as the sheer number of transactions carried out on the Airtel and MTN mobile money platforms proves that Congolese citizens are aware of these solutions that are adapted to their needs, and that it is not always necessary to copy the development approaches designed for and by 'industrialised and developed' countries. Information and Communication Technologies (ICTs) will continue to be at the heart of this digital transformation, although it must not be limited to the collection of taxes and duties; the fields of application must be much broader.

7.5. Role of banks and microfinance institutions in the development of the digital economy

Eleven (11) institutions are authorised to operate in the banking sector in the Republic of the Congo. They had 496,009 customers in 2017 compared to 395,734 in 2016. This is what emerged from a 2017 report on the Congolese banking system, which was drawn up by the Direction Générale des Institutions Financières Nationales, the General Directorate of National Financial Institutions. These data make it possible to estimate the banking services access rate in Congo.

Table 5: Customers of banks established in Congo

	ACRONYM	2016	2017
Banque Commerciale Internationale	BCI	79,438	79,438
Banque Congolaise de l'Habitat	BCH	29,743	33,436
Banque Espirito Santo Congo	BESCO	337	810
Banque Gabonaise et Française Internationale	BGFIBank	11,497	13,454
Banque Postale du Congo	BPC	70,478	80,161
Banque Sino Congolaise pour l'Afrique	BSCA	878	1,045
Crédit du Congo	CDC	58,576	57,613
Ecobank Transnational Inc.	ECOBANK	56,641	105,072
La Congolaise des Banques	LCB	46,574	78,634
Société Générale Congo	SGC	6,759	13,303
United Bank for Africa	UBA	34,813	33,043
Total		**395,734**	**496,009**

Source: Direction Générale des Institutions Financières Nationales (DGIFN)

In addition to banks, there are 58 licensed MFIs (Microfinance Institutions), including 33 MUCODEC (Mutuelles Congolaises d'Épargne et de Crédit) network agencies and 25 independent institutions[13]. In 2018, the MFIs had 498,810 clients (or members) compared to 471,242 in 2017. With 340,806 members, the MUCODEC network enjoys the largest market share in the MFI segment. In 2017, banks and MFIs (together) had close to one (1) million clients or members, i.e. 967,251 to be exact[14].

According to the Congolese National Institute of Statistics (NIS), the country's population was estimated to be 3,697,490 in 2007[15]. Based on an average annual growth rate of 2.8%, the low growth hypothesis presented in the ARPCE and NIS forecasts, the population can be estimated for 2016, 2017 and 2018 (see table below). Based on the make-up of the Congolese population, 51.12% of men and women over the age of 19 are legally entitled to open a bank account. The rate of access to banking services must be pegged to this sub-section of the population and not the total population at the risk of skewing the overall results.

13 See the minutes of the consultation meeting with the heads of microfinance institutions organised by the General Directorate of National Financial Institutions (DGIFN) of the Ministry of Finance and Budgets held on Wednesday, 30 October 2019 in Brazzaville.

14 To our knowledge, the banking sector data have not been updated since the report was published in 2017.

15 National Institute of Statistics: https://ins-congo.org/projections-demographiques/, website consulted on 04/01/2021.

Table 6: Rate of access to banking services in Congo

	2016	2017	2018
Population			
Total population	4,740,728	4,873,468	5,009,926
Population > 19 years of age (eligible pop.)	2,423,360	2,491,316	2,561,074
Banking Sector			
Total number of clients	395,734	496,009	486,282
Banking penetration rate in the eligible population	**16.3%**	**19.9%**	**18.9%**
Microfinance Institutions (MFI)			
Total number of MFI clients:	nd	471,242	498,810
of which MUCODEC clients	322,408	333,286	340,806
Rate of access to banking services* (Banks + MUCODEC)	**29.6%**	**33.2 %**	**32.9 %**

**Out of the eligible population.*
Sources: DGIFN, INS[16], FCM[17], COBAC[18]

The rate of access to banking services in the Congo stood at close to19% in 2018 (NB: this figure only takes into account institutions in the banking sector) compared to 16.3% in 2016. Although MUCODEC is an MFI, it offers similar services to traditional banks. It is interesting to note that none of these banks has as many clients or members as MUCODEC. The calculation of the rate of access to banking services should not exclude customers who have opened an account with MUCODEC.

In 2018, the rate of access to banking services in Congo was estimated to be almost 33%, i.e. more than 827,088 customers (banks + MUCODEC) but a lack of up-to-date data means that it is not possible to know how or if this rate has changed since then.

Actors in the banking and microfinance sectors rely on telecoms infrastructures to carry out their missions. Some of their offers and products depend on the availability of an Internet connection and speeds that make it possible to provide their customers with services. For example, in order for banks and MUCODEC agencies to be able to provide ATMs (Automatic Teller Machines), they require a reliable Internet connection. Customers also have to be issued with cash withdrawal cards to use these ATMs.

MUCODEC has already issued over 250,000 withdrawal cards to its members; traditional banks have also issued cards but data on the numbers are not available. The same applies to transactions, such as domestic and international bank transfers, which also require an Internet connection. Congo Télécom, mobile operators (MTN and Airtel), and other telecoms players provide this access to the Internet.

16 National Institute of Statistics.
17 Fondation du Crédit Mutuel, Rapport Annuel 2017.
18 Commission Bancaire de l'Afrique Centrale.

However, digital or online banking is still struggling to take off, partly due to Congo's economic structure. In fact, the majority of economic players are used to paper bank notes and coins, especially in the informal economy. Apart from a few payments that are made by bank cards in large retail outlets, the state-owned markets — where most citizens live — have an informal structure that favours physical rather than electronic money. The same applies to hardware shops, bakeries, public transport, etc., which are not able to accept electronic payments.

The Congolese population has a lower access rate to banking services compared to other countries. However, close to one million Congolese do have access to banking services. This suggests that banks, businesses and the tax authorities (among others) may not have been able to adapt to these new developments. Therefore, it is a combination of factors linked to the economic, sociological and cultural factors that explains why the Congolese have not yet widely adopted electronic payments made by bank cards. "Cash" still reigns and the informal economy plays an important role in economic transactions.

In 2017, the informal economy generated over 3,000 billion FCFA and over 73,000 economic actors were active in 40,200 economic units[19]. This shows that the informal sector is dynamic but cut off from certain strata of the formal economy, including traditional banks. This is why the alternative solutions provided by mobile operators with mobile money has aroused and continues to arouse real interest for actors in the formal and informal sectors in Congo.

7.6. Mobile Money (electronic money sent/received over a mobile network)

Thanks to electronic money solutions (on mobile networks), MTN and Airtel have been able to develop a range of mobile financial services that mainly compete with microfinance and money-transfer institutions (Maouené, Charden-Farell, etc.), as well as traditional banks. Currently, mobile operators act as electronic money distributors, and have entered into partnerships with banks, which are responsible for issuing the electronic money. However, mobile operators can now — thanks to their status as payment institutions — issue and manage electronic money[20] whereas in the past this was reserved exclusively for traditional banks. Unlike opening a classic bank account, opening a mobile money account is far easier and requires less paperwork.

19 Les Dépêches de Brazzaville N°3466 on 8 April 2019, p.3. The newspaper quotes from a study on the mapping of the informal sector in the Republic of the Congo.

20 In accordance with articles 3 and 5 of Regulation n°04/18/CEMAC/UMAC/COBAC on payment services in the Economic and Monetary Community of Central Africa of 21 December 2018

Definition of mobile money

Mobile money is a currency that uses mobile telecoms networks (stored on electronic memories) and is not linked to a bank account. Mobile money transactions are financial transactions that rely on telecoms equipment to carry them out. Mobile money differs in this way from fiat money[21] and bank money[22].

There is, however, still some confusion between **mobile banking** and **mobile money. Mobile banking** is an online service offered by banks and credit institutions to their customers. It is accessible via the Internet from an access device (mobile phone, tablet, desktop or laptop, etc.), and via these online services, customers can access their accounts and perform certain simple banking transactions and operations (checking their balances, making bank transfers, etc.). To do this customers must first have a bank account in order to be able to access these mobile banking services. Mobile money, on the other hand, is a service that is available on the GSM network provided by mobile network operators, and users do not need a bank account or even Internet access.

Shift from mere mobile operators to providers of mobile financial services

The Airtel and MTN mobile network operators have succeeded in making mobile phones a mass consumer product that is affordable to all categories of the population. It has become a powerful development tool that makes it possible to rapidly share information over the mobile Internet networks, as well as making it easier to transfer money from one mobile phone to another.

Mobile money also allows users — the well-off and less well-off — to store (deposit), receive and transfer money, as well as making purchases using their mobile phones. Mobile phones can also be seen as e-wallets.

Mobile money has contributed to eroding the market share of operators who traditionally dominated the money-transfer market (Charden-Farell, Maouené, etc.). The relatively low density of their network cannot compete with the thousands of kiosks (outlets) that provide mobile telephony and money-transfer services. This vast network of kiosks when combined with the number of subscribers of the two operators is in the millions. At any time of day or night and from any location (as long as it has coverage), subscribers can send money to friends and family in record time across the country. However, deposits and withdrawals can only be made during the business hours of these kiosks.

Thanks to mobile money, the culture of the digital economy is gradually gaining a foothold in the Republic of the Congo, where mobile phones can be used to pay electricity and water bills, make purchases in certain shops and supermarkets, subscribe to satellite radio and television channels, etc.

21 Fiat money includes bank notes and coins, i.e. it is the physical money that people handle on a daily basis.

22 Bank money is not represented by physical notes or coins. It is an abstract currency represented by entries in a bank account or cheque book, for example.

The shift from mobile telephony (voice + SMS + mobile Internet) to mobile financial services (MFS) demonstrates how mobile operators have been able to diversify their activities. It is much more than a shift that we are witnessing, but rather a veritable convergence of services (voice + data + mobile financial services). Online purchases and payments made with mobile phones should lead to MTN and Airtel developing mobile banking, as is the case in Côte d'Ivoire with Orange Bank. Mobile network operators (MNOs) in Congo could start competing with traditional banks and microfinance institutions once they have pushed money-transfer companies out of the market.

This transformation of MNOs into players in the banking sector will inevitably pose problems in terms of regulation, and this must be addressed. MNOs already have telecoms infrastructures at their disposal that allow them to provide a range of services to their subscribers. Compared to banks and microfinance institutions, they also have the advantage of having a very large base of subscribers spread throughout the country. Therefore, it is relatively easy for them to attract new customers to their mobile financial services (mobile money and future banking services).

Could MNOs also compete with or even push certain microfinance players out of the market? The mobile money experience shows that subscribers of MNOs rapidly adopted this service, which allows them to deposit money into their accounts, and which can also be seen as a savings account albeit on a mobile network. One of the possible consequences if "MTN Bank "and "Airtel Bank" were to become a reality, would be that MNOs would attract more of these savings as their subscribers would be able to have their salaries paid directly into a mobile network bank account.

Transfers from one bank account to another linked to a mobile phone number could encourage some traditional bank account holders to switch to an account offered by mobile network operators. Moreover, there would no longer be any need to physically go to the bank to withdraw money, for example. The long queues seen at some banks and microfinance institutions when civil servants and pensioners receive their salaries or pensions could gradually become a thing of the past thanks to the immediacy and mobility offered by these new technologies on mobile operators' networks.

7.7. Regulating mobile financial services – challenges and perspectives

Community-wide regulation of mobile financial services[23]

The regulation of Mobile Financial Services (MFSs) in the Republic of the Congo and the wider CEMAC zone is one of the challenges to developing the digital economy. The Bank of Central African States (BEAC) and the Central African Banking Commission (COBAC) are responsible for regulating the issuing of electronic money. As the Republic of the Congo is a member of CEMAC, it is BEAC that:

- establishes the rules for issuing electronic money and its conversion into fiat or bank money;
- establishes the rules on the interoperability obligation of technical systems and platforms used to provide payment services;
- monitors the compliance, security and availability of technical payment solutions;
- ensures that when a payment service is provided via a mobile phone that the entity in charge of the service has received authorisation from the regulating authority (ARPCE) to use the technology required to provide this service.

Pending the transformation of mobile operators into "payment institutions" in accordance with Regulation n° 04/18/CEMAC/UMAC/COBAC on payment services in CEMAC, the following figure briefly describes the current relationship between BEAC (Bank of Central African States), COBAC (African Banking Commission), and the commercial banks authorised to issue e-money. Mobile network operators partner with commercial banks (that are authorised to issue e-money) so they can distribute money to their subscribers. The main role of ARPCE, the state market regulator for the post and electronic communications, is to validate the technical platforms used by these mobile operators.

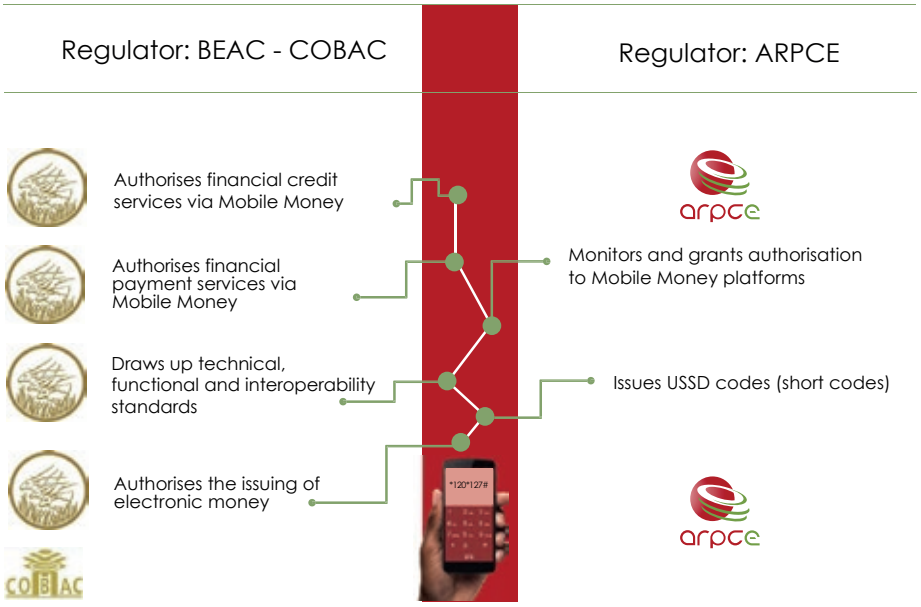
23 The following texts were consulted:
- Regulation n° 04/18/CEMAC/UMAC/COBAC on payment services in the Economic and Monetary Community of Central Africa of 21 December 2018.
- Instruction n° 001/GR/2018 on the definition of the scope of interoperability and interbanking of electronic payment systems in the CEMAC.

Figure 8: Main mobile money stakeholders

Regulatory Authorities	1	BEAC & COBAC
Issuers of Electronic Money	2	Commercial Banks
Distributors of Electronic Money	3	MTN & Airtel
Bearers of Electronic Money	4	Users / Subscribers
Accepters of Electronic Money	5	Merchants

The figure below summarises some of the powers of the banking regulator, and outlines the two main missions of ARPCE. Any electronic money distributor must apply to ARPCE to request the allocation of a short code or a USSD code. ARPCE also monitors and validates mobile money technical platforms.

Figure 9: Regulating mobile money in Congo



What is the boundary between the banking and telecoms sectors?

The CEMAC texts set out the roles of BEAC and ARPCE with regard to the regulation of electronic money that uses mobile telephony networks. When a bill is paid via a mobile money service, MTN or Airtel charge the service user a small fee. Even though the payment is made via the MTN or Airtel network, ARPCE does not regulate the tariffs charged to the user by the operators; the latter in this case act as electronic money (mobile money) distributors. It is, therefore, up to BEAC to ensure the regulation of mobile money products and services, including any promotional offers in accordance with article 18 of Regulation n° 04/18/CEMAC/UMAC/COBAC of 21 December 2018, which stipulates that BEAC is responsible for defining the rules pertaining to payment transactions and related fees. Therefore, a service declaration is added to the portfolio of mobile money services; this service, which is the result of a partnership between a mobile operator and a microfinance institution that grants loans with interest to the mobile operator's subscribers, does not fall within the jurisdiction of the electronic communications regulator (ARPCE).

BEAC and COBAC are also responsible for dealing with any customer complaints linked to mobile money; complaints that are still being handled by ARPCE on its platform. Customer complaints dealt with by ARPCE generally tend to concern those for which the customer has not found a satisfactory solution with the operator. However, users as a whole do not differentiate between voice and mobile money services, since the device used to make calls, browse the Internet and use mobile money services is the same, i.e. a mobile phone. Clarification with regard to the management of mobile money complaints is needed so that ARPCE only has to deal with complaints within its legal remit.

