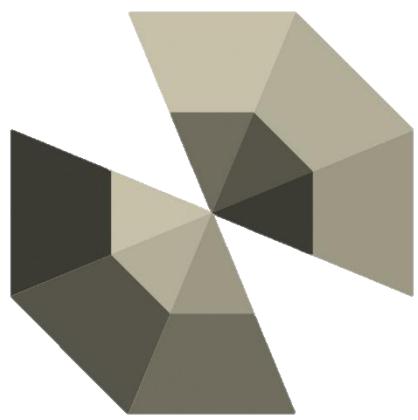


SION  COIN



QUANTUM ROCK

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CHAPTER I

Africa must wake up

“Every movement, whatever its cause, is creative.”

- Edgar Allan Poe

1. Africa must wake up

1.1. Introduction

Africa is the world's second largest and second-most populous continent, after Asia in both cases. At about 30.3 million km² (11.7 million square miles) including adjacent islands, it covers 6% of Earth's total surface area and 20% of its land area. With 1.3 billion people as of 2018, it accounts for about 16% of the world's human population. Africa's population is the youngest amongst all the continents; the median age in 2012 was 19.7, when the worldwide median age was 30.4. Despite a wide range of natural resources, Africa is the least wealthy continent per capita, in part due to geographic impediments, legacies of European colonization in Africa and the Cold War, undemocratic rule and deleterious policies. Despite this low concentration of wealth, recent economic expansion and the large and young population make Africa an important economic market in the broader global context.



Although it has abundant natural resources, Africa remains the world's poorest and least-developed continent, the result of a variety of causes that may include corrupt governments that have often committed serious human rights violations, failed central planning, high levels of illiteracy, lack of access to foreign capital, and frequent tribal and military conflict (ranging from guerrilla warfare to genocide). Its total nominal GDP remains behind that of the United States, China, Japan, Germany, the United Kingdom, India, and France. According to the United Nations' Human Development Report in 2003, the bottom 24 ranked nations (151st to 175th) were all African.



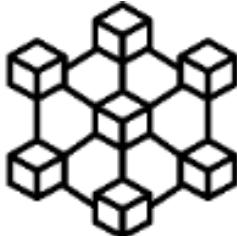
Bitcoin, the first cryptocurrency presented in 2008, along with other cryptocurrencies created in the last decade, has been proved to solve the century banking system democracy. Allowing users to be its own bank, secured by a decentralized and shared network much more secure than the traditional centralized data storage systems.

Sion Coin will give access to all Africans to free digital, private, and secure banking services, financial investment, be more competitive worldwide, delete cross-border limitations and delete international transfers costs with the traditional services, like Western Union. Making its people 'richer' and more free and allowing Governments to keep track of citizens anonymous data to create smart models to make smarter decisions.

1.2. The technology behind the crypto currency

The first peer-to-peer transaction in a decentralized system was made right after the Great Financial Crash of 2008. Caused by the bank default of the "too big to fail", Lehman Brothers. Since then, crypto currency market has evolved to a market capitalization overcome the trillion US Dollars in 2020.

Bitcoin was deployed in 2009 under the Massachusetts Institute of Technology (MIT) license, which allowed worldwide developers to create new public and private projects based on the Bitcoin technology. It was not until 2013 that the second blockchain was deployed under the name of Ethereum, which introduced the concept of the Smart Contracts.



Blockchain is going to be used for more than just currency and transactions. To give you an idea of how seriously it has been studied and adopted, IBM has 1,000 employees working on blockchain-powered projects. They have also set aside \$200 million for development. Financial and tech firms invested an estimate \$1.4 billion dollars in blockchain in 2016 with an increase to \$2.1 billion dollars in 2018. [3]

2008



Wallets, a digital wallet (or e-wallet) is a software-based system that securely stores users' payment information and passwords for numerous payment methods and websites. By using a digital wallet, users can complete purchases easily and quickly with near-field communications technology. They can also create stronger passwords without worrying about whether they will be able to remember them later. [2]

2008



Bitcoin uses peer-to-peer technology (blockchain) to operate with no central authority or banks; managing transactions and the issuing of bitcoins is carried out collectively by the network. Bitcoin is open source; its design is public; nobody owns or controls Bitcoin and everyone can take part. Through many of its unique properties, Bitcoin allows exciting uses that could not be covered by any previous payment system. [3]

2008



Smart Contracts is a computer program or a transaction protocol which is intended to automatically execute, control or document legally relevant events and actions according to the terms of a contract or an agreement. The objectives of smart contracts are the reduction of need in trusted intermediaries, arbitrations and enforcement costs, fraud losses, as well as the reduction of malicious and accidental exceptions. [4]

2015



Ethereum is the community-run technology powering the cryptocurrency, ether (ETH) and thousands of decentralized applications. Ethereum is a technology that is home to digital money, global payments, and applications. The community has built a booming digital economy, bold new ways for creators to earn online, and so much more. It is open to everyone, wherever you are in the world – all you need is the internet.