The application of texts on the interoperability of competing mobile money platforms is another weakness in the regulation of mobile financial services. In simple terms, the platform that manages MTN Mobile Money does not yet communicate with the platform that manages Airtel. Consequently, an Airtel Money user cannot transfer money to an MTN Mobile Money account and vice versa. In accordance with regulation n° 04/18/CEMAC/UMAC/COBAC on payment services and Instruction n° 001/GR/2018 on the interoperability and interbanking of electronic payment systems, BEAC is responsible for ensuring the interoperability of payment systems. It can, if necessary, call on ARPCE's expertise.

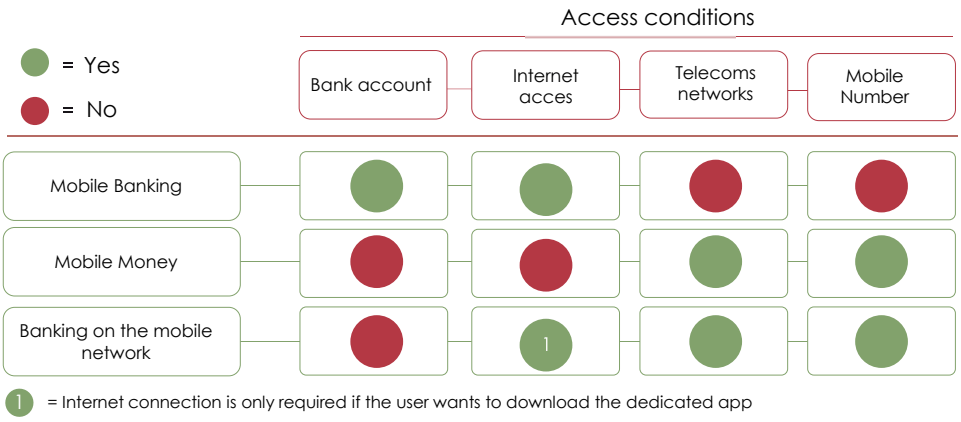
It would be beneficial to users if this interoperability became effective as they would no longer need a different SIM card for each operator. Therefore, mobile financial services contribute to the use of multiple SIM cards by mobile users to access the same services, but from a different operator. The high rate of multiple SIM cards has its origins in the use of mobile financial services. Effective regulation on the interoperability of mobile money platforms by BEAC could help, if only slightly, to lowering this rate.

Banking on the mobile network

Mobile money, mobile banking and banking on the mobile network, these similar terms require nuanced definitions. The difference between mobile banking and mobile money has already been covered in the section on the definition of mobile money. Banking on the mobile network is based on an operator's existing mobile money network. While mobile banking is linked to a bank account, mobile money and banking on the mobile network are linked to a mobile phone number. While mobile banking requires an Internet connection to access an online account, mobile money and banking on the mobile network do not require an Internet connection. However, it would be possible to develop an Internet app to access banking on the mobile network.

However, both of these services rely on network coverage provided by the mobile operator. But, unlike mobile money, banking on the mobile network allows the user to open a current account and a savings account (interest-bearing), as well as the option to apply for bank loans with an unparalleled level of immediacy that traditional banks cannot offer owing to their strict procedures. Banking on the mobile network is a smart solution that is accessible 24/7, a clear advantage with regard to the competition. However, the amounts of the bank loans on offer would not be very large compared to traditional banks, and would depend on the borrower's credit history, which would be analysed by the artificial intelligence systems set up for this purpose.

Figure 10: Comparison of access conditions to digital financial services



There is a pressing need to anticipate how banking on the mobile network in Congo will develop, which could result in the creation of 'MTN Bank' and 'Airtel Bank', for example. These are two possible scenarios in response to this innovation by the French group Orange, which has deployed Orange Bank in Côte d'Ivoire. Orange obtained a licence for this new activity from the Central Bank of West African States (BCEAO). It is also the result of a partnership between the Orange Group and the NISA Group (banking and insurance).

In Congo, MTN and Airtel have not yet started issuing electronic money, although they have the option of doing so in the vein of mobile network operators in the WAMU zone that are recognised as EMIs (Electronic Money Institutions).[24] Therefore, it is their partner banks that issue electronic money for the moment.

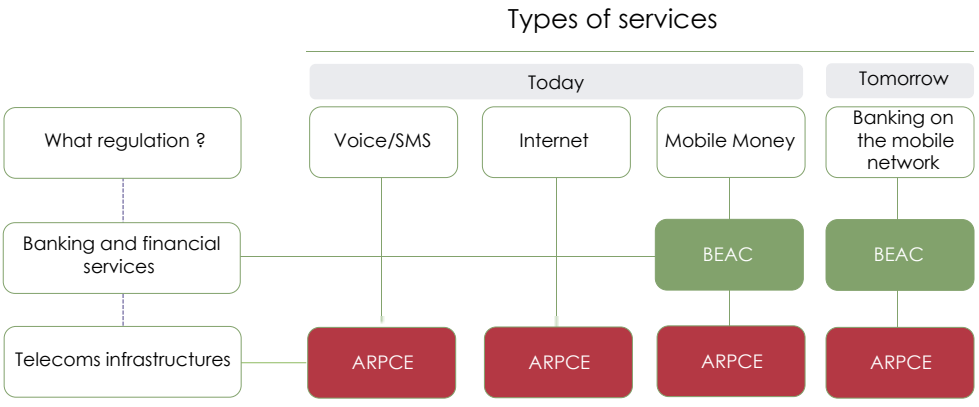
The evolution of the regulatory framework in the CEMAC zone (since 2018) should allow mobile network operators who migrate to banking on the mobile networks to become "e-money issuers". By freeing themselves from the oversight of traditional banks, which have until now issued electronic money on their behalf, mobile operators will become even more formidable competitors of traditional banks.

From mobile network operators to multiservice operators: what regulation is required?

Mobile network operators (MNOs) have developed their services in a spectacular manner and have taken advantage of the various technological developments to such a point that they have succeeded in penetrating sectors that may have seemed a long way away from their traditional core businesses. From mobile phones offering call (voice) and messaging (SMS) services, they have now become Internet Service Providers (ISPs). They then spotted an opportunity to offer money-transfer services via mobile networks (mobile money), and were able to add banking services supported by their own mobile telephony networks.

The complexity of this diversification lies in the fact that these MNOs must comply with two types of regulations (depending on the service); namely, ARPCE and BEAC regulations. Despite this diversification, MNOs have not relinquished their telecoms networks (technical platform), which remain at the heart of their development strategies. For example, it was BEAC that had to adapt its regulations to cover innovative services in the telecoms sector.

Figure 11: Evolution of the regulation of telecoms operators' services



24 https://www.bceao.int/fr/content/etablissements-de-monnaie-Électronique, website consulted on 21/01/2021.

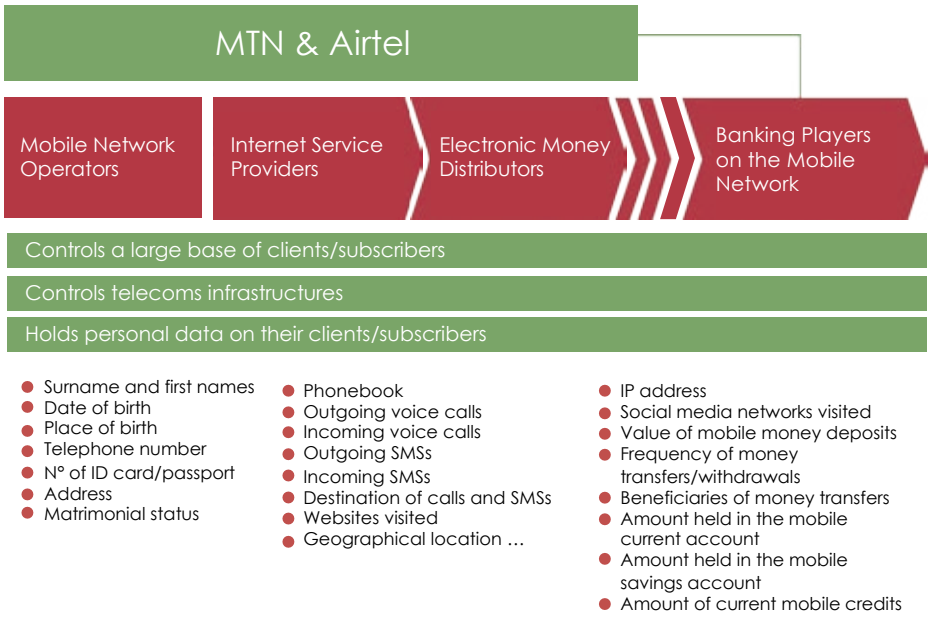
The regulation of "voice" and "SMS" services mainly falls within the remit of ARPCE unlike mobile money, which requires the creation of electronic money that can then be converted into fiat money, and thus falls within the remit of BEAC. Be that as it may, the mobile financial services offered by MNOs rely on their telecoms networks, which are regulated by ARPCE. It is therefore necessary to distinguish between the "layer" related to the network equipment and the "layer" related to the financial flows that pass through the MNOs' network equipment.

7.8. Data protection

Mobile network operators (MNOs) have considerable financial resources at their disposal in order to use Big Data and artificial intelligence to produce accurate profiles about their subscribers or customers. By becoming multiservice operators, they will control increasing amounts of personal data that could be used without the informed consent and scrutiny of their subscribers. MNOs are becoming, in a way, data aggregators that store and control sensitive and marketable information, with the risk that they may become uncontrollable goliaths.

Although the Government has already anticipated this development from a regulatory point of view, the actual regulation of personal data and operationalisation has not yet begun. The Commission in charge of managing and protecting personal data has still not been set up, which means that it is not possible to apply law n° 29-2019 of 10 October 2019 on data protection. The Commission would be responsible for checking whether MNOs use, for example, third-party service providers based outside Congo to process and store such data.

Figure 12: Transformation of MNOs and the management of sensitive data



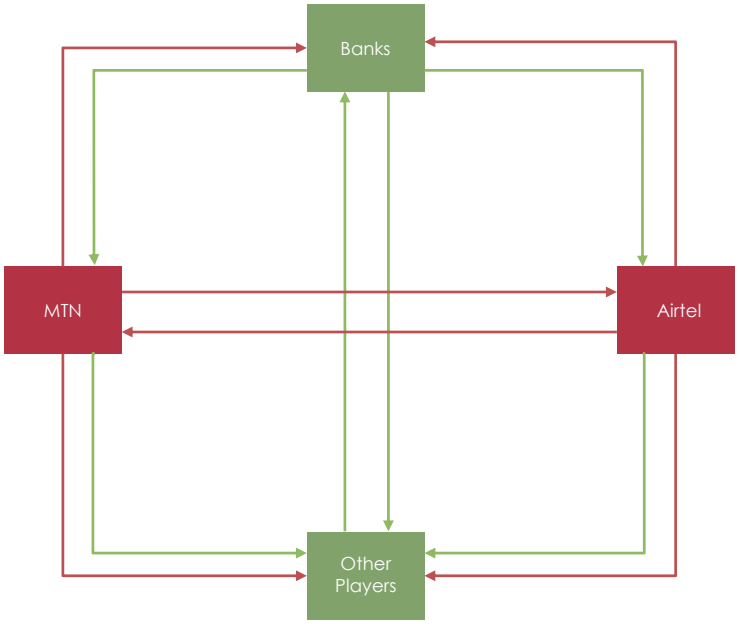
7.9. Interoperability of digital financial services platforms

The interoperability of digital financial services is ongoing in the Republic of the Congo. At some point in the future, all digital financial platforms will be able to communicate with each other. In actual terms this means that a bank account holder will be able to transfer money to his/her Airtel Money or MTN Mobile Money account, and vice versa. It will also be possible to transfer money from an Airtel Money account to an MTN mobile money account, which is not possible at the moment due to technical reasons.

As the Republic of the Congo is a member of CEMAC, payment systems must be compatible throughout the community. This would allow a person in Congo with a mobile money account (MTN or Airtel) to transfer, from his/her phone, money to a bank account of a person living in Cameroon for example, and vice versa. Just as an Orange Cameroon subscriber could transfer money from their Orange Money account to an Airtel Money or MTN Mobile Money account in Congo. If all merchants in the CEMAC community were properly set up, it would be possible for an individual living in Gabon to use a mobile money account to buy goods from a merchant operating in Chad, for example. Although this is a simplified explanation, it highlights the importance of the interoperability of digital payment systems in Congo and the CEMAC community.

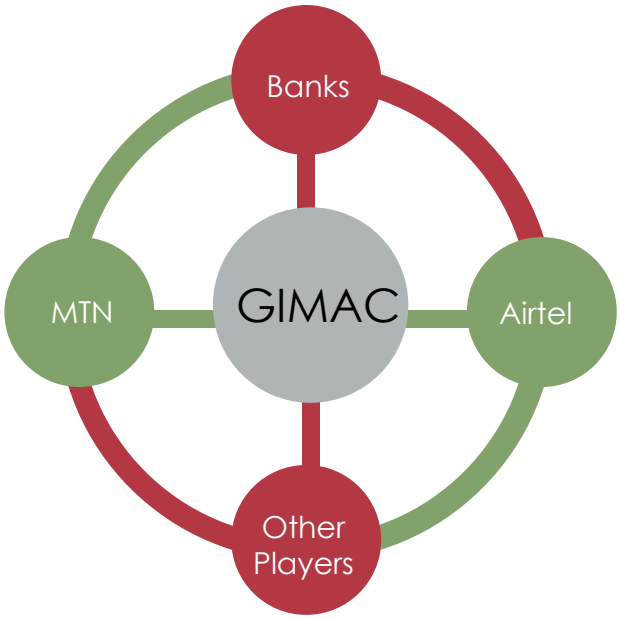
At the community level, the platform that has been set up to aggregate all digital payment platforms is called GIMACPAY, a system developed and supervised by the Groupement Interbancaire Monétique de l'Afrique Centrale (GIMAC), or the Interbank Electronic Banking Group of Central Africa. This avoids the need for all stakeholders providing digital financial services to enter into separate interoperability agreements with each other, which would be ineffective and time-consuming.

Figure 13: Decentralised interoperability of digital payment systems



Centralised interoperability demonstrates that GIMAC does simplify the interconnection of payment platforms unlike a decentralised system. GIMAC, therefore, automatically manages the flows from one operator to another, which saves time and improves efficiency.

Figure 14: Centralised interoperability of digital payment systems



Internationally, the GIMACPAY platform will enter into agreements with similar platforms so that users in the CEMAC zone can also transfer and receive money from other countries. The equivalent of GIMAC in West Africa is GIM-UEMOA, the Interbank Electronic Banking Group of the West African Economic and Monetary Union.

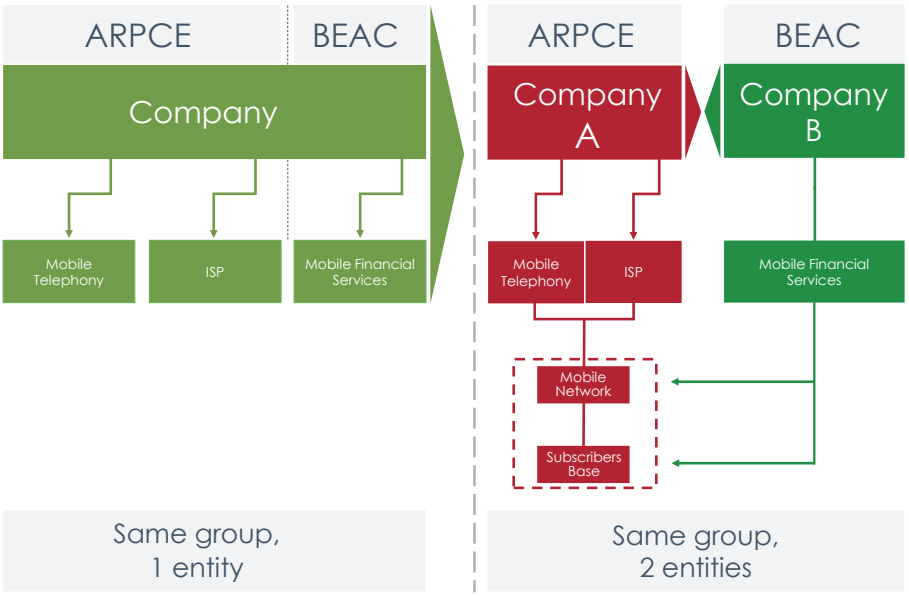
The interoperability of digital and mobile financial services platforms is a huge market that is attracting the interest of major telecoms groups which, having a strong presence in Africa and proven financial power, want to set up a continental platform for the interoperability of payment and electronic money transfer systems via their mobile telephony networks. Central banks, commercial banks, mobile money operators, and so forth would have to interconnect to this continental platform. But who would regulate this platform at the continental level if the central banks, which are supposed to regulate and oversee interoperability, become members? The financial stakes are so high that it is preferable for the Republic of the Congo, and especially CEMAC, to favour local or community-wide solutions under the close scrutiny of BEAC and the Congolese Ministry of Economy and Finance.