2015



EOSIO is a blockchain protocol based on the cryptocurrency EOS. The smart contract platform claims to eliminate transaction fees and conduct millions of transactions per second. Calling itself the most powerful infrastructure for decentralized applications, EOS is a blockchain-based, decentralized system that enables the development, hosting, and execution of commercial scale decentralized applications (Dapps) on its platform. ^[6]

2018



Sion Coin is the official digital currency - or cryptocurrency - from Africa. It allows users to safe, transfer and receive payments in few seconds. Sion system it is based in EOSIO blockchain and provides a secure environment for a decentralized, scalable, and robust economic system. Thanks to Smart Contracts individuals, collectives, businesses, and enterprises will be able to automate agreements and contracts, transactions, secure peer-to-peer borrowing, peer-to-peer credit interests.

2021

Sion Coin will help Africa to develop a competitive international commerce, substituting Standby Letter of Credit (or SBLC) in foreign trading. SION ecosystem will provide Africans decentralized financial services for everybody and will provide to international investors a secure and trustable bridge to Africa reconstruction and sustainable development.

1.3. Transaction protocols overview

There are various ways to reach consensus among a group of distributed parties in a decentralized system. Most consensus models reach agreement through some proof. Two of the most popular ones are Proof of Work (PoW) and Proof of Stake (PoS), although other types of proof-based schemes exist, such as Proof of Activity (a hybrid between PoW and PoS), Proof of Burn, Proof of Capacity, Proof of Elapsed Time, etc. Other consensus schemes also exist, such as Paxos and Raft.

1.3.1. Proof of Work (PoW)

In Proof of Work, miner nodes compete to find a nonce added to the header of a block which causes the block to have some desired property (typically a certain number of zeros in the most significant bits of the cryptographic hash of the block header). By making it computationally expensive to find such nonces that make the blocks valid, it becomes difficult for attackers to create an alternative fork of the blockchain that would be accepted by the rest of the network as the best chain. The main disadvantage of Proof of Work is that the security of the network depends on spending a lot of resources on computing power to find the nonces.

1.4. Proof of Stake (PoS)

In Proof-of-Stake, nodes that own the largest stake or percentage of some assets have equivalent decision power. In other words, voting power is proportional to the stake held. One interesting variant is Delegated Proof-of-Stake (DPoS) in which many participants or stakeholders elect a smaller number of delegates, which in turn make decisions for them.

1.5. EOSIO Consensus (DPoS + aBFT)

EOSIO-based blockchains use delegated proof of stake (DPoS) to elect the active producers who will be authorized to sign valid blocks in the network. However, this is only one half of the EOSIO consensus process. The other half is involved in the actual process of confirming each block until it becomes final (irreversible), which is performed in an asynchronous byzantine fault tolerant (aBFT) way.

Therefore, there are two layers involved in the EOSIO consensus model:

- ❖ Layer 1 - The Native Consensus Model (aBFT).
- ❖ Layer 2 - Delegated Proof of Stake (DPoS).

The actual native consensus model used in EOSIO has no concept of delegations/voting, stake, or even tokens. These are used by the DPoS layer to generate the first schedule of block producers and, if applicable, update the set at most every schedule round after each producer has cycled through. These two layers are functionally separate in the EOSIO software.

1.6. Traditional financial transactions comparison

	Cash (bills, notes)	Credit/Debit Card	SEPA Transfer	International Transfer
Protocol	Physical transportation	SSL, TLS, iKP (IBM), SEPP, STT	SEPA European protocol	SWIFT, BIC
Avg. transaction time	1 - 5 minutes	10 - 60 seconds	10 seconds - 2 days	2 - 4 days
Avg. transaction cost	free (maybe diseases)	\$30-\$600 year	\$10-\$300 per transaction (depending on the amount)	\$50-\$1,000 per transaction (depending on the amount)

1.7. Cryptocurrency financial transactions comparison

	Bitcoin	Ethereum	EOS	Sion Coin
Protocol	Proof of Work (PoW)	Proof of Stake (PoS)		EOSIO consensus
Avg. transaction time	5 - 120 minutes	5 - 25 minutes		1 - 5 seconds
Avg. transaction cost	\$0.05 - \$10 per transaction (depending on the network capacity)	\$0.03 - \$10 per transaction (depending on the network capacity)		free

The current digital payments methods are only available to 60-70% of the population worldwide. In 2021 international bank transfers are still expensive - more if there are intermediary banks involved in the transaction - for developed countries.

However, it is still more expensive for immigrants that work outside their country and must send money back to their families in their mother land, services like Western Union, Rewire, World Remit, Money Gram, etc. charge extraordinary expensive fees for their wires. On the other hand, cryptocurrencies have reduced the funds transfer fee extremely, to the point that blockchains like EOSIO, offer a fast transfer protocol with zero fees. We believe that a healthy economy, is one with no financial intermediaries. That is why Sion Coin transfers will be 100% free as well.