7.10. Unbundling mobile network operators' activities: a trend to watch

In the organisational structure of mobile operators in the Republic of the Congo, mobile financial services are currently divisions or departments of the parent company. The strong potential for the further development of mobile financial services is prompting some mobile operators to think very seriously about the need to separate their mobile telephony and ISP activities from their mobile and digital financial services. For example, MTN Rwanda[25] has already approached the Central Bank of Rwanda to enquire about the administrative and legal requirements for an independent mobile financial services subsidiary to be authorised to operate.

It is unlikely that the Congolese telecoms market will escape this trend. Therefore, the repercussions of such a development, with regard to market regulation, should be anticipated. How will the banking and telecoms regulators deal with such expansion by one or both of the leading mobile operators in Congo?

Figure 15: Unbundling activities within the same telecoms group



A multiservice company, which unbundles its activities to separate its financial services from its traditional offerings, will lead to the creation of two distinct companies. The figure above shows that one company would offer traditional telecoms services (voice and Internet) while the other would specialise in the provision of mobile financial services such as mobile money. Company A has the network infrastructure and a large subscriber base that Company B does not have; Company B would therefore have to enter into a partnership or agreement with company A in order to gain access to Company A's network and subscribers, even though Companies A and B both belong to the same group. This

25 https://www.newtimes.co.rw/business/mtn-considers-setting-financial-tech-firm

begs the question as to what, apart from the administrative and legal aspects, will actually distinguish them.

Could a company X, which wants to specialise in mobile money, also sign a partnership with Company A to benefit from its network and subscriber base? Could Company A be considered as an operator with essential infrastructure for the provision of digital mobile network services? Does the idea of operators exercising significant market power over the infrastructure of digital services on mobile networks make sense?

In fact, this is already an issue in the Republic of the Congo as banks and microfinance institutions also want to be able to access the subscriber base of mobile operators in order to offer them mobile network services via USSD codes. This would require mobile operators to open up access to their USSD platforms. Should the USSD platforms of mobile network operators be considered a relevant market under these circumstances in order to regulate barriers to entry?

The regulation of mobile financial services could become very complex if CEMAC member states do not anticipate scenarios that may change the dynamics of the telecoms and banking sectors. Congo is gradually digitalising its economy, not because it is 'fashionable' but because the population, economic players and the State have an interest to do so, due to the speed, simplification and traceability of the solutions on offer among other considerations.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4191
VALID FROM 04/12
VISA BUSINESS
GOOD THRU 05/15
POWER MEDIA S.A.
ELECTRONIC USE ONLY
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VIII

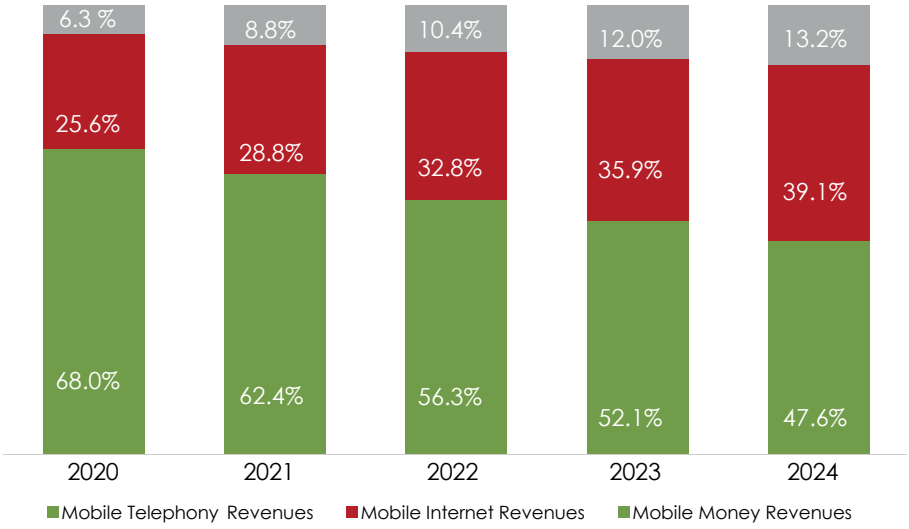
THE IMPORTANCE OF MOBILE FINANCIAL SERVICES IN THE DIGITAL ECONOMY IN THE REPUBLIC OF THE CONGO

Congo is not on the sidelines when it comes to innovations in the field of mobile financial services. Their growing importance attests to their attractiveness and gradual adoption by the Congolese people as a means of transferring funds and making dematerialised payments. The changes taking place in the telecoms sector will have an impact on many economic sectors including banking. The regulation of mobile network operators, traditionally under the supervision of the telecoms sector, could become more complex.

8.1. Evolution of mobile money and mobile Internet compared to voice

Current trends and projections in the electronic communications sector show that mobile telephony revenues are falling in favour of mobile Internet and mobile money. A forecast up to 2024 shows that the market share of mobile telephony revenues fell from 82.3% in 2017 to 47.6% in 2024, thus a loss of about 35 percentage points. The share of mobile Internet could increase from 17.7% to 39.1% over the same period. And mobile money revenues could account for up to 13.2% of total revenues by 2024.

Graph 4: Mobile operators' revenue projections



Source: ARPCE

The changes taking place in the telecoms sector in Congo are likely to disrupt certain traditional sectors, including the banking sector which is likely to face very strong competition from mobile network operators if they become mobile network banks. Hence the interest in clearly defining how the banking and telecoms sectors will be regulated.

8.2. Evolution of demand deposits from mobile money (cash in) compared to banks

In 2002, the market share of the mobile money segment in the revenues of mobile operators was 6.3%. Forecasts for 2024 show that this share could reach 13.2 % as indicated above. However, the figures in the graph (see above) do not take into account an in-depth assessment of the importance of the mobile money market, as well as the growing importance of mobile network operators in the banking and finance sectors. This justifies the following comparison between the demand deposits of all banks and the demand deposits (cash in) stored electronically on the networks of mobile phone operators.

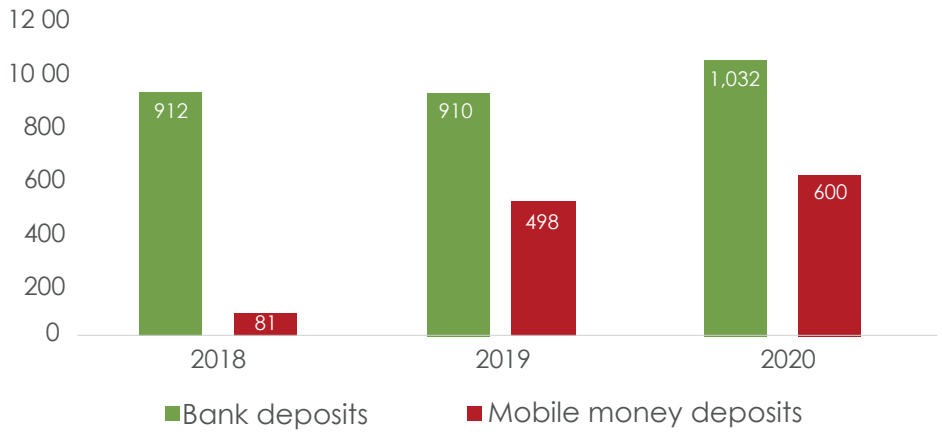
Between 2018 and 2020 demand deposits in the banking sector increased by 13.1%, i.e. going from 912 billion FCFA to 1,032 billion FCFA. During the same period, deposits (cash in) to the networks of mobile network operators increased by 640.7%, i.e. going from 81 billion FCFA to 599 billion FCFA.

The lack of data on demand deposits[26] made in microfinance institutions over the same period does not allow for a more detailed assessment of the growth of deposits managed by mobile network operators. In 2020, MTN and Airtel deposits already accounted for close to 60%[27] of the deposits of banks.

26 A demand deposit refers to funds deposited by an economic agent (legal or natural person) to an account opened with a financial institution. These funds can be withdrawn at any moment, in total or partly, with no waiting period.

27 Not to be confused with the market share.

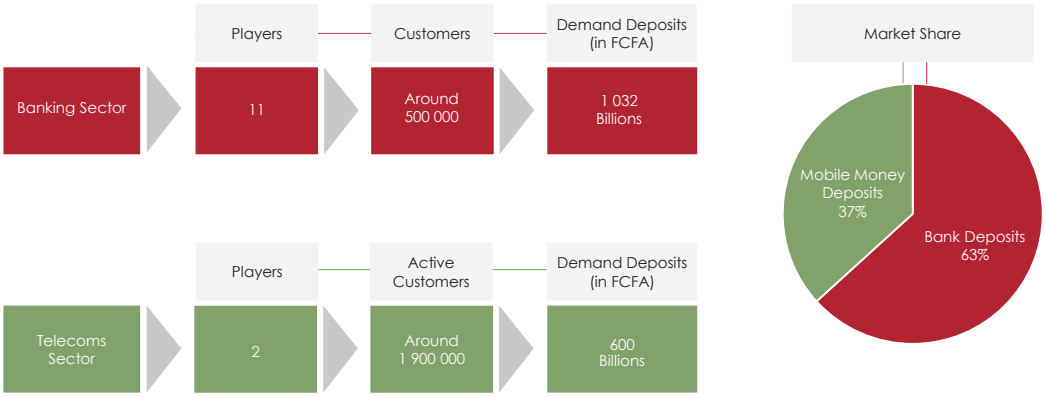
Graph 5: Comparative evolution of banks' and MNOs' demand deposits (in billion FCFA)



Sources: CNEF , MTN, Airtel

These figures confirm the transformation that is taking place in the telecoms sector, and show that the eleven (11) banks authorised to operate in Congo will need to reinvent themselves if they wish to rival the services offered by the two (2) mobile network operators. With close to two (2) million active users of mobile money services, mobile network operators will probably dominate the banking sector in the coming years. This will depend on the type of regulation that is put in place to oversee the strong capacity of mobile operators to mobilise funds, including those that were previously 'hidden' in the informal sector.

Figure 16 : Market share of demand deposits



Sources: CNEF[28], MTN, Airtel

Mobile network operators have already succeeded in ousting powerful money-transfer institutions with the development of mobile money services. It is probable that once they become banks, they will reduce certain banks to mere loan providers. Congolese employees working in the public and private sectors could have their salaries paid directly into their mobile bank accounts, thus benefiting from the advantages associated with the

28 Comité National Économique et Financier, the National Economic and Financial Committee.

mobility and simplicity of interoperable mobile financial services. As a result, the amount of demand deposits managed over time by mobile network operators are expected to exceed those of traditional banks.

Some banks will survive thanks to their capacity to grant large loans (several tens or hundreds of millions of FCFA) to individuals, but especially to companies able to provide satisfactory guarantees. Mobile operators may find it difficult to lend such large sums of money due to the risk of jeopardising their business model. This is why traditional banks would benefit from forming strategic partnerships with mobile operators which, it should be remembered, already have a huge subscriber base that could be easily converted into mobile banking customers.

8.3. Evolution of charges and taxes associated with electronic communications

Trends observed in Congo on the digitisation of tax revenues will make it possible to assess the impact of digital taxation in the short and medium term. In the immediate future, the following trends can be observed:

- **Mobile money:** since October 2019, the State has levied a 1% tax on all withdrawals made from the demand deposits of mobile money users. Between January and December 2020, this tax generated 4.8 billion FCFA.
- **Electronic stamp:** this is a fee of 50 FCFA, which is applied to all electronic transactions collected by a limited number (for the moment) of legal entities. Between July and January 2020, the electronic stamp generated a little over 102 million FCFA. This fee came into force in July 2020.
- **Digital hub:** this is a 1% fee levied on financial transactions paid by banking institutions in Congo. This fee came into force in November 2020, and between November and December 2020, it generated 136 billion FCFA.

The tax on mobile money, the electronic stamp, and the charges applied to financial transactions are just some of the revenues generated by the digital economy in Congo. All the digital tax projects (e-tax, e-customs, etc.), once properly up and running, will give an overview of the medium and long-term impact on public revenues, but first the ecosystem must be understood and accepted by everyone.

In the case of the payment of electricity bills, only 1,325 electronic payments were made by Congolese citizens between July and December 2020. However, in the same time period 1.7 million electronic transactions were made to pay for Canal + cable TV channels, i.e. an average monthly amount in the region of 286,000 transactions. One reason for this is the fact that Canal + had already anticipated and advertised electronic payment methods by partnering with MTN and Airtel.

IX

IMPACT OF DATA ON HOW THE TELECOMS SECTOR IS REGULATED

The continuous growth of the Internet market clearly raises questions about the technical evolution of networks, the type of licences to be favoured, possible revenues expected by the State, as well as the economic regulation of the markets (among other considerations).

9.1. Technical impacts of developing the Internet

The further development of the Internet will have an impact on the transport network, the fibre optic backbone and the access networks. We can also observe that:

- **on the transport network**, the growth in data traffic will lead to an increased use of frequencies on the access network. Migrating operators' traffic to very high-speed transport networks (VHS) via fibre optic backbones (FO) will lead to a decrease in the use of microwave links.
- **on the fibre optic backbone,** the capacity required by operators will increase domestically due to services associated with the VHS network, and internationally due to VHS content in order to ensure the transit of traffic to neighbouring countries through the authorised cross-border links;
- **on the access network,** greater demand will be put on the bandwidth. This is the case with 5G, which requires considerable spectrum capacity with bandwidths of 60 MHZ, 80 MHZ, 100 MHZ and more per operator to offer these innovative services.

9.2. Impacts on types of licences and State revenues

The growing importance of the Internet in Congo, as well as the associated applications and services, will require the legislator to carry out an in-depth study that could lead to a modification in the laws governing the telecoms sector and, in particular, how technology neutral spectrum licences are issued.

This type of licence would allow operators to replace old equipment in a frequency band with equipment that meets a more advanced standard. This reallocation of frequencies would make it possible to migrate from 3G to 4G and from 4G to 5G with the least possible administrative burden.

Technological neutrality can increase the cost of frequencies, thus boosting State revenue. However, the legislator should also ensure that these costs are not prohibitive so as not to discourage investment by operators.

9.3. Impacts on the segments of regulated markets

The growing demand for data will also have an impact on the economic regulation of certain market segments in the telecoms sector. Hence the necessity for;

- regulating IP networks;
- anticipating the virtual disappearance of interconnection costs for domestic networks as a result of their migration to "all IP";
- the option to cancel all roaming fees within the community thanks to migrating to "all-IP";
- analysing the impact of network convergence with regard to calculating electronic communications;
- anticipating the regulation of MVNOs[29], which could benefit from this convergence. As operators, MVNOs do not have their own networks, rather they rely on existing networks to offer telecoms services to their subscribers; and
- anticipating the regulation of "brand licensing" agreements between network operators and a third-party company that is not a network operator or an MVNO. These agreements provide for the marketing of a service offering by using (renting) the brand of the network operator by a third-party company.

29 MVNO: Mobile Virtual Network Operator


SECURITY

X

CYBERSECURITY: CHALLENGES AND PERSPECTIVES IN THE REPUBLIC OF THE CONGO

The security of the Republic of the Congo's cyberspace must be a priority for the public authorities. Efforts must be made to ensure training in technologically advanced occupations associated with the development of the digital economy in order to allow Congo to address weaknesses in its cyberspace.

10.1. Challenges and limitations of Congo's cyberspace

Cyberspace (interconnected computers or the networks to which these computers, servers, etc. belong) has given rise to virtual spaces in which data and information, some sensitive, can be exchanged. However, cyberspace can fall foul of virtual attacks whose consequences can be dramatic. All countries, regardless of their level of development, are vulnerable to these attacks. Hackers pose serious threats both at the domestic and international level.

In Congo, laws n° 26-2020 of 5 June 2020 and n° 27-2020 of 5 June 2020 on cybersecurity and combating cybercrime were passed. These laws follow on from law n° 30-2019 on the creation of the Agence Nationale de Sécurité des Systèmes d'Information (ANSSI) or the National Agency for Information Systems Security whose main mission is to guarantee the protection of Congo's national cyberspace. Therefore, ANSSI is responsible for predicting and assessing the possible consequences of a cyberattack targeting information systems in Congo, as well as drawing up and implementing a response strategy to mitigate the vulnerability of networks and computer systems. Therefore, cyberespionage and cyberattacks of any kind must also be covered in the national digital defence strategy.