In the following table we compare the current digital transaction systems costs:

						
YOU PAY \$0	YOU PAY < \$0.01	YOU PAY \$0.13	YOU PAY \$0.12	YOU PAY \$0.43	YOU PAY \$0.43	YOU PAY \$4.02

1.8. The need to unify and decentralize African economy

Unify and decentralize are two words that can mean opposite actions, however, in our universe unifying African Central Banks and Governments for a common understanding and incrementing Africa's trading between its 54 independent countries with a common (unified) currency. The key strategy is that thanks to decentralize accounting systems the control of the finances belongs to its own community network. There is no central entity controlling the deposits and thanks to cryptography we can secure deposits by blockchain technology.

Creating an official African blockchain economy with multiple currencies and assets integrations will empower African economy in the short and long run. To commit with our mission, we will need the support of all (or most) African Central Banks and its respective governments. On the other hand, this project is financed by Central Africa, so already we count inside our starting team with African public and private support,

1.9. The European colonization in Africa in the 19th century

The colonization of Africa was part of a global European process reaching all the continents of the world. European colonization and domination changed the world dramatically. Historians argue that the rushed imperial conquest of the African continent by the European powers started with King Leopold II of Belgium when he involved European powers to gain recognition in Belgium.



The Scramble for Africa took place during the New Imperialism between 1881 and 1914. The focus of this lesson will be on the causes and results of European colonization of the African continent, with special focus on the Ashanti kingdom (colonized by the British as the Gold Coast, and today the independent African country of Ghana).

1.9.1. Africa before European colonization

Due to worldwide insufficiency of world knowledge, the size, and abilities of Africa as a continent was majorly undermined and oversimplified. Before colonization, Africa was characterized by widespread flexibility in terms of movement, governance, and daily lifestyles. The continent consisted not of closed reproducing entities, equipped with unique unchanging cultures, but of more fluid units that would readily incorporate outsiders into the community with the condition that they accepted its customs, and where the sense of obligation and solidarity went beyond that of the nuclear family. Pre-colonial societies were highly varied, where they were either stateless, run by the state or run by kingdoms. The notion of communalism was accepted and practiced widely; land was held commonly and could not be bought or sold, although other things, such as cattle, were owned individually. In those societies that were not stateless, the chiefs ran the daily affairs of the tribe together with one or more councils. The colonization of Africa through Europe brought about many forms of government that are still visible today.

Before colonization, however, there were many forms of government in Africa, ranging from powerful empires to decentralized groups of pastoralists and hunters. The use of iron tools marks a significant turning point in African civilization. Iron tools enhanced weaponry, allowed groups to manage and clear dense and thick forests, plough fields for farming, and making everyday life more convenient.

Because the iron tools allowed Africans to flourish in their natural environment, they could live in larger communities which led to the formation of kingdoms and states. With this creation came the formation of modern civilizations, common languages, belief and value systems, art, religion, lifestyle, and culture. Another unique characteristic of pre-European Africa was the favoring of oral tradition within these societies. Stories were told and handed down generations in verbal form. This poses a threat to the survival of these stories because certain aspects could be forgotten or told in a different way. National borders were also not much of a concern before colonization. European countries fought over African countries mainly for their natural resources. Lines were drawn through African communities which had existed for many years, and these lines can presently be seen as national borders. "A brief history of European Colonization in Africa".

1.9.2. Berlin Conference 1884

The Conference of Berlin and British 'New' Imperialism, also known as the "Congo conference" began. In 1884 at the request of Portugal, German Chancellor Otto von Bismarck called together the major western powers of the world to negotiate questions and end confusion over the control of Africa. The countries represented at the time included Austria-Hungary, Belgium, Denmark, France, Germany, Great Britain, Italy, the Netherlands, Portugal, Russia, Spain, Sweden-Norway (unified from 1814-1905), Turkey, and the United States of America. Of these fourteen nations, France, Germany, Great Britain, and Portugal were the major players in the conference, controlling most of colonial Africa at the time. Britain, France, Germany, Belgium, Italy, Portugal, and Spain were competing for power within European power politics. One way to demonstrate national pre-eminence was through the acquisition of territories around the world, including Africa.



Another reason for European interest in Africa is the industrialization when major social problems grew in Europe: unemployment, poverty, homelessness, social displacement from rural areas, etc. These social problems developed partly because not all people could be absorbed by the new capitalist industries. Europe saw the colonization of Africa as an opportunity to acquire a surplus population, thus settler colonies were created. With this invasion, many European countries saw Africa as being available to their disposal. However, several disputes took place regarding which European country would colonize a specific African country. Thus, in 1884, Portugal proposed a conference in which 14 European countries would meet in Berlin regarding the division of Africa, without the presence of Africa.



The initial task of the conference was to agree that the Congo River and Niger River mouths and basins would be considered neutral and open to trade. Despite its neutrality, part of the Kongo Basin became a personal Kingdom (private property) for Belgium's King Leopold II and under his rule, over half of the region's population died. At the time of the conference, only the coastal areas of Africa were colonized by the European powers.

At the Berlin Conference the European colonial powers scrambled to gain control over the Interior of the Continent. The conference lasted until February 26, 1885 – a three month period where colonial powers haggled over geometric boundaries in the interior of the continent, disregarding the cultural and linguistic boundaries already established by the Native Indigenous African population. What ultimately resulted was a hodgepodge of geometric boundaries that divided Africa into fifty irregular countries.

1.9.3. Causes of colonization

The reasons for African colonization were mainly economic, political, and religious. During this time of colonization, an economic depression was occurring in Europe, and powerful countries such as Germany, France, and Great Britain, were losing money. Africa seemed to be out of harm's way and had an abundance of raw materials from which Europe could make money from. Due to cheap labor of Africans, Europeans easily acquired products like oil, ivory, rubber, palm oil, wood, cotton, and gum. These products became of greater significance due to the emergence of the Industrial Revolution. Africa's colonization was also because of European rivalries, where Britain and France had been in a dispute since the Hundred Year's War.



These countries became involved in a race to acquire more territory on the African continent, but this race was open to all European countries. Britain had had some success in halting the slave trade around the shores of Africa. But inland the story was different -- Muslim traders from north of the Sahara and on the East Coast still traded inland, and many local chiefs were reluctant to give up the use of slaves.

During the nineteenth century barely, a year went by without a European expedition into Africa. The boom in exploration was triggered to a great extent by the creation of the African Association by wealthy Englishmen in 1788, and as they travelled, they started to record details of markets, goods, and resources for the wealthy philanthropists who financed their trips. With the beginning of colonization in Africa, morality became an increasing issue. The Europeans could not comprehend the existence of the Muslim Swahili trade which made them want to implement the Three C's: Christianity, Commerce, and Civilization. First, Europe experienced a Christian revival in the 19th century.

Missionaries began to focus on the large working class with the goal of bringing spiritual salvation to the workers and their families. The bible was made available to workers. Due to their large successes, missionaries began to look beyond Europe. Missions were established all over Africa. Missionaries did not serve as direct agents of European imperialism, yet they drew European governments deeper into Africa.

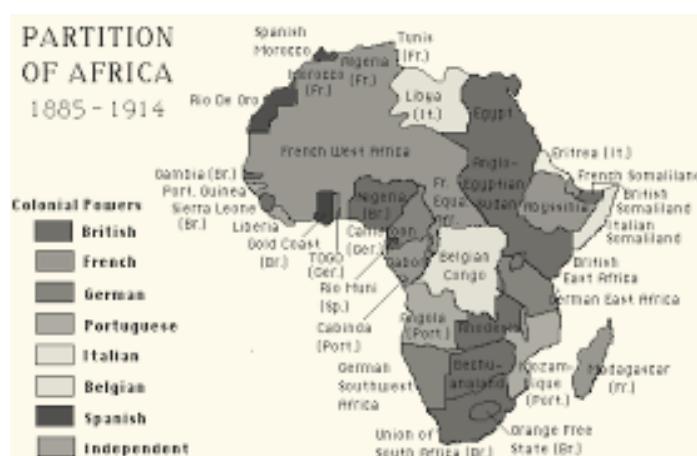
In their efforts to preach Christianity, to bring western-style education to Africa and to ingrain monogamy in African societies, missionaries often felt threatened by warfare within Africa. Hence, missionaries called on European governments for protection and intervention. Second, for centuries, European explorers have travelled throughout the African continent in their attempts to discover new things and to chart the African continent.

Trade would be well instantiated; the work of the Suez Canal Company at the north-eastern tip of Africa had been completed in 1869. Lastly, Livingstone believed that civilization could be achieved through good government and education. The combination of these three elements, Livingstone believed, would end human suffering in Africa, and the ultimate level of civilization would be achieved within the continent. Christianity would therefore provide the moral principles that would guide Africans, while education and commerce would encourage Africans to produce their own goods to trade with Europeans. For this to work a functioning and legitimate governing system was needed to ensure the civil rights of the people.

1.9.4. Which countries colonized which parts of Africa

By 1900 a significant part of Africa had been colonized by mainly seven European powers—Britain, France, Germany, Belgium, Spain, Portugal, and Italy. After the conquest of African decentralized and centralized states, the European powers set about establishing colonial state systems. The colonial state was the machinery of administrative domination established to facilitate effective control and exploitation of the colonized societies.

Colonial states were authoritarian, bureaucratic systems, partly due to their origins in military conquest and the racist ideology of the imperialist enterprise. The French directed their attention to the active economies of the Niger Delta, the Lagos Hinterland, and the Gold Coast.



1.9.5. Why European countries were able to colonize Africa

The European countries were able to colonize African countries rapidly because there were rivalries between African leaders. These kings and chiefs were competing to be the richest and most powerful within their tribes.

During these rivalries, European leaders would take advantage of the situation and persuaded some leaders to be on their side to fight against other leaders. Natural disasters also played a big role in the rapid and easy colonization of Africa. In 1895, a serious drought reached many regions in Africa which was caused by a sudden decline in rainfall. Hardly any crops were produced, and the food shortage which followed caused the death of many people and animals.



The little crops that were produced were destroyed by a plague of locusts. In addition to this plague, the cattle plague broke out during the 1890's which killed cattle, sheep and goats. This led to even more deaths of animals and people, and due to their physical and mental weakness, they were unable to fight against European powers.