Despite these laws, the ecosystem of Congo's national cyberspace remains vulnerable as ANSSI has still not been set up, meaning that there is no official administrative or supervisory body. In addition, the courts and security forces, while aware of the challenges associated with protecting cyberspace, do not have sufficient qualified human resources and adequate equipment to carry out their mission. Currently, public bodies and private companies are forced to set up information systems (where possible) with protection protocols that are not always the same from one company to another or from one administrative

body to another. ANSSI will have to ensure standardisation in this respect in addition to coordinating and ensuring cooperation between all the actors in the public and private sector, and the security services (police, army, etc.).

The vulnerability of Congo's cyberspace is particularly highlighted by the fact that there is no further education school/university specialising in training experts capable of protecting it. Could this protection be outsourced to external foreign partners with expertise in this area? This is an option but one that would put the monitoring of Congo's cyberspace into the hands of non-Congolese experts. It is also important to consider the possibility that these partners — who are supposed to protect Congolese cyberspace — could use it to control and transfer sensitive data (financial, economic, security, etc.) out of Congo, thus exacerbating the vulnerability of Congolese cyberspace through a dependence on foreign experts.

However, the existing laws are already a major step in the right direction when it comes to cracking down on digital criminals, on the condition that Congo has the means to track them down when they are operating within its cyberspace (or even outside it) thanks to cooperation agreements drawn up with international bodies combating cybercrime. This assumes that the Congolese are in a position where they are able to defend their digital economy and society against all kinds of cyberterrorism and cyberattacks by training experts. However, it must not be forgotten that even highly industrialised countries are not safe from cyberattacks, e.g. the cyberattack of May 2017 that targeted British and EU hospitals, and mobilised the intelligence of the cybersecurity agencies of the countries affected by this attack. This goes to show that all countries can fall victim to cyberattacks, and that the responses to these attacks largely depend on the degree of preparedness of the agencies in charge of the security of their national cyberspace.

10.2. Provision of training for digital professions : the foundations of a digital society

The Republic of the Congo is continuing to develop telecoms infrastructures that will further develop digital services in different economic sectors. Companies will need a skilled local workforce that is capable of meeting the demands of developing Information and Communication Technologies (ICTs). This is why schools and training institutes dedicated to digital professions are necessary to build on the investments already made by the State and private operators. If these types of new schools are not created, these courses could be gradually incorporated into secondary and university education.

Below are a few examples of key digital occupations :

- *Web developer*: the digital economy largely takes place on the Internet, which is why no serious company can operate without a website today. Company websites offering online services must meet certain norms and standards. These companies may also

need to develop digital apps and so forth requiring the expertise of website and app developers.

- *Systems and network administrator:* the intranet sites of companies and organisations are generally monitored by a systems and network administrator who manages user accounts and all the computers in the IT network, as well as ensuring the proper management and security of the IT system.
- *Information Systems Manager*: he/she plays a cross-cutting role within an organisation or company by ensuring that databases, human resources management software, payment systems, and so forth are all functioning properly.
- *Data analyst, data scientist or data miner*: once the interface and IT systems are in place, companies need to be able to manage increasingly large amounts of data. Data analysts collect, manage, analyse and secure these data in order to extract useful and profitable information for the company or organisation, i.e. Big Data. Data, including personal data, has become a goldmine in the digital economy. Hence the interest in Congo in training and having the tools to manage this data locally.
- *Data Protection Officer or DPO*: this is an important occupation to be developed so that the law introduced by the Ministry of Posts, Telecommunications and the Digital Economy on the protection of personal data can be effective on the ground. It is up to the DPO to ensure that his/her employer complies with the law when using or processing data for commercial or internal purposes (human resources, health, banking, etc.).
- *Penetration testers (or pentesters)*: networks are regularly hacked and breached resulting in the theft or destruction of highly sensitive data. Hackers working in networks around the world have become a very serious threat and must be combated. Pentesters create fake network attacks in order to better understand and stop them. Simulated attacks could consist of one group of students penetrating a network while a second group tries to thwart the attack.

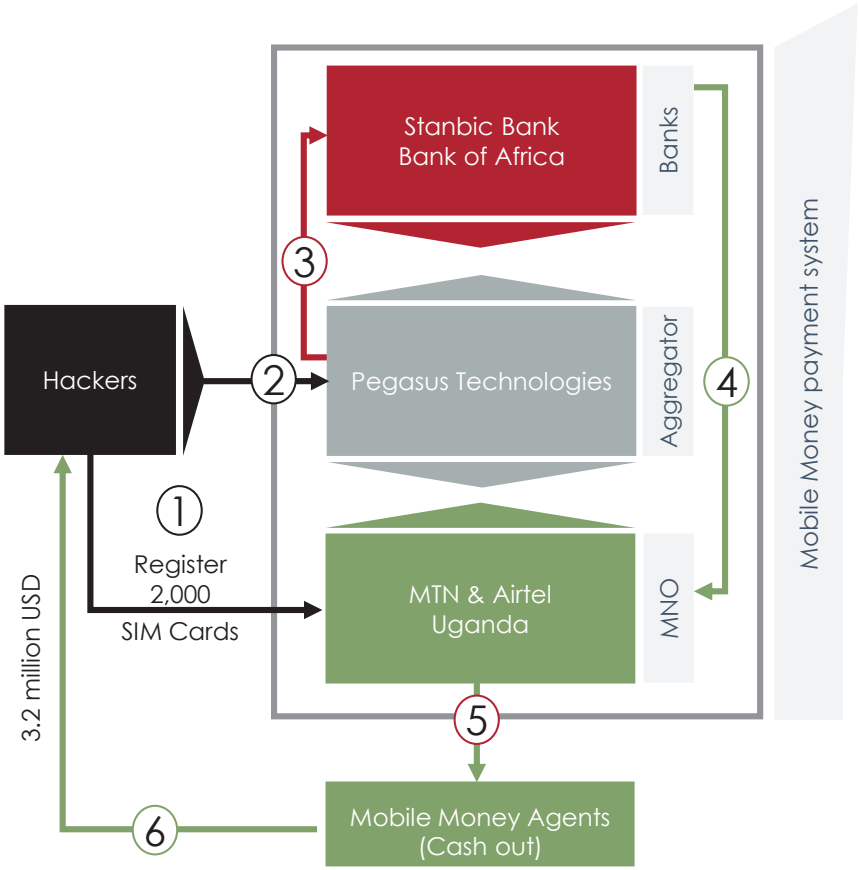
  ANSSI should employ pentesters to secure the networks of institutions, such as the army, police, ministries, the national assembly, banks, mobile and fixed-line operators, etc. as reducing Congo's vulnerability in the digital economy depends on this.

These types of job training (and others) should be 'hands-on' and of a high standard. The training offered by those responsible for secondary and higher education should not only focus on degrees, but also the skills actually acquired by the learners so that the specialists who graduate from these courses will be able to solve (for the administrative bodies and private companies) the kind of IT problems with which they are confronted; thus providing a local response to global problems.

10.3. Risks inherent to mobile financial services

In October 2020 in Uganda, hackers got into the system of a finance aggregator, Pegasus Technologies. The hackers used around 2,000 mobile MTN and Airtel SIM cards to gain access to the mobile money payment system. They then instructed Pegasus Technologies, using digital commands, to transfer billions of Ugandan shillings from Stanbic Bank and the Bank of Africa to mobile money accounts opened with the two mobile network operators. Between 3 October and 6 October 2020, the equivalent of 3.2 million USD were stolen by the hackers.

Figure 17: Hacking the mobile money payment system in Uganda



This example shows that the digital ecosystem is not foolproof, despite the security measures put in place. Hackers are continually looking for 'back doors' that will allow them to bypass these security measures. Given that Congo is not immune from hacking, advanced training in the digital economy makes sense. Hence the urgent need to set up ANSSI, to equip it with state-of-the-art IT equipment, and to do the same with the public authorities.

The figure below shows an overview (limited) of the stakeholders who need or will need to strengthen cybersecurity in Congo. While ANSSI should be at the heart of the strategy to protect Congo's cyberspace, the army should also play a role in preventing and countering cyberterrorism. The Centre d'Informatique et de Recherche de l'Armée

et de la Sécurité (CIRAS), the Army and Security IT and Research Centre, was created in 1979[30]. Following its reorganisation in 2011[31], it has a number of responsibilities, including participating in the design and development of the force's IT policy.

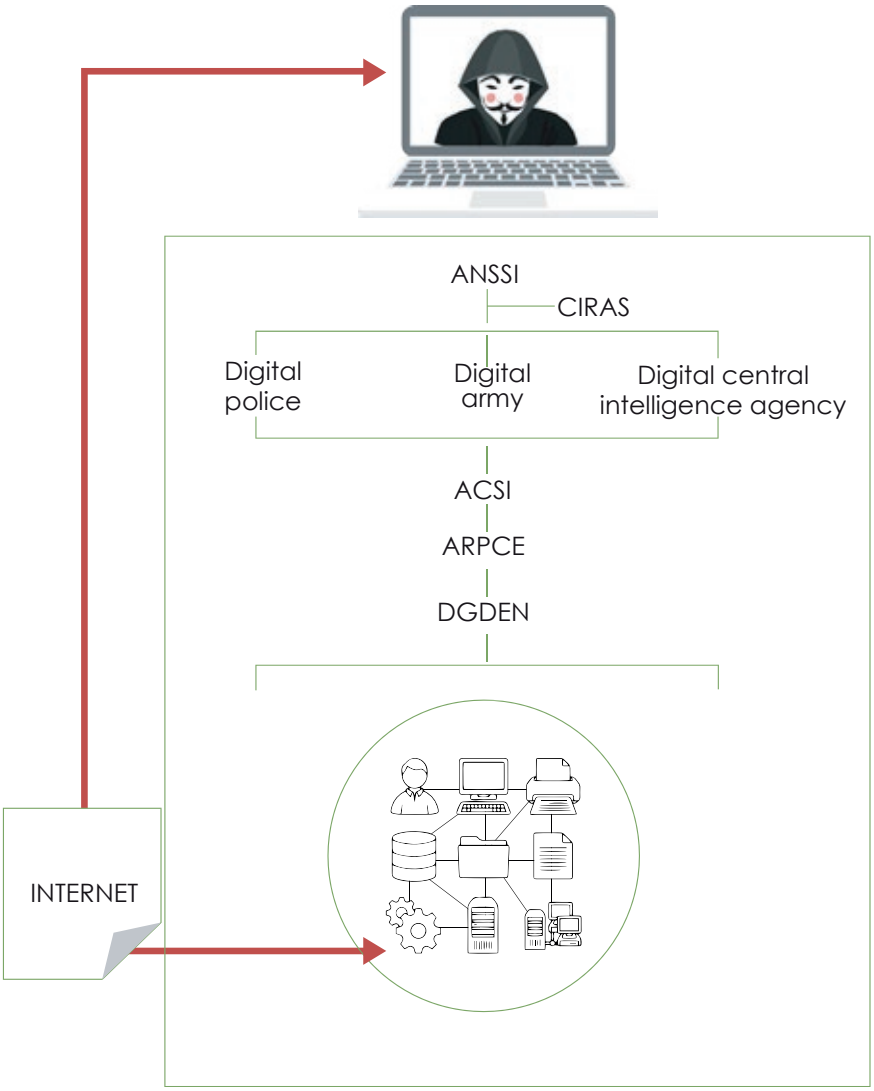
Combating cyberespionage will also have to become a priority in order to protect sensitive and strategic State or company data in Congo's cyberspace. This is why information systems must comply with standards that have been first approved by ANSSI. In this way, ACSI (Agence Congolaise des Systèmes d'Information, the Congolese Agency for Information Systems) will be better able to secure all the innovations it has undertaken (e-tax, e-customs, etc.) in the field of digital taxation.

ARPCE working with ANSSI will also have to contribute to strengthening the security standards of the various telecoms actors operating in Congo. For example, the Bank of Central African States (BEAC) relies on ARPCE to approve the technical platforms of mobile network operators who develop mobile financial services. This IT architecture should be under the control and protection of ANSSI which, in the event of a cyberattack, would be able to defend Congo's national cyberspace, and its economic and financial interests.

The Direction Générale du Développement de l'Économie Numérique, the Directorate General for the Development of the Digital Economy, must also be involved in the cooperation that is needed between institutions tasked with the protection of Congo's national cyberspace. This assumes that it has the financial, technical and human resources to fulfil its remit.

30 Decree no 79/521 of 25 September 1979 on the creation of CIRAS.
31 Decree no 2011/437of 25 June 2011 on the roles and organisation of CIRAS.

Figure 18: Actors combating cybercrime in Congo



10.4. SIM Box fraud: a cybercriminal activity

Out of all the continents, Africa suffers the most when it comes to having its incoming international traffic hijacked. A study[32] revealed that 46% of fraud on incoming international traffic concerned Africa. The Republic of the Congo is also affected by this type of fraud, which is more commonly known as "SIM box fraud". ARPCE has also helped to dismantle several networks operating in Congo thanks to the ongoing investigations of its anti-fraud committee, which works in close cooperation with the national security services.

32 Anne Kouam, Aline Carneiro Viana, Alain Tchana, SIMBox Bypass Frauds in Cellular Networks: Strategies, Evolution, and detection survey, 2021, hal-03105845v1.

How the SIM box fraud works

When Operator A wants to route its traffic to Operator B, which is located in a different country, it has to use a carrier. In other words, an international call routed to a local (or national) network is routed through the carrier, which will pay an access (or termination) charge to the local (or national) operator's network.

SIM box fraud involves an illegal or unscrupulous carrier diverting international calls via the Internet (VoIP) and terminating them as local (or national) calls using a complex device called a SIM box, which is located and operated in the country where the calls are terminated. Therefore, when a person receives a call from someone who is abroad, a local number appears on their mobile phone.

In addition to the SIM box, fraudsters use a high-speed Internet connection, a server, several SIM cards, top-up cards, a generator (in countries where the electricity supply is unreliable), and a router connected to the SIM box which, thanks to a relay antenna, automatically alternates the traffic on the various SIM cards connected to the operators' networks.

Consequences of the SIM box fraud

The SIM box fraud affects operators, the Government and the users of mobile telephony and landline networks, as well as the regulators in the following manner:

- **Operators:** the operators' quality of service (QoS) is negatively affected resulting in a significant loss of revenue as they do not receive their termination charge on incoming international traffic.
- **The Government:** the government also loses out on the tax revenues generated by incoming international traffic between the operators, the technical provider and the Government. It also breaches the security of Congo's cyberspace.
- **Network users:** users will experience a degradation of telecoms operators' networks, which will have a negative impact on users' quality of experience (QoE).
- **Regulator:** ARPCE, the regulator of the telecoms sector, needs to invest in very costly cutting-edge equipment in order to track down the fraudsters, who are becoming increasingly ingenious at avoiding detection. In this way, ARPCE will contribute, as far as possible, to limiting the loss of revenue for telecoms operators and the State.

Amount of revenue embezzled by fraudsters

During the first quarter of 2021, a SIM box fraudster was caught by the ARPCE teams and the national gendarmerie (police). This fraudster's network was stealing an average daily amount of 3,831,300 FCFA. If the fraudster had not been caught, in 365 days he would have made around 1.4 billion FCFA with a SIM box containing 128 SIM cards[33]. The State and the operators

33 Some SIM boxes can contain as many as 512 SIM cards, which can be bought easily on the

would have lost this revenue. However, the reality is a little more complex as the fraudster diverted international traffic from its usual route, sometimes with the passive complicity of the operators themselves who entrust their traffic to carriers who offer transport services at reduced prices, while the latter sometimes resort to 'grey routes' via the Internet. If the diverted traffic had followed a legal (normal) route, the carrier or transporter would have paid the international traffic tax in force in Congo. Legally routed incoming international traffic would have generated revenue of over 1.4 billion FCFA in 365 days for the telecoms operators and the State

It is not easy to estimate a country's loss of revenue caused by SIM box fraud. While the fraudsters' activities are not detected on the various operators' networks, they can operate with impunity and make considerable amounts of money that will not be paid to the operators or the State. Therefore, there may be other undetected fraudulent networks active in the Congo that harm the interests of users, operators and the State.

Combating SIM box fraud

The loss of revenue and unsatisfactory quality of experience (QoE) for subscribers caused by the poor quality of service (QoS) of the operators affected by SIM Box fraud is fuelling a relentless fight against the fraudsters. Although ARPCE is taking the situation very seriously and acting accordingly, the ecosystem to combat this type of fraud needs to be strengthened. Some possible responses are explored below:

Stronger identification procedures for subscribers

Around 85% of telecoms users have been identified in the Republic of the Congo. However, it still happens that SIM cards are sold without the purchaser presenting any form of identity. Moreover, the buyer may present a fake piece of identification to purchase one or more SIM cards, making it relatively simple for SIM box fraudsters to procure SIM cards, which goes some way to explaining why these fraudsters are so active in Africa. Therefore, it is necessary to strengthen the process for checking the identification of subscribers. There is, however, one fundamental problem associated with this, namely problems related to obtaining a national identity card (NIC).

Is it possible to identify as many subscribers as possible when obtaining a national identity card is a real obstacle course? It is true that a sponsorship system has been set up in Congo to remedy this problem. But is such a procedure effective and secure in the long term? This means that part of the solution to combating SIM box fraud also depends on the ability of the identification centres to produce sufficient identification documents in a timely manner.

Internet.

Banning the sale of pre-activated SIM cards

Some SIM card vendors do not check the identity of buyers, and very often use identities already contained in their customer databases to pre-activate new SIM cards, which is a real benefit to fraudsters. Telecoms operators, their distributors and the mobile sales channels they operate are partly responsible for this troubling situation, which can lead to money laundering via mobile money, digital fraud, crime, etc. They must be made to comply with the regulations in force to help reduce this form of cybercrime.

Economic model of the telecoms market

In Congo, 99% of subscribers use prepaid top-up cards, which means that fraudsters cannot be linked to a specific address. In countries where the post-paid model is the norm, the subscriber's identification, bank account number and physical address are required.

Post-payment cards are not common in Congo. Moreover, the informal sector provides a significant number of jobs, which mainly relies on fiat money (physical bank notes and coins) and is one of the reasons why the prepaid model is a real asset for SIM box fraudsters. Mobile money, which is mainly used to transfer money, could help combat SIM box fraud. In the future, if a user was forced to top up his/her SIM card by means of an electronic transaction, it would be easier to trace payments related to SIM card top-ups made by mobile money or other digital payment methods. In this way, SIM box fraudsters could be identified more easily. However, to open a mobile money account, the user would need a national identity card, which brings us back to the underlying problem of obtaining a national identity card under satisfactory conditions.

Reducing termination charges on incoming international traffic

In many African countries, the ITR[34] is much higher than the LTR[35]. In Congo, the charge applied to incoming international traffic is 170 FCFA per minute, while the weighted tariff for an on-net (intra-network) call was 25 FCFA in 2020, and 23 FCFA in the first quarter of 2021 (Q1-21).

This pricing structure encourages fraudsters to bypass the carrier when they terminate international traffic in Congo. Fraudsters only pay the lower LTR termination rate rather than the higher ITR. Consequently, a country where the ITR is far higher than the LTR becomes a potential target for SIM box fraudsters[36].

International cooperation (operators, regulators, security forces, etc.)

Combating SIM box fraud is not an easy task as the ecosystem that helps make this fraud possible is vast and complex, and involves many different actors. This fraud is also international and extremely well-organised.

34 International Termination Rate
35 Local Termination Rate
36 Anne Kouam, Aline Carneiro Viana, Alain Tchana, SIMBox bypass frauds in cellular networks: Strategies, Evolution, and Detection Survey, 2021, hal-03105845v1.

A fraudster in Congo does not work alone, he/she has accomplices working outside the country. International cooperation, involving telecoms equipment manufacturers, operators, carriers, regulators and national cyberspace managers, could help to curb this type of crime, and perhaps even completely eradicate it.

XI

DEVELOPMENT OF ITCS AND INDUSTRIAL LIMITATIONS IN THE REPUBLIC OF THE CONGO

The post, telecoms and digital economy sector relies on technology and equipment manufactured in Asia, Europe and North America. In these continents, powerful industrial companies are behind technological developments. The Republic of the Congo, like many other African countries, uses technologies and equipment that it neither designs nor manufactures.

Like all countries that consume technological equipment that they do not produce, Congo must bear the upstream costs of importing it, while downstream it is subject to the consequences of imports on telecoms tariffs. This means that the tariffs for services offered by telecoms operators operating in the Congo are not the same as those in industrialised countries where they are generally lower. Conceptually — *ceteris paribus*[37] — the pricing of telecom operators' offerings takes into account some of the following realities:

- equipment manufacturers in industrialised countries develop, manufacture and fix the standards and costs for telecoms equipment;
- telecoms operators in Congo import this equipment and technology, and have to bear the significant costs linked to the exchange rate (euros or US dollars), which is then offset in the purchasing price;
- transporting this equipment to Congo incurs international transport costs;
- the equipment is then taxed at the ports and/or airports by the customs authorities in accordance with the law;
- once cleared through customs, this equipment must be transported to the place of sale, which also incurs logistics costs (local transport); and
- once the operators' network is up and running there is the cost of electricity, generators, fuel and back-up energy solutions to be taken into consideration.

The result of all this is that the tariffs charged by operators must cover all the various incurred costs. They also have to make a profit in order to, among other things, pay the taxes which are due.

37 All things being equal.

The following figure shows the gap or theoretical difference in the pricing of telecoms services in the Congo compared to a developed country which has the industrial capacity to manufacture its own equipment. It is clear that Congo, a technology-importing country, has a longer value chain when it comes to the cost of telecoms services. This is generally reflected in the access costs to telecoms services, which are more affordable in industrialised countries. In other terms, Congo's technological dependence means that it cannot easily compete with the lower costs of telecoms services offered in industrialised countries.

Figure 19: Comparative structure of tariff formation for telecoms services

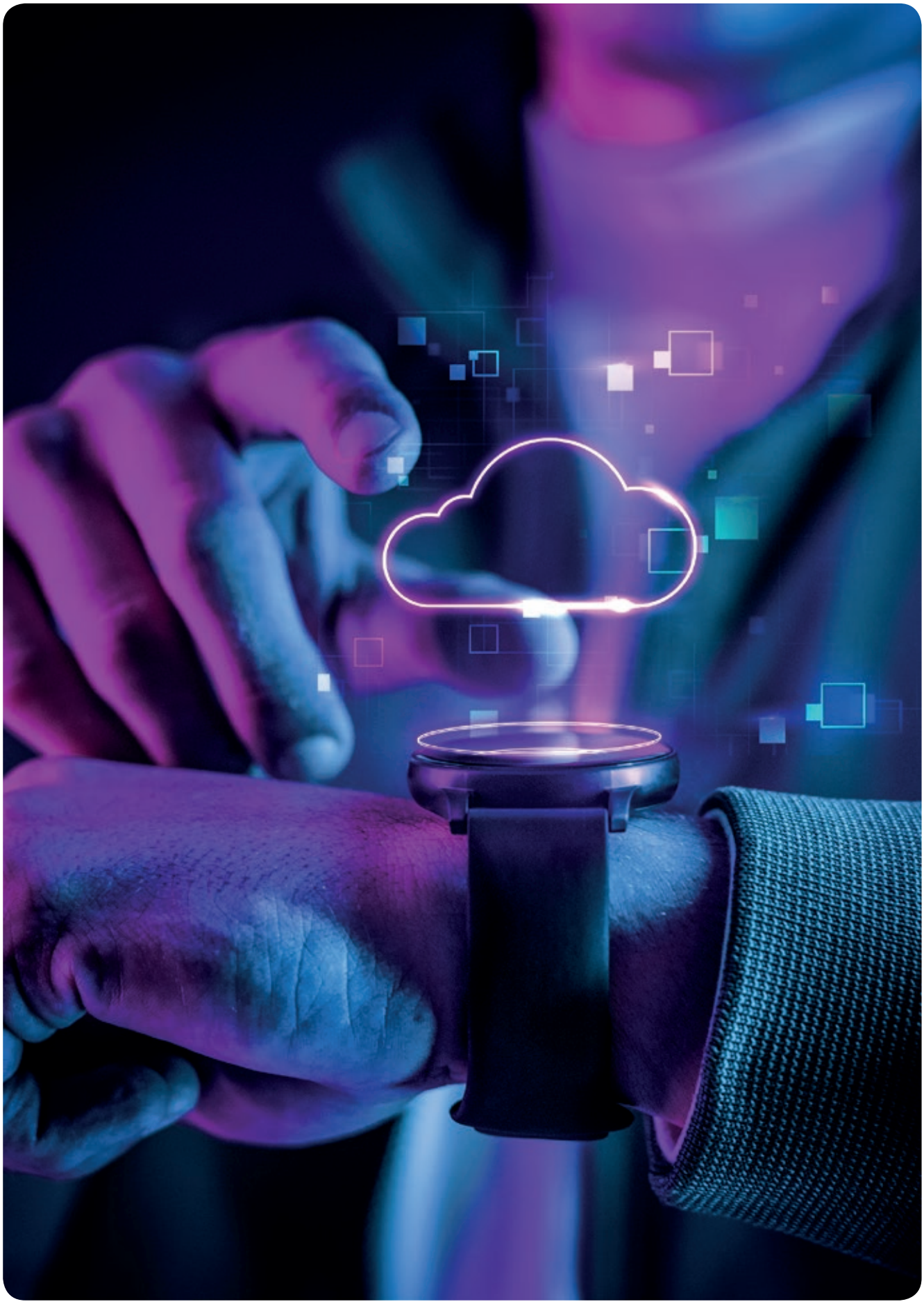
The aforementioned value chain also applies to access devices (phones, tablets, etc.). The Congolese company, VMK, built a device assembly plant in Brazzaville to provide Congolese citizens with high-quality products at affordable prices. Putting aside the reasons that explain the failure of this enterprise, it did demonstrate that it is possible for a country like Congo to enter the club of African countries capable of mounting/assembling access devices.

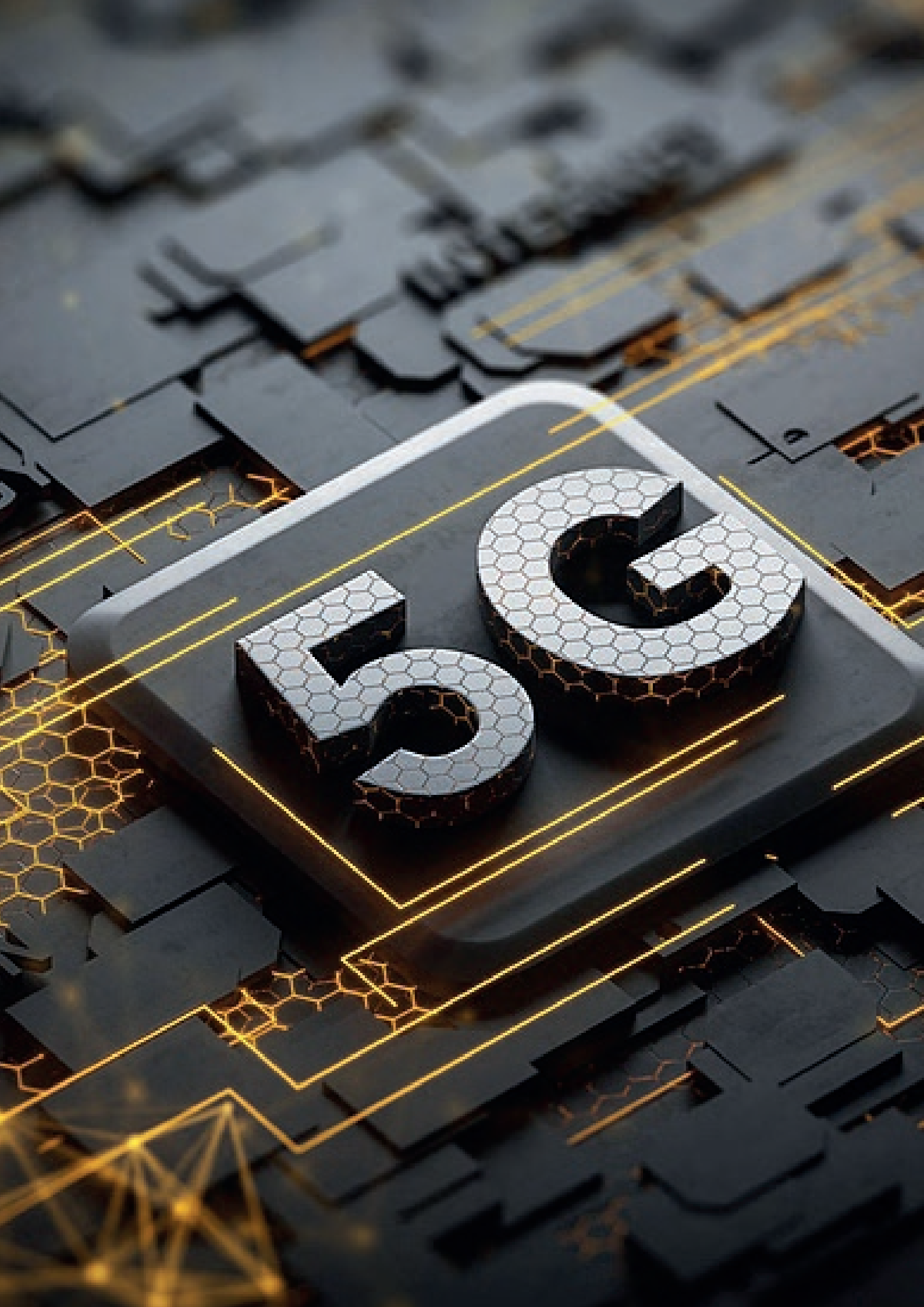
Congo would benefit from learning lessons about VMK's failure so that in the future an initiative of this kind could be a success. By producing certain kinds of equipment locally, it would be possible, under certain conditions, to boost digital inclusion in an affordable manner. Special attention should also be paid to 'Made in Africa' innovations that reflect local realities (climate, quality of the electricity supply, etc.), which imported products do not always take into consideration. There are significant industrial stakes linked to integrating Information and Communication Technologies (ICTs) into Congo's general development policy.

However, considerations about industrial development should also integrate a regional vision, i.e. beyond the CEMAC community[38]. Congo is a small market due to the size of its population, which has to make concessions with other CEEAC member countries[39], including the Democratic Republic of Congo (DRC) and Angola. A concerted and shared industrial and economic approach, based on a sub-regional vision, would make it possible to better design the sub-region's approach to industrialisation based on the local context and needs.

38 Central Africa Economic and Monetary Community (Cameroon, Central African Republic, Republic of the Congo, Gabon, Equatorial Guinea and Chad).

39 Economic Community of Central African States (Angola, Burundi, Cameroon, Central African Republic, Republic of the Congo, Democratic Republic of Congo, Gabon, Equatorial Guinea, Rwanda, Chad, and São Tomé and Príncipe).




5G

XII

5G TECHNOLOGY IN THE REPUBLIC OF THE CONGO: A LUXURY OR A NECESSITY?

Compared to 3G and 4G, 5G technology stands out due to the very high speed data rates it makes possible. It will enable the connection of intelligent or smart objects, promote advanced telemedicine, Augmented Reality, etc. It will also enable industrialised countries, thanks to the quality of their basic infrastructures, to move towards the 'fourth industrial revolution'. In Congo, basic infrastructures require modernisation, and some still need to be constructed. Given this state of affairs, can Congo benefit from the same 5G applications as those that will be rolled out in developed countries?

12.1. 5G and the Internet of Things (IoT)

Simply put, 5G technology makes it possible to send and receive data ten (10) times faster than 4G technology. What is particularly remarkable is the very low latency of the data flows (around 50 milliseconds for 4G vs. under one (1) millisecond for 5G). Augmented Reality, in-car video systems, improved security of sensitive or strategic data, data-transfer equipment, predictive technologies, and so forth will really take off with 5G. It will allow connected objects to communicate with each other at extremely high speeds, which requires reliable and uninterrupted connectivity for the exchange of data.

5G is seen as a technology that will enable the Internet of Things (IoT), among other things, to fully develop. Should Congo, an African country, as opposed to developed and industrialised countries, be forced to roll out 5G technology throughout its territory?

12.2. 5G applications in industrialised countries

In industrialised and developed countries, expectations are high with regard to the introduction of 5G. For example, telesurgery or remote surgery will make it possible to carry out highly complex surgical procedures where the surgeon and patient are located in two different places, or even in two different countries or continents. The equipment will be linked (end to end) using fifth-generation relay antennas. Remote patient monitoring will allow doctors to provide care at a distance. Driverless cars will become a reality thanks to the many sensors positioned along roads and motorways, which will use 5G relay antennas to guide

these vehicles. Taxis and buses will operate 24/7, and people will only be responsible for monitoring them on a computer screen in a control centre. Smart homes will also become a reality with connected appliances (TVs, microwaves, fridges, coffee makers, freezers, washing machines, gates, alarm systems, etc.) that are all controlled from a smartphone, tablet or computer.