European powers could easily take control of any source of land by using force and violence. They accomplished this by using more powerful weapons, and had the advantage of the newly invented machine gun called the Maxim gun which was invented in the 1880's. This gun could fire eleven bullets per second and outdid the weapons that the African forces had. African armies did not manage to get hold of European weapons because it was not sold to them. Thus, Africans were at a military disadvantage. An outbreak of new diseases made an appearance during the late 1890's and the first one was a range of smallpox epidemics.

The Europeans, who were already in Africa, had developed immunity to these diseases due to past experiences of these outbreaks in Europe. The indigenous African population had no immunity or resistance to these diseases and thus weakened the African population. Many the African population thus died out or became too weak to fight back.

1.9.6. Results of the colonization

The impact that colonization had on Africa can be described as both good and bad. In terms of European political practice in Africa, all colonizing countries share similar attributes. Colonial political systems were un-democratic; Law and Order, as well as Peace, was a primary objective of colonial governments; Colonial governments lacked capacity and colonial governments practiced "divide and rule." Firstly, colonial governments did not allow popular participation, and all political decisions were made by the small political elite with no or little input from the African population. Secondly, the African population was not satisfied with the way that Europeans imposed on their governing system without any proper representation, thus the maintenance of peace under the African population was made an important priority for the colonial government. Thirdly, seeing as most colonial governments were not rich, they did not fund the governing of their colonies fully. Although they were responsible for raising the money for their own colonies, they still lacked the income to properly develop and maintain a successful governing system.



This meant that colonial governments were not able to provide basic infrastructure, such as roads and communication networks, nor were they able to provide basic social services such as education, health care, and housing. Lastly, the principle of "divide and rule" meant that policies that intentionally weakened indigenous power networks and institutions were implemented.

Due to the lack of revenue within the colonies, little attention was given to promoting social change or development. Although all the colonies did not experience the same extent of social change, these colonies share the same characteristics in terms of social change. Firstly, colonial and political practices caused a large scale movement of people. In some areas, migrations were primarily from one rural area to another. In other places, the migration was from rural areas to urban areas. These movements resulted in dislocation of peoples that impacted society and culture. Social and cultural beliefs and practices were challenged by these migrations. Long-held practices had to be adapted, and at times were completely abandoned, to fit the new colonial circumstances.



Secondly, and partly due to the first consequence, the dislocation of families also occurred. Men mainly left the household to work in mines and on plantations, leaving their wives and children behind. As a result, women and adolescents were forced to take on new roles and to cope in absence of their husbands and fathers. Due to colonialism, the African family structure had been severely changed.

Prior to colonialism, the extended family structure (family that extends beyond the immediate family) was the norm in most African societies, but by the end of colonial era, the nuclear family (family consisting of a pair of adults/ parents and their children) was becoming the norm in many African countries. Thirdly, urbanization emerged as colonization was imposed.

During colonialism, urbanization occurred fairly and rapidly in many African colonies. Several pre-colonial African societies had towns and small cities. However, even in these societies, most people were engaged in agriculture in rural villages or homesteads. Urban living resulted in changes in economic activities and occupation, and in changes in the way people lived. These changes often challenged existing values, beliefs, and social practices. Fourthly, the religious beliefs of Africans were adapted or changed. A small percentage of the African population regarded themselves as Christians, and today more than half of the African population is Christians. Colonial rule provided an environment in which Christianity, in many forms, spread in many parts of Africa. While Islam was widespread in Africa prior to the coming of colonialism, it also benefited from colonialism. British and French colonial officials actively discouraged Christian mission work in Muslim areas.

Lastly, the public education system of African was also changed. Most colonial governments did little to support schools. Most formal schooling African colonies were a result of the work of missionaries. Missionaries felt that education and schools were essential to their mission. Their primary concern was the conversion of people to Christianity. Missionaries believed that the ability of African peoples to read the Bible in their own language was important to the conversion process. However, most mission societies were not wealthy, and they could not support the number of schools that they really wanted. Consequently, with limited government support, most African children did not go to school during the colonial era. In fact, at the end of colonial rule, no colony could state that more than half of their children finished elementary school, and far fewer attended secondary school.

1.10. A little walk into the US Dollar economy history

The modern American economy traces its roots to the quest of European settlers for economic gain in the 16th, 17th, and 18th centuries. The New World then progressed from a marginally successful colonial economy to a small, independent farming economy and, eventually, to an overly complex industrial economy. During this evolution, the United States developed ever more complex institutions to match its growth. And while government involvement in the economy has been a consistent theme, the extent of that involvement generally has increased. North America's first inhabitants were Native Americans -- indigenous peoples who are believed to have traveled to America about



20,000 years earlier across a land bridge from Asia, where the Bering Strait is today. (They were mistakenly called "Indians" by European explorers, who thought they had reached India when first landing in the Americas.) These native peoples were organized in tribes and, in some cases, confederations of tribes. While they traded among themselves, they had little contact with peoples on other continents, even with other native peoples in South America before European settlers began arriving.