As the development of telecoms technologies is controlled by industrialised countries, 5G-related applications are primarily of concern to them. In fact, these countries have already built all the basic infrastructures required to support their development (reliable electricity supply and grid, modern roads and motorways, airports, efficient river and sea ports, connected hospitals and schools, etc.). The fourth industrial revolution in these countries builds on the previous ones.

12.3. Utility of 5G in Congo

With regard to 5G in the Republic of the Congo, frequency bands have already been allocated to meet the future demand for licences. But is this technology absolutely necessary when so much remains to be done with regard to constructing basic infrastructure? Can Congo's roads be equipped with sensors for driverless vehicles transporting road users? Are there enough traffic lights on the various main routes in the two major cities to regulate the circulation of driverless vehicles? And are all the existing traffic lights even working?

Are very frequent power outages compatible with the Internet of Things (IoT) whose highly sensitive devices could be damaged due to the poor quality of the electricity supply? In 2017, the overall energy loss rate (technical and commercial) was 54%[40]. Given this state of affairs, could surgery be safely performed using advanced telesurgery techniques between Congo and South Africa, for example? Moreover, we can already see that the health and technical infrastructures are generally deficient, and that the poor quality of the electricity supplied is often responsible for the breakdown of certain sensitive equipment, such as scanners, magnetic resonance imaging (MRIs), etc. These are just some of the questions and observations whose answers should, objectively, lead us to reconsider certain ambitions relating to 5G in Congo and in Africa in general. The pace of development of the Congo should not encourage the mass implementation of 5G in the two major cities, and even less so in rural areas where the basic infrastructure is poor or non-existent in some cases.

On the other hand, there are industrial sectors in Congo where a limited roll-out of 5G may be necessary. This is true for the oil industry where companies such as ENI, Total, Schlumberger, etc. could use 5G technology to facilitate their long-distance communications, e.g. transmitting data collected from sensors on offshore sites to onshore installations, and then to their headquarters (located outside Africa) where these huge amounts of data could be centralised and analysed virtually in real time.

40 See the National Development Plan (NDP) - Operational Appendix N°1 PPAP 2018-2022, p.158.

With 5G these companies could make faster operational decisions that would lead to the reduction of certain costs, for example.

The speeds obtained by 5G could also facilitate predictive and preventative maintenance on oil sites thanks to Augmented Reality (AR)[41] and Virtual Reality (VR)[42]. Using VR, these companies could simulate, model, interpret and then evaluate seismic data to generate images of the subsurface to optimise the deployment of equipment using visualisation techniques. Thanks to the power of 5G networks, VR could also be used to create a mirror site (platform, barge, refinery, etc.) to generate dynamic interactions between the virtual and physical reality in order to optimise certain processes and adjust the design of installations[43].

The 5G deployment requirements identified in the oil industry are relatively similar to those in the mining sector. This is why its deployment should meet specific identified needs based on the economic characteristics of Congo, and not be implemented simply because 'everyone else is doing it'.

12.4. Regulation of 5G in Congo

The network operators, MTN and Airtel, will be able to apply for a licence to operate 5G networks when they deem that the time is right. As a reminder, the following frequency bands have been allocated for the use of 5G: 700 MHz, 800 MHz and from 3300 to 3800 MHz. Therefore, with regard to frequency allocation, Congo is ready to deploy 5G.

However, our analysis shows that mobile network operators have not yet managed to convert all their 2G subscribers to 3G, let alone 2G/3G subscribers to 4G. In the end, it will be up to mobile network operators to assess the opportunity costs of the mass or limited roll-out of 5G technology.

41 Augmented Reality (AR) superimposes virtual images on or around objects in a real world.
42 Virtual Reality (VR) takes a person out of the real world via a device (e.g. a virtual reality headset) which immerses him or her completely in a virtual world.
43 https://teletimesinternational.com/2020/5g-oil-gas-advantages-use-cases/, website consulted on 07/02/2021.

XIII

FUTURE OF THE REGULATION OF ITCs IN THE REPUBLIC OF THE CONGO

The regulation of the electronic communications sector must evolve and take into account current and future technological trends whose uses are disrupting many economic sectors. Telecoms regulation is no longer limited to the legal aspects of network installation, ensuring fair competition between mobile network operators, certifying equipment, managing scarce resources, promoting access to universal services or ensuring the privacy of users of electronic communications networks. A phone number, associated with both a SIM card and the operators' network, has become a very important financial tool that mobile operators have succeeded in exploiting thanks to innovations in traditional mobile telephony uses.

13.1. Future developments in the regulation of mobile financial services

Mobile financial services (MFSs), as shown in the following figure, are growing and will continue to play an important role in the telecoms and financial landscape. ARPCE's fairly conservative forecasts show the future evolution of MFSs in 2024, and the resulting implications with regard to regulating this new trend.

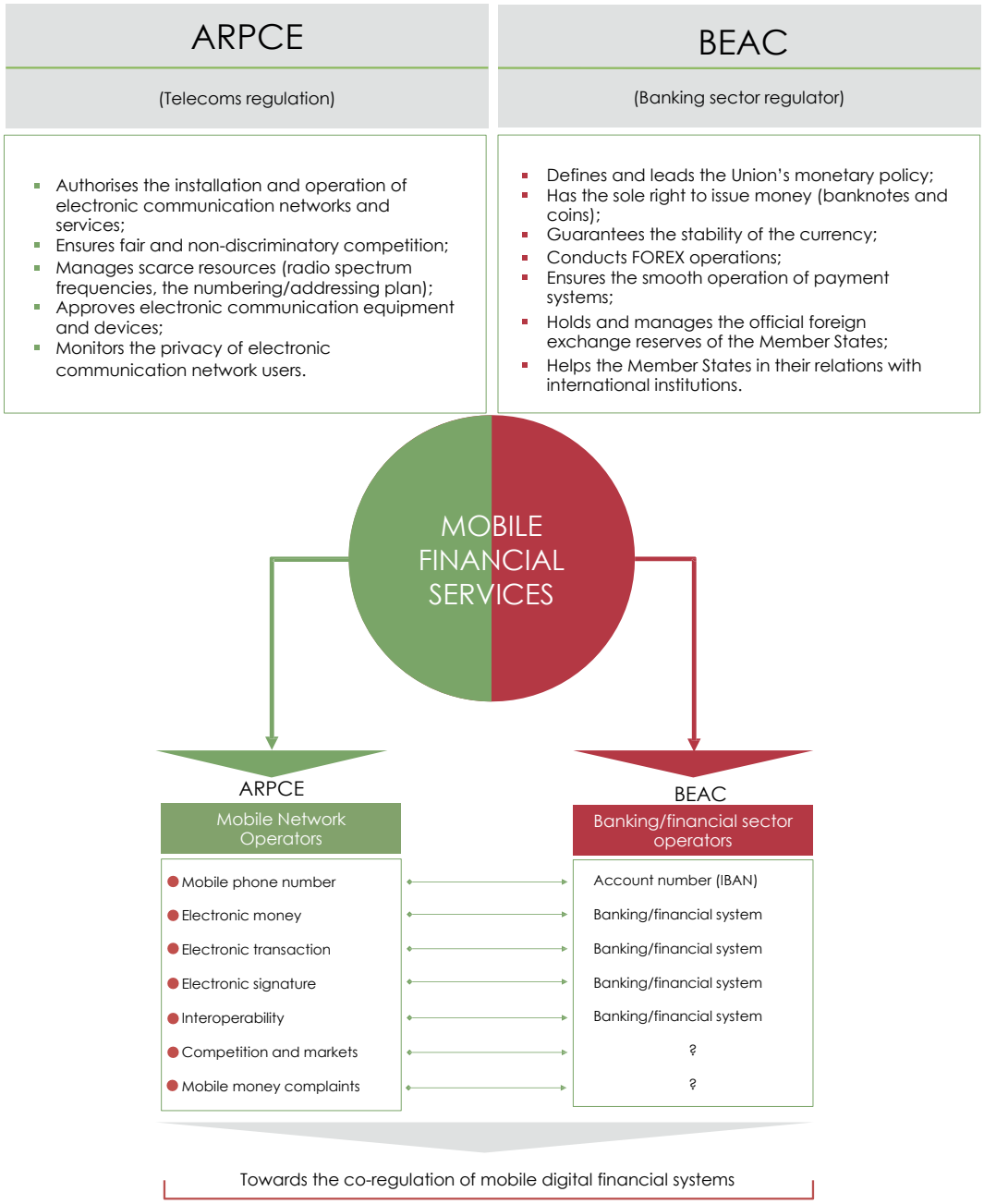
BEAC, COBAC and, to a certain extent, CNEF (Comité National Économique et Financier, the National Economic and Financial Committee), are the institutions that will be involved in the regulation of MFSs.

ARPCE will continue to manage the numbering plan. However, phone numbers, which are also used for financial transactions, will change or become standardised. For BEAC this means dissociating phone numbers from payment accounts as, currently, mobile money payment accounts are unique to each number. This number, within financial institutions, will become a kind of alias that will allow several payment accounts to be accessed. In other words, it will be possible to access different accounts from a single phone number belonging to a legal or natural person.

The rationale for the standardisation of mobile financial services payment accounts is so that they have the same 27-character IBAN structure as in traditional bank accounts. This will contribute to increasing the interoperability of financial transactions from mobile networks to banking networks, and vice versa. It will also encourage the development of banking on the mobile network services.

Electronic money is distributed by mobile network operators but issued by banks with whom they have signed agreements. Moreover, the sending and receiving of e-money is carried out over the operators' networks. BEAC and COBAC are responsible for regulating the issuing of e-money. These transactions must be certified by an electronic signature. However, their regulation remains the domain of BEAC, which requires approval from ARPCE for the validation of the technical platforms used by the mobile operators. Furthermore, applications sent to BEAC by the mobile operators for the authorisation of payment services are considered incomplete without the approval of ARPCE. BEAC/COBAC (the supranational regulators) and ARPCE (the national regulator) must therefore work together to ensure the optimal regulation of mobile payment services.

Figure 20: Co-regulation of mobile financial services



The regulation of a sector, in addition to the legal and technical aspects, must also take into account competition and market factors. For example, the USSD market is a key issue that needs to be analysed in greater depth in order to ensure fair regulation that will promote financial inclusion in Congo. Banks and microfinance institutions would also like access to the mobile network operators' USSD platforms. This demand is particularly relevant as the mobile operators are considering, in the short or medium term, separating their mobile telephony activities from their financial services. This would have consequences on the role played by the regulator, which would be responsible for approving tariffs for MFSs, financial promotions, etc.

The same would be true for complaints submitted by mobile phone users, which are handled directly by the operators. However, complaints about MFSs (mobile money) that are not resolved by the operators are also submitted to ARPCE; complaints which should in fact be investigated by BEAC. However, the banking and financial regulator has not yet put in place a mechanism (similar to ARPCE's) for handling these types of complaints. This seems to have been devolved to CNEF, the National Economic and Financial Committee, which — to date — is not able to deal with these grievances.

A co-regulation of MFSs seems inevitable and assumes that the roles of the various parties are clearly set out in a regulatory text that takes into account the various aspects (legal, technical, commercial, competition, user protection, etc.) inherent in each sector (telephony and banking/ finance). Insofar as CEMAC is a community organisation and that the aforementioned issues are not limited to Congo, it would be beneficial to organise a public consultation to gather the opinions of all the sub-regional stakeholders involved in the management and operation of mobile payment activities.

13.2. Blockchain: what does its future look like in Congo?

Blockchain technology allows data and transactions to be stored and transmitted in a decentralised manner within a network, meaning that there is no one system that centralises and controls the storage and transmission of data and transactions. The blockchain is a sort of open database shared between several members or users who can verify the validity of the data exchanged using an encryption system.

■ Crypto-currency

Cryptocurrencies (such as Bitcoin) rely on blockchain technology to secure electronic money transactions from person to person (peer to peer) without the need of an intermediary. Cryptocurrency does not depend on a central bank or financial institution.

■ Regulatory framework

In the CEMAC zone, all monetary projects must obtain prior authorisation from BEAC. However, the blockchain is opposed to any form of centralisation, which means that cryptocurrencies do not meet one of BEAC's core requirements, i.e. the centralisation of operations. As a result, cryptocurrencies in the CEMAC zone have not been approved by BEAC, unlike mobile money.

To date, there is no regulatory framework in place that would favour the deployment of cryptocurrencies in the CEMAC zone, let alone in the Republic of the Congo.

Data protection

A transaction made within a blockchain network is verified and approved by other members of the network using highly advanced cryptographic techniques to check the authenticity of the transaction and the user. Wouldn't the fact that everyone has access to the data of other members contravene the data protection principle enshrined in law n° 29-2019 of 10 October 2019 on the protection of personal data? This concern would be of particular relevance if cryptocurrencies were made legal in the CEMAC zone. A more in-depth analysis (technical, legal, etc.) should be carried out in order to identify these different aspects and not block technological innovations.

System security

As the blockchain is an open network, it can be accessed via the Internet and as with cryptocurrencies, the risk of harmful cyberattacks should not be downplayed. There are also risks associated with money laundering using cryptocurrencies, including the possibility of funding a range of criminal acts, such as terrorism, etc.

Energy consumption

Mining cryptocurrencies requires a lot of energy. In 2020, the electricity consumed by Bitcoin miners was the equivalent of the energy required to provide 110% of the annual energy needs in the Czech Republic[44]. In early 2017, Bitcoin mining used 6.6 terawatt[45] hours of energy. In October 2020, it was 67 terawatt hours. Cryptocurrencies exchanged using blockchain technology have an impact on electricity generation. In Congo, and the CEMAC zone in general, could electrical installations meet such a high demand for electricity if cryptocurrencies were allowed?

13.3. Big Data: is Congo ready?

The more the Republic of the Congo develops its telecoms infrastructures, the more it will be confronted with problems associated with the production of mass digital data, which will then have to be stored. As some data are more sensitive than others, they need to be protected to prevent them falling into the hands of wrongdoers.

Definition of Big Data

Big Data refers to all digital data generated by the use of new Information and Communication Technologies (ICTs) for either personal or professional purposes.

44 https://www.statista.com/statistics/881522/bitcoin-energy-consumption-relative-to-select-countries, website consulted on 18/03/2021.

45 https://www.dw.com/en/why-does-bitcoin-need-more-energy-than-whole-countries/a-56573390, website consulted on 18/03/2021.

Production and storage of mega data

The digitalisation of the Congolese economy (like everywhere else) produces massive amounts of data: databases, emails, videos, images, sounds and texts exchanged on social networks or the Internet, electronic transactions of all types, etc. In Congo, the sectors that use the most Big Data are the oil, telecoms, and banking sectors, tax and customs authorities, and the various digital initiatives that have been set up (e-customs, e-tax, digital hub), to name but a few.

Once collected, sorted and analysed, this Big Data is then transformed into information that is useful to its owners. Collecting Big Data requires infrastructures that are capable of storing and securing it. This has led to the construction of private and public Data Centres in Congo to meet the country's immediate and future data storage needs. Big Data is not a new concept in Congo, it is already happening. However, the volume of data stored and processed cannot be compared to the vast amounts generated in developed and industrialised countries.

Big Data offers various opportunities for Congolese cyberspace, including the archiving of public-sector data. Given the importance of archives and documentation in any well-run administration office, Congo would benefit from rethinking (where possible) how such documents are archived. All this data will constitute one of the axes in the strategic management of the digitalisation of Congolese society. Administrations will have to modernise their working practices in order to meet the legitimate expectations of citizens in terms of the provision of public services. This would also apply to the private sector, which is generally further ahead than public administrations, because the digitalisation of the Congolese economy can only succeed through the efforts of all stakeholders involved in its modernisation.

Big Data and the protection of sensitive data

Data that are stored by mobile network operators and banking institutions, for example, are considered to be sensitive as they contain personal information that must not be shared with unauthorised persons. In accordance with the regulations in force, these data cannot be transferred outside the Republic of the Congo without the approval of the "Commission" in charge of protecting personal data.

There is a trend — usually driven by powerful foreign companies wanting to control as much personal data as possible — which criticises or even minimises the ability of African countries to protect such data on their continent. It is believed that these data are better protected when stored in Data Centres located outside Africa. In other words, personal data should be easily transferable from Africa to Europe, America or Asia for hosting purposes; except that these data are not only stored on these continents. They are subject to advanced data analytics which provide valuable information on the gender, location, income, habits, tastes, opinions, etc. of ICT users. These data, which have now become 'sensitive personal information', have an extraordinary monetary value,

especially for advertisers. For example, Google's turnover was 21.4 billion USD in 2015 of which 19.07 billion USD was generated by advertising[46] (i.e. 90% of its turnover in this period).

The fact that Congo has tightened its regulations on the transfer of digital data outside its territory suggests that it has not succumbed to the criticisms raised by certain countries. It must be seen as an important issue of digital sovereignty which, if not taken very seriously, could lead to the cyber-colonisation of Congo and Africa in general. This is why data collected in Congo from digital applications must be stored in the country.

13.4. Artificial Intelligence: dream or reality?

Artificial Intelligence (AI) does not seem to have gained a foothold in the collective imagination of the Congolese, and even less so in the scientific world. The stakes related to AI are so high that the delay in the Republic of the Congo and Africa in general should prompt a more detailed reflection on its implementation.

Definition of Artificial Intelligence (AI)

Artificial Intelligence can be defined as the ability to teach a machine to improve its learning capabilities on its own (machine learning) in order to contribute, among other things, to the automation of tasks with a view to reducing the costs of industrial production, knowledge, etc.

Prerequisites for the development of AI in Congo

For the moment, AI remains a very elitist subject. It is therefore not surprising that industrialised countries, such as China and the United States, are leading the way in this area. In these countries, education is not an afterthought, but a priority and this is what leads to permanent innovation. The concept of AI is hard to grasp without advanced training in science, technology, engineering and maths, collectively known as STEM. It is no coincidence that countries with the highest levels of education perform better than others. Seen from this angle, Congo is not yet at the forefront of such developments and does not have a robust strategy for the development of AI. And in any case, could it really compete with the likes of Google, Facebook, Alibaba or Amazon? It would be delusional to think it could, especially as Alibaba and Amazon respectively invested 15 and 16 billion USD in Research and Development (R&D) projects linked to AI in 2017[47]. These R&D investments are higher than Congo's GDP (gross domestic product).

46 Anahiby Becerril, The value of our personal data in the Big Data and the Internet of all Things Era, DOI: http://dx.doi.org/10.14201/ADCAIJ2018727180, article consulted on 20/03/2021.

47 Nicholas, Miailhe, Géopolitique de l'intelligence artificielle : le retour des empires?, Politique Etrangère | 3:2018, p.113.

Based on the above, the prerequisites for AI depend on education/training, R&D, digital infrastructures (submarine cables in FO, HS and VHS networks, etc.), and public services (digitalisation of administrative acts, etc.).

However, there is a high risk that the Congolese education system will produce graduates with practically obsolete knowledge and who will not be able to meet the needs of businesses in a world where digital technology is becoming increasingly important in almost all areas. This will lead to the use of foreign consultants or firms to deal with problems surrounding AI in Congo.

Have any serious Artificial Intelligence R&D projects been planned or financed? And, if so, to what extent? Are current digital infrastructures sufficient to meet the conditions for its implementation? How long will it take before the majority of public administrative bodies and departments are able to meet the requirements of the digital economy? Yet despite all this, AI does represent a real opportunity for Congo.

AI: an opportunity to nurture Congolese talents

AI should be looked at as an opportunity for the Congolese to showcase their talents. Despite challenging educational conditions, many Congolese are already writing complex algorithms to address local issues.

To prevent Congo having to resort to skills from overseas to find solutions to its problems, an effective ecosystem should be put in place to allow the most talented people to express themselves and to break down the inferiority complex stemming from the recent past, which assumes that truth and scientific knowledge is always Western. Rather than seeking to compete with leading digital companies, Congo should first carefully analyse the areas in which it could use AI with a local workforce — "The only wealth is man" — as the saying goes.

With regard to health, for example, Congolese talents could come up with digital solutions to help people in the field of telemedicine by designing devices that are able to diagnose or even prevent diseases thanks to the algorithms they have developed. With regard to education, Congolese talents could also customise and adapt algorithms to boost e-education, e-training, etc. They could also contribute to the digitalisation of training platforms (open digital classrooms) in order to share knowledge in a way that is different from traditional teaching methods. In e-agriculture, they could come up with systems for detecting specific pests and diseases by taking and sending photographs of the infected plant on a smartphone, and instantly receiving a diagnosis and treatment plan.

However, training Congolese talent in the most advanced areas of AI will be a major challenge, and they must be properly nurtured and paid. If not, there is a risk that the best Congolese talent will be poached by the world's largest digital firms that can afford to pay top-flight salaries. These companies represent real sources of competition, even in industrialised

countries. Moreover, unless Congo can reinvent itself, there is a high risk that it will remain a mere consumer with no real stakes in AI.

Evidence of this strong industrial dependence can be seen in Zimbabwe, where a Chinese company, CloudWalk Technology[48], signed an agreement to develop a facial recognition system. But where are these resulting data stored? Who controls and analyses these data? Is it conceivable that Chinese biometric data could be controlled by a Russian or German company? To do so, would be to allow a foreign power to control the surveillance and security systems of another country. It must be remembered that today's allies can become tomorrow's enemies, and that the data they control could be used to destabilise a country. This is why the notion of digital sovereignty is not a purely abstract concept.

13.5. The shift from ICT regulatory bodies to digital authorities

Whether it is mobile financial services (MFSs), blockchain, Big Data or Artificial Intelligence (AI), the regulation of Information and Communication Technologies (ICTs) as it was conceived a little more than ten years ago in the republic of the Congo is already beginning to show certain limitations. The digital economy is far-reaching and thus requires a range of multifaceted skills. The regulation of the digital economy must be supported with skills in the field of banking and financial regulation, in addition to skills in telecoms. But it is also necessary to integrate new jobs and challenges brought about by the realities of blockchain technology, Big Data and AI. Some countries are considering transforming their ICT agencies into digital authorities that can regulate the aforementioned areas in addition to those related to the security of information systems.

The various stakeholders in the regulation of the digital economy must, more than ever, understand the new jobs and professions associated with these innovations. It would be inconceivable for digital operators to have a greater understanding of the issues than the regulators themselves. These issues are related to the economy, technology, the law, security, etc., and are linked to the transformation of ICTs in Congo, CEMAC, Africa and the rest of the world. The credibility of Congo depends on its ability to effectively regulate its digital economy in order to mitigate its vulnerability.

Ultimately, the digital economy is a result of the development of the Internet, which, in turn, is dependent on telecoms equipment. Digital financial services offered on mobile networks, the blockchain, Big Data, and AI would not exist without telecoms infrastructures, and access to high and very high speed Internet. Therefore, this is one of the key reasons for placing telecoms at the heart of Congo's digital transformation.

48 Ibid, p.116.

XIV

ENERGY TRANSITION WITH REGARD TO TELECOMS IN THE REPUBLIC OF THE CONGO

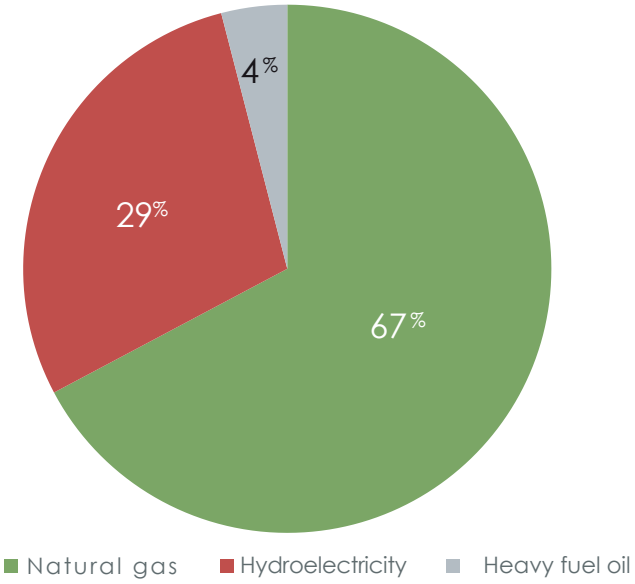
Since 1991 there has been an environmental protection law[49], which was further reinforced by an implementing decree in 2009[50]. However, there is no specific law covering the issue of energy transition in the Republic of the Congo. There is, however, an international committee on renewable energy in Congo, which is not yet operational, although its members have been appointed[51]. It would appear that there are no particular constraints that would oblige natural or legal persons to switch to renewable energy.

14.1. Energy mix in Congo: what place for green energy?

As an oil-producing country, Congo has halted natural gas flaring[52] so that it can be used to increase electricity production in the country. This resulted in the construction of two (2) gas power plants in Pointe-Noire. Congo's energy policy largely relies on the development of natural gas. While natural gas is a fossil fuel, it has a lower carbon footprint than coal, which is still used in some European countries. Today, natural gas accounts for 67% of the nominal electricity capacity of Congo, which is estimated to be in the region of 800 MW. The various hydroelectric dams (Imboulou, Moukoukoulou, Liouesso and Djoué) account for a little under 30% of this capacity compared to 4% for the thermal power plants which run on heavy fuel oil.

49 Law n° 003/91 of 23 April 1991 on the protection of the environment.
50 Decree n° ° 2009/415 of 20 November 2009 setting out the scope, content and procedures for environmental and social impact assessments.
51 Acts n° 6209 and 6211 of 2 April 2021 of the Ministry of Scientific Research and Technological Innovation.
52 Flaring consists of burning the natural gas released by oil wells.

Graph 6: Energy Mix in Congo



Sources: E²C, PND 2018-2022, Les Dépêches de Brazzaville[53]

Congo's energy transition programme consists of replacing polluting fossil fuels with non-polluting or less polluting sources of energy, also called renewable or green energies. The switch to using greener energies — spread over a period of time defined by governmental or local authorities — will involve making modifications and changes to the production, transport, distribution systems and energy consumption patterns to reduce their environmental impact as far as possible.

Congo's hydroelectric potential, which is still largely under-exploited (22 GW), as well as solar energy, are all assets that could reduce the proportion of natural gas in its energy mix in the longer term. In the meantime, the aforementioned energy mix enables the national electricity distributor, E²C, to supply electricity to households, local authorities and companies, including mobile telephony and telecoms infrastructure operators.

Power outages cuts are still common in Congo and force customers of E²C to acquire expensive generators or solar panels, which represent an estimated 34.5% of the national supply[54], i.e. around 270 MW is basically supplied by generators.

53 No 2947of Friday, 23 June 2017.
54 National Development Plan (NDP)- Operational Appendix N°1 PPAP 2018-2022, p.158

14.2. Telecoms infrastructures and electricity

Awareness of the need to safeguard the planet and its atmosphere from greenhouse gases (among other elements) requires various actors around the world, including those in the value chain of the ICT industry, to change how they produce and consume energy. This is a general trend and one which electronic communications operators are keen to avoid for fear that their brand become associated with global warming.

There are also purely economic considerations that are pushing telecoms operators to migrate to non-polluting energy. In fact, energy represents a considerable proportion of their operating costs. Therefore, it is in their interest to find cost-saving alternatives, if possible, with green energy, in order to reduce their carbon footprint, but also to lower or stabilise their energy operating costs.

The following telecoms infrastructures in Congo are leading to an increase in energy consumption (this list is not exhaustive):

- Matombi Landing Station (CLS) where the WACS fibre optic cable lands;
- Microwave links and fibre optic (FO) cross-border backbones;
- Data Centres for storing data;
- Internet eXchange Point (CGIX) to exchange traffic between operators;
- VSAT[55] for satellite communications, etc.

Given the regular use of generators to compensate for power outages, these infrastructures contribute to the emission of polluting particles into the atmosphere. For example, the Matombi Landing Station (CLS) is located in a village that is still not hooked up to E²C; this has been the case since it was commissioned back in 2012. However, the CLS is a key link in the chain for telecoms and the digital economy in Congo, and it should have been connected to the national electricity grid. Due to this situation, diesel generators have been used for nine (9) years[56] to power the CLS. Moreover, these generators create greenhouse gases, including CO2, which contributes to air pollution.

In many areas not connected to the E²C grid, the sites (or relay antennas) belonging to infrastructure and mobile network operators have to be operational 24/7. There are over 1,300 sites in Congo (not including FASUCE sites), which all contribute, albeit to differing degrees, to air pollution. A site generally consumes between 2,500 and 3,000 litres of diesel a month, but this consumption goes down to around 750 litres for hybrid sites (diesel and solar power)[57].

55 Very Small Aperture Terminal.
56 Over nine years (with no interruption) the various generators have clocked up around 80,000 hours of operation at the Matombi CLS.
57 Louis-Marc Sakala, Mémoire sur la transition énergétique - Optimisation de la gestion énergétique dans les télécoms, Paris-Dauphine, 2020.

The generators used on telecoms operators' site have to be regularly serviced resulting in used oil, which is very harmful to the environment. How is this oil recycled by the technical service providers who maintain the infrastructure and mobile network operators' sites? If this used oil is buried or left on the surface, the consequences can be harmful to the water table and watercourses, as well as to fauna and flora.

Therefore, the provision of telecoms services has an impact on the environment, which is why the legal system makes it compulsory to carry out an environmental impact assessment prior to any economic development project in the Republic of the Congo. These rules apply to everyone, including players in the telecoms value chain.

14.3. CO2 emissions in the telecoms sector

Telecoms operators suffer from the lack of an effective E²C network throughout the country, as well as the patchy supply of electricity. Due to these shortcomings, these operators (or their contractors) independently generate the energy that allows subscribers in areas not served by E²C to be connected to operators' networks. However, this independent approach to energy production is a source of pollution. Therefore, even in the absence of an energy transition policy, the telecoms sector would benefit from switching to renewable energy.

■ Estimation of CO2 emissions in the mobile telephony sector

In the Republic of the Congo, Helios Towers managed 427 sites in the first quarter of 2021 of which 64% were in urban areas[58]. On this basis, we can estimate that 30% of operators' sites are located in rural areas. There are a little over 1,300 sites in the country.

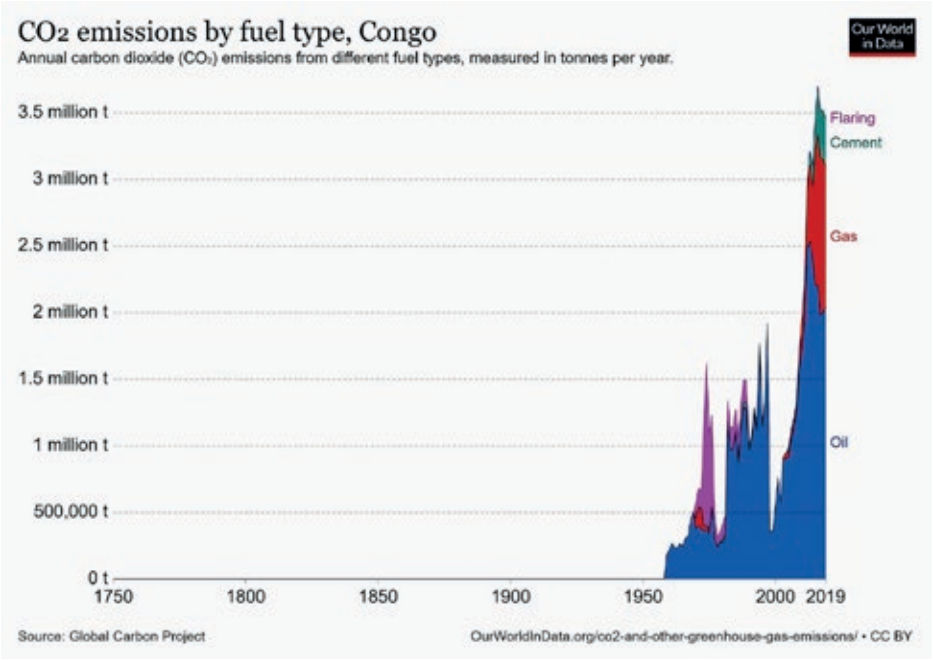
Therefore, there are almost 390 sites in rural areas. It is assumed that 80% of rural sites are not connected to the E²C national grid, i.e. approximately 312 sites are permanently powered by generators. Each site consumes, as indicated above, between 2,500 and 3,000 litres of diesel a month. Using the lower estimate of 2,500 litres per month, the 312 sites would consume 780,000 litres of diesel per month (or 9.36 million litres a year). How much pollution is generated by this level of diesel consumption?

One (1) litre of diesel produces around 2.7 kg of CO2. Based on our assumption, rural sites would emit around 25.27 million kg of CO2 (i.e. 25,272 tonnes of CO2). In 2019, Congo is estimated to have emitted 3.46 million tonnes of CO2. In relation to the total pollution, the pollution generated by rural sites would represent only 0.73%. This gives an indication of the impact of mobile telephony on air pollution levels. However, this figure needs to be amended to include the diesel consumption of urban sites connected to E²C, whose consumption is much lower than that of rural sites not connected to E²C. In any case, the cumulative pollution generated by generators in urban and rural locations would not be more than 1.3% of the total CO2 emissions in Congo. The graph below

58 https://www.heliostowers.com/where-we-work/congo-b/, site consulted on 07/06/2021.

shows that CO2 emissions in Congo are mainly caused by oil, gas and cement manufacturing.