Every economic system they developed was destroyed by the Europeans who settled their lands. Vikings were the first Europeans to "discover" America. But the event, which occurred around the year 1000, went largely unnoticed; at the time, most of European society was still firmly based on agriculture and land ownership. Commerce had not yet assumed the importance that would provide an impetus to the further exploration and settlement of North America.

In 1492, Christopher Columbus, an Italian sailing under the Spanish flag, set out to find a southwest passage to Asia and discovered a "New World." For the next 100 years, English, Spanish, Portuguese, Dutch, and French explorers sailed from Europe for the New World, looking for gold, riches, honor, and glory. But the North American wilderness offered early explorers' little glory and less gold, so most did not stay. The people who eventually did settle North America arrived later. In 1607, a band of Englishmen built the first permanent settlement in what was to become the United States. The settlement, Jamestown, was in the present-day state of Virginia.



The history of the United States dollar begins in 1775, when the Second Continental Congress of the newly-formed United States authorized the issuance of Continental Currency or "Continentals". Continentals were denominated in dollars, a term which had already been in common usage since the Spanish dollar, the first world currency during the late 18th century.

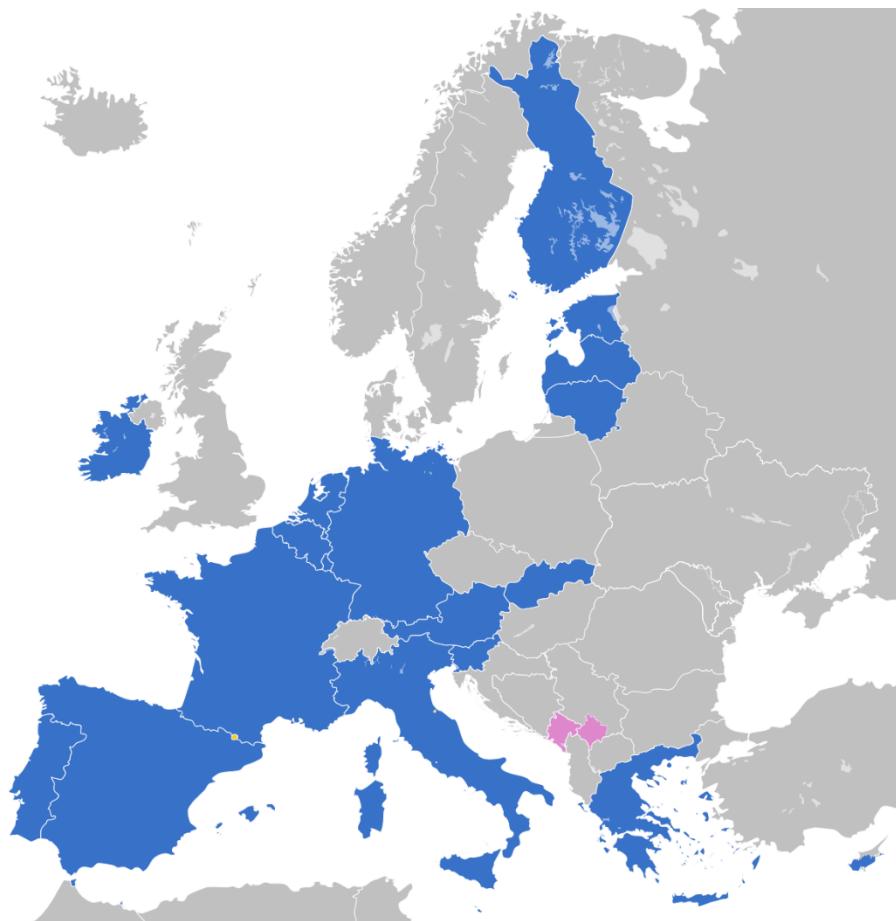
Due to depreciation, by May 1781 Continentals had become essentially worthless. They became exchangeable at 1% of face value for treasury bonds in the 1790s, after the ratification of the United States Constitution in 1789. In 1792, the new Congress's Coinage Act of 1792 established the United States dollar as the country's standard unit of money, creating the United States Mint tasked with producing and circulating coinage.

United States Dollar (USD) has become the global currency index in the global foreign exchange market and in multiple commodity markets. US Equity market has been extra performing in the last decade thanks to digitalization, the internet era and many technological firms that have become the owner of the world's information, converting data in the new oil fever.

1.11. Analysis of the Euro adoption in the European economy

On January 1, 1999, the European Union introduced its new currency, the euro. The euro was created to promote growth, stability, and economic integration in Europe. Originally, the euro was an overarching currency used for exchange between countries within the union. People within each nation continued to use their own currencies. Within three years, however, the euro was established as an everyday currency and replaced the domestic currencies of many member states. The euro is still not universally adopted by all the EU members as the main currency. However, many of the holdouts peg their currencies to it in some way.

Given the enormous influence of the euro currency on the global economy, it is useful to look closely at its advantages and disadvantages. The euro, which is controlled by the European Central Bank (ECB), was launched with great fanfare and anticipation. However, the euro's considerable flaws became more apparent when it was tested by a series of challenges early in the 21st century.





1.11.1. Pros of the Euro creation

a) Promoting Trade

The main benefits of the euro are related to increased trade. Travel was made easier by removing the need for exchanging money. More importantly, the currency risks were eliminated from European trade. With the euro, European businesses can easily lock in the best prices from suppliers in other eurozone countries. That makes prices transparent and increases the competition between firms in countries using the euro. Labor and goods can flow more easily across borders to where they are needed, making the whole union work more efficiently.

b) Encouraging Investment

The euro also supports cross-border investments within the eurozone. Investors in countries using foreign currencies face significant foreign exchange risk, which can lead to an inefficient allocation of capital. Although stocks also have exchange rate risks, the impact on bonds is far greater because of their lower volatility. The prices of most debt instruments are so stable that exchange rates influence returns far more than interest rates or credit quality. As a result, foreign currency bonds have a poor risk-return profile for most investors. Before the euro, successful companies in countries with weak currencies still had to pay high interest rates.

On the other hand, less efficient firms in nations with stable currencies enjoyed relatively low interest rates. The primary risk in lending across borders was the currency risk, instead of default risk. With the euro, investors in low interest rate countries, such as Germany and the Netherlands, were able to lend money to firms in other eurozone countries without currency risk.

c) Mutual Support

In theory, the euro should help countries that adopt it to support each other during a crisis. The currencies of countries with larger economies tend to be more stable because they can spread risk more effectively. For example, even a prosperous small Caribbean country can be devastated by a hurricane. On the other hand, the U.S. state of Florida can turn to the rest of the United States to help rebuild after a hurricane. As a result, the U.S. dollar is one of the most stable currencies in the world.

The coronavirus crisis tested mutual support within the eurozone in 2020. Initially, there was not enough collective action. Even worse, many nations closed their borders to each other. However, the European Central Bank consistently bought up enough debt in afflicted countries, especially Italy, to keep interest rates relatively low. More importantly, France and Germany supported a recovery fund worth over 500 billion euros.



1.11.2. Cons of the Euro creation

a) Rigid Monetary Policy

By far, the largest drawback of the euro is a single monetary policy that often does not fit local economic conditions. It is common for parts of the EU to be prospering, with high growth and low unemployment. In contrast, others suffer from prolonged economic downturns and high unemployment.

The classic Keynesian solutions for these problems are entirely different. The high growth country ought to have high interest rates to prevent inflation, overheating, and an eventual economic crash. The low growth country should lower interest rates to stimulate borrowing. In theory, countries with high unemployment do not need to worry much about inflation because of the availability of the unemployed to produce more goods. Unfortunately, interest rates cannot be simultaneously raised in the high growth country and lowered in the low growth country when they have a single currency like the euro.

In fact, the euro caused precisely the opposite of standard economic policy to be implemented during the European sovereign debt crisis. As growth slowed and unemployment increased in countries like Italy and Greece, investors feared for their solvency, driving up interest rates. Typically, there would be no solvency fears for governments under a fiat money regime because the national government could order the central bank to print more money.

However, the European Central Bank's independence meant printing money was not an option for eurozone governments. Higher interest rates increased unemployment and even caused deflation and negative economic growth in some countries. It would be fair to say that the euro contributed to an economic depression in Greece.

b) Possible Bias in Favor of Germany

The first stage of the euro was the European exchange rate mechanism (ERM), under which prospective future members of the eurozone fixed their exchange rates to the German mark. Germany has the largest economy in the eurozone and had a history of sound monetary policy since World War II. However, pegging exchange rates to the German mark may have created a bias in favor of Germany.

The idea that the euro favors Germany is politically controversial, but there is some support for it. In the 1990s, Germany pursued a looser monetary policy to deal with the burdens of reunification. As a result, the strong U.K. economy of that era experienced excessive inflation. The U.K. was first forced to raise interest rates and eventually pushed out of the ERM on Black Wednesday in 1992.

The German economy was relatively prosperous by 2012, and European monetary policy was far too tight for weaker economies. Portugal, Italy, Ireland, Greece, and Spain all faced high debt, high interest rates, and high unemployment. This time, monetary policy was too tight rather than too loose. The only constant was that the euro continued to work in favor of Germany.