Graph 7: CO2 emissions by type of fuel in Congo



Economic consequences of reducing greenhouse gases

Assuming that the 312 rural sites are permanently powered by generators, then the financial impact of not connecting them to the national grid can be estimated. At 475 FCFA per litre of diesel, the annual cost of fuel is 4.44 billion FCFA[59][60][61].

Would the financial cost have been the same for the operators if these sites were connected to the E²C network? In other words, what is the average monthly electricity consumption of a site connected to the E²C network? This consumption can be estimated based on the basic equipment of a site. With a margin of error that allows for a certain amount of caution, the average monthly consumption of a site connected to the E²C network in a rural area can be estimated at 7,500 kWh[62][63]. Using this reference value for the 312 sites gives an annual consumption of 28.08 million kWh. With the lowest price per kWh being 37 FCFA including tax (31.2 FCFA not including tax), the electricity production of these sites — if they were connected to the E²C network — would have cost the operators 1.04 billion FCFA compared to 4.44 billion FCFA if they used generators running on diesel. In this scenario, the operators would have saved 3.4 billion FCFA on their annual energy bill.

59 9.36 million litres × 475 FCFA/litre.
60 Urban sites were not included in the calculation.
61 This figure does not take into account all the costs associated with the management/ transportation of the fuel.
62 Albert Ayang et al., Power Consumption: Base Stations of Telecommunication in Sahel Zone of Cameroon: Typology Based on the Power Consumption—Model and Energy Savings, Hindawi Publishing Corporation, Journal of Energy, Volume 2016, Article ID 3161060, http://dx.doi.org/10.1155/2016/3161060.
63 Josip Lorincz et al., Measurements and Modelling of Base Station Power Consumption under Real Traffic Loads, Sensors 2012, 12, 4281-4310; doi:10.3390/s120404281.

14.4. Energy priorities in the telecoms sector in Congo

Technological advances in the telecoms sector will require an increase, direct or indirect, in Congo's energy capacity. Decisions about energy will have to be made in order to support the ongoing digital revolution. However, ecological issues linked to electricity generation must not be taken lightly. Given the reality of the local energy mix, will Congo have to reduce its reliance on fossil fuels?

Upward forecast of energy consumption in telecoms

From an ethical point of view, and in accordance with the principles to combat global warming, it would seem useful for Congo to adopt renewable energies by legislating on energy transition. In the telecoms sector, this transition would contribute to energy savings. By adopting a hybrid solution (solar and diesel) to provide energy to sites, an operator could reduce its diesel consumption by over 70%.

Equipment manufacturers will also have to play their part by manufacturing equipment and developing technologies that consume less energy[64]. Access devices consume increasing amounts of energy and this is particularly true of smartphones whose many features and applications contribute to lowering these devices' battery autonomy, i.e. they run out of power more quickly forcing their users to recharge them more often. This, in turn, places greater demands on the electricity grid, or generators in the event of power outages. In both scenarios, there is an increase in energy consumption, as well as Congo's carbon footprint (even if that associated with the telecoms sector is extremely low).

Cryptocurrencies exchanged through blockchain technology also have an impact on electricity generation. Before adopting such a technology in Congo, it would first be necessary to ensure that the energy supply conditions solely dedicated to this technology are up to the job. This would require (among other things) an increase in the electrical power supply in Congo.

And then there is 5G technology, which is very energy-hungry. A 5G antenna consumes three times as much energy as a 4G antenna[65], although manufacturers are hoping to reduce this ratio over the coming years. The deployment of 5G technology in Congo could increase operators' energy costs. Apart from infrastructure, 5G-enabled terminals will not be any less energy-hungry because of their "intelligence", which results primarily from their ability to perform many complex operations simultaneously.

The Internet of Things (IoT), Big Data and Artificial Intelligence are all technological developments that may not take off in Congo if the fundamental issue of electricity supply is not addressed.

64 However, this does not depend on Congo, which is not an industrial ICT player. It is industrialised countries that set the standards and impose them on the rest of the world.

65 Olimpjon Shurdi et al., 5G Energy Efficiency Overview, ESJ Natural/Life/Medical Sciences, Doi:10.19044/esj.2021.v17n3p315.

Energy optimisation in the telecoms sector: what is the right mix?

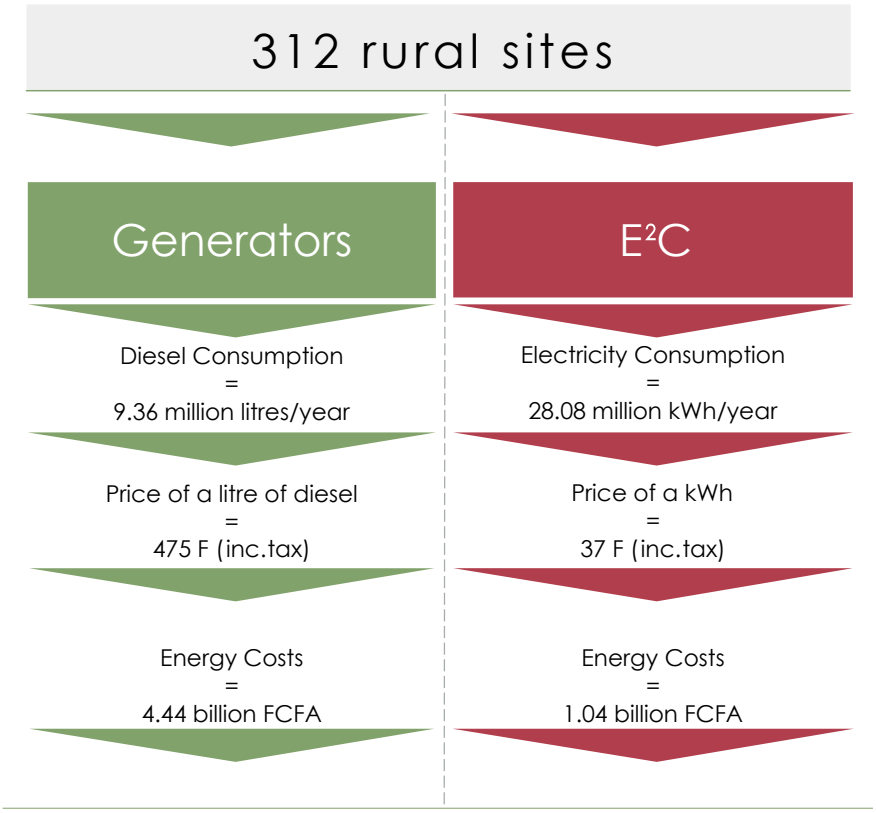
Optimising energy consumption in the telecoms sector through renewable energies is undeniably a noble ambition, but one that is limited by the current make-up of Congo's energy mix, which is dominated by fossil fuels and chiefly natural gas. Congo's economy is also dominated by the oil and gas industries. Natural gas has a very high carbon footprint in Congo. However, at the global level Congo is not a net polluter, quite the opposite in fact.

In Congo, there is the energy producers (CEC[66] and E²C), and the national energy distributor (E²C). The current distribution network does not cover the entire country, which leads to the use of polluting (and expensive) generators that run on diesel. Although the carbon footprint of the generators used by mobile network operators is negligible, this does not prevent operators from having to comply with the environmental standards in force.

Based on the above assumptions for rural areas, it has been shown that the energy distributed by E²C (67% of which comes from natural gas) is more cost-effective than that produced independently by mobile operators. If these areas could be connected to the national grid, it would help to prevent air pollution in these areas, as well as harm to fauna and flora. Another major consequence of this shift toward greener energy would be lower electronic communication tariffs, as energy costs constitute a significant part of telecoms operators' overheads; these savings could be passed on to customers.

66 Centrale Électrique du Congo, the Congo Power Plant.

Figure 21: Independent on-site power generation or connection to the national grid



With regard to natural gas, the Republic of the Congo is a member of the Global Gas Flaring Reduction Partnership (GGFR[67]), which was set up by the World Bank. The signatories to this partnership, as well as the companies involved in this initiative, are working to identify ways to remove the barriers to reducing natural gas flaring. In other terms, Congo has made the choice, as demonstrated in its energy mix, to retain natural gas as an important source of its economic development.

In Tanzania for example, the government extended the electricity network by 1,000 km, which enabled Helios Towers to connect 147 sites to the national grid[68]. The Tanzanian government was also able to make savings by eliminating or reducing costs associated with logistics and purchasing diesel for these sites, and reducing the greenhouses gases they produced.

Ultimately, the telecoms industry and the digital economy would benefit from the 'energy boulevard' initiative becoming a reality so that Congo's energy production supports the distribution of high-quality electricity in sufficient quantities.

67 Global Gas Flaring Reduction Partnership, https://www.worldbank.org/en/programs/gasflaringreduction#4, website consulted on 11/06/2021
68 Helios Towers, Annual Report and Financial Statements, 2019, p.10.

CONCLUSION

Notwithstanding the new legal provisions that have strengthened the postal and telecoms sectors and the digital economy, the technological upheavals that are taking place make it necessary to reconsider the current legal and institutional frameworks in order to better address the challenges related to their regulation.

The 2009 legal framework relating to the regulation of the postal and electronic communications sectors should be strengthened in line with the constraints posed by the development of mobile financial services (MFSs), which involves the management of money, an exclusive domain of the Bank of Central African States (BEAC). This is all the more justifiable as mobile network operators (MNOs) are gradually transforming themselves into mobile banking or financial institutions. While BEAC is in the process of reviewing its regulations in this area, the regulation of the telecoms sector should evolve accordingly, thus forcing the two regulators to work together through a co-regulation approach.

The economic structure of the Republic of the Congo could — thanks to its progressive digitalisation — at last incorporate the informal economy into its national taxation system. Many actors in the informal sector have a mobile money account and will have a mobile banking account in due course. This risks changing the structure of the banking sector by exposing the vulnerabilities of traditional banks and increasing competition from powerful MNOs. Digital inclusion not only promotes financial inclusion, but also digital taxation through telecoms infrastructures.

However, much still remains to be done to bridge the digital divide. With this in mind, the Government, under the supervision of the Ministry of Posts, Telecommunications and the Digital Economy, has set up a Universal Electronic Communications Service Access Fund (FASUCE) to connect people in 'white areas'. It will be necessary to ensure that the quality of services and access technologies in these 'white areas' are the same as those offered in urban areas to avoid creating digital inequality.

The infrastructure of the telecoms sector already favours the digitalisation of the Congolese economy. Congo would, however, benefit from being connected to at least a second submarine fibre optic cable. Redundancy with Gabon must also become a reality in terms of traffic given that the infrastructure already exists, although it requires modernisation. Today, the greatest vulnerability in the digital sector is the risk that the WACS fibre-optic cable breaks, something that has already happened on several occasions, paralysing the Congolese economy. This is a compelling reason for linking up to additional submarine cables, including the Facebook cable that will go round Africa; the rest of the sector's infrastructure is primarily dependent on access to international capacity.

The postal sector has not reached its full potential either. One of the many obstacles to the effective development of the postal sector is the addressing system used for urban and semi-urban locations, which is required so that parcels, letters and so forth can be delivered directly to the physical address of the addressee. However, a truly effective and efficient postal system also depends on good access roads. The poor condition of several roads and the isolated nature of many communities also explains why the incumbent and private operators are not able to offer services in these areas. Contrary to good practice, which requires postal workers to physically go to the addressee's property, in the Congo it is the addressee who has to go to the Post Office or private operator to pick up his/her parcels, letters, etc. However, in order to reverse this trend and respect international practices, the simple goodwill of the operators or indeed the regulator will not be sufficient. These are issues that also concern land use planning, as well as the construction of road and waterway infrastructures, etc.

The development of the digital economy is also giving rise to major discussions on the challenges and limitations of Congolese cyberspace, particularly in terms of cybersecurity. Relevant initiatives have been taken to address these concerns, including the creation of ANSSI (the National Agency for Information Systems Security). However, the fact that this agency is still not operational is exacerbating Congo's vulnerability in terms of its cyberspace. Moreover, the lack of very high-level academic training in the digital economy remains another significant weakness for Congo. If measures are not taken to address this, Congo risks becoming digitally dependent by having to outsource the design of information systems and the management of certain sensitive data to foreign companies.

While there is no doubt that infrastructure lies at the heart of the optimal functioning of operators' networks, and that it promotes the development of the digital economy, it cannot function properly without a high-quality energy supply. As the demand for energy outstrips supply in Congo, telecoms operators, like all other businesses in the country, have opted to use back-up systems, namely generators powered by diesel. Although diesel is a polluting fossil fuel, it has an extremely low impact on air pollution in Congo (less than 1%).

To date, Congo has not passed any laws on energy transition and continues to focus on the development of natural gas to produce electricity, which makes sense for an oil producing country. Moreover, almost 70% of the electricity distributed by E²C comes from natural gas, an energy source that plays a role in Congo's 'energy boulevard'. The production standards for this energy must be strictly regulated so that Congo's main power plant (Centrale Électrique du Congo) emits as few polluting particles as possible into the air.

It has also been shown that telecoms sites powered continuously by the national electricity distributor (E²C) can lower the cost of diesel and generator maintenance fourfold. If solar panels were an effective stand-

alone solution, it is almost certain that all operators' sites would have already migrated to "all solar"; which is not the case. Consequently, Congo will need a supply of abundant cheap energy to achieve its full development potential, including in the postal and telecoms sectors and the digital economy.

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ACRONYMS

AI: Artificial Intelligence

ANSSI: Agence Nationale de Sécurité des Systèmes d'Information, the National Agency for Information Systems Security

AR: Augmented Reality

ARPCE: Agence de Régulation des Postes et des Communications Électroniques, the State Market Regulator for the Post and Electronic Communications Sectors

ATM: Automated Teller Machine

BCEAO: Banque Centrale des États de l'Afrique de l'Ouest, the Central Bank of West African States

BEAC: Banque des États de l'Afrique Centrale, the Bank of Central African States

CAB: Central Africa Backbone

CEC: Centrale Électrique du Congo, the Congo Power Plant

CEEAC: Communauté Économique des États de l'Afrique Centrale, the Economic Community of Central African States

CEMAC: Communauté Économique et Monétaire de l'Afrique Centrale, the

CGIX: Congo Internet eXchange Point

CLS: Cable Landing Station

CNEF: Comité National Économique et Financier, the National Economic and Financial Committee

COBAC: Commission Bancaire de l'Afrique Centrale, the Central African Banking Commission

CSI: Centre de Santé Intégré, Integrated Health Centre

DGIFN: Direction Générale des Institutions Financières Nationales, the General Directorate of National Financial Institutions

DTS: Dematerialised Tax Stamp

E²C: Énergie Électrique du Congo, the Nationl Electric Power Company

EMI: Electronic Money Institution

ES: Electronic Stamp

FASUCE: Fonds d'Accès au Service Universel des Communications Électroniques, Universal Electronic Communications Service Access Fund.

FO: Fibre Optic

GDP: Gross Domestic Product

GGFR: Global Gas Flaring Reduction Partnership

GIMAC: Groupement Interbancaire Monétique de l'Afrique Centrale, the Interbank Electronic Banking Group in Central Africa

GVA: Group Vivendi Africa

GW: Gigawatt

HAPS: High Altitude Platform Systems

HS: High Speed

IBAN: International Bank Account Number

ICT: Information and Communication Technologies

IoT: Internet of Things

IP: Internet Protocol

ISP: Internet Service Provider

ITR: International Termination Rate

kWh: Kilowatt hour

LTR: Local Termination Rate

MFI: Microfinance Institution

MNO: Mobile Network Operator

MVNO: Mobile Virtual Network Operator

MW: Megawatt

NIC: National Identity Card

NIS: National Institute of Statistics

ONPT: Office National des Postes et Télécommunications, the National Post and Telecommunications Office

QoE: Quality of Experience

QoS: Quality of Service

R&D: Research and Development

SOPECO: Société des Postes et de l'Epargne du Congo, the Congo Postal and Savings Company

SOTELCO: Société des Télécommunications du Congo, the Congo Telecommunications Company

STEM: Science, Technology, Engineering, and Mathematics

UIN: Unique Identification Number

USSD: Unstructured Supplementary Service Data

VHS: Very High Speed

VoIP:	Voice over IP
VR:	Virtual Reality
VSAT:	Very Small Aperture Terminal
WACS:	West Africa Cable System
UEMOA:	Union Economique et Monétaire Ouest Africaine, the West African Economic and Monetary Union
WRC:	World Radiocommunication Conference

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