CHAPTER II

African economy

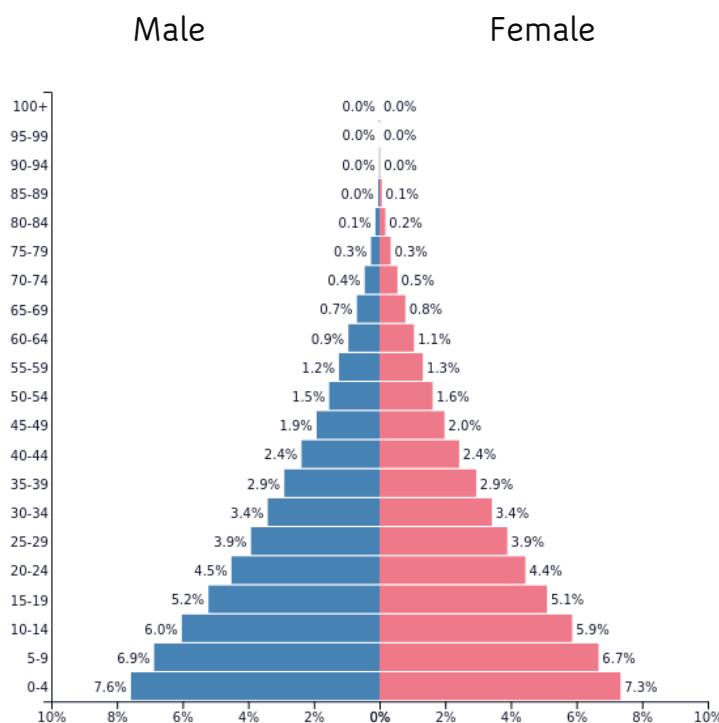
“Everyone is related to Africa; everyone comes from Africa. We are all distant relatives.”

- Damian Marley

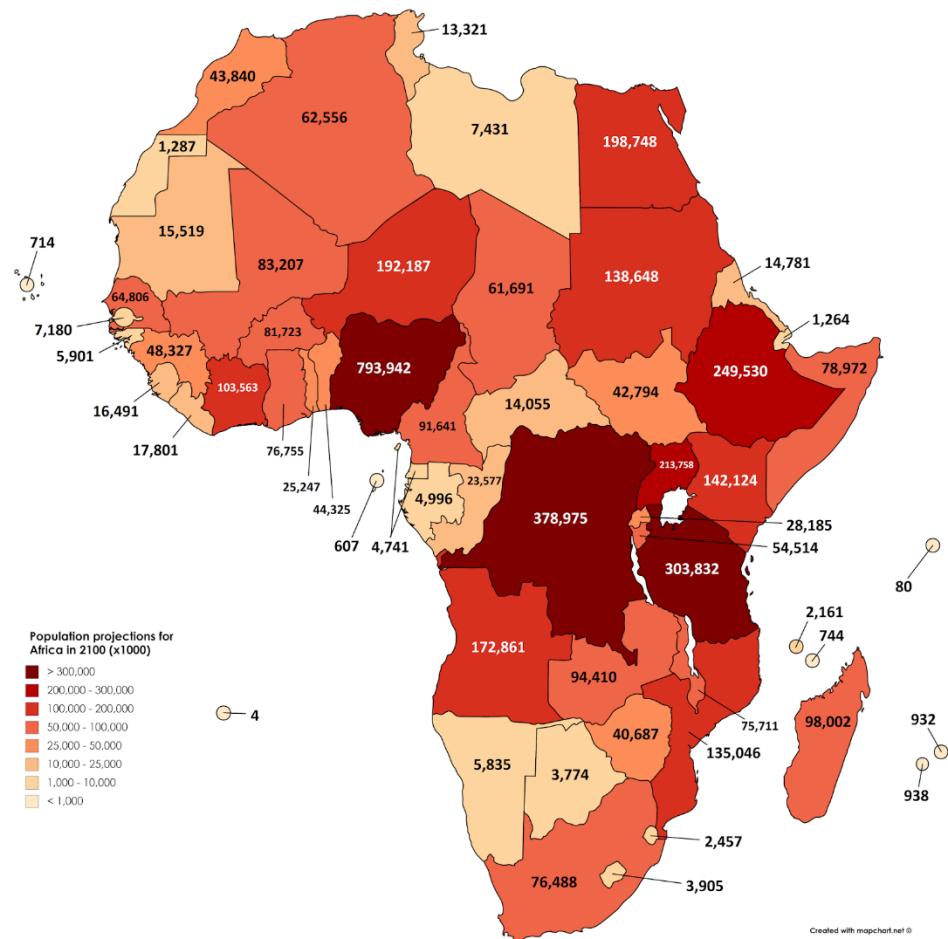
2. African economy

2.1. A quick view of the recent African economy

The historic cause of Africa's economic problems are European colonizers exploited Africa's resources and people through trade and slavery. While millions of Africans have died in Africa from harsh working conditions while working for foreign interests, the land has been mined and drilled with little to no regard for the environment. These and as well as political instability has restrained the economy of Africa to increase. African nations might achieve economic growth by reducing debt, increasing corporation, and building industries. What western leaders are doing to help African economies are they are urging their countries to forgive Africa's debts so that it has more money to build its economies. Economists urge African nations to diversify because since Africa is a one-commodity, it makes the economy unstable. Economists believe that if they diversify their economy, they will achieve economic growth and stability. Education can help Africa's economy grow because people with education have high levels of skills that can help aid the economy. However, African population grows exponentially as age distribution in Africa is composed by a lot of young people and fewer old.



The following geo-chart shows the UN projections of African population by country in 2100:



2.2. The real richness of Africa

Throughout our educational system (high school) and our media, we are taught to believe that Africa is a poverty stricken nation. What we are less informed on however, is how it became that way and what it was before the beginning of slave trade. Not only is Africa the second largest and second most populous continent (1.1 billion people as of 2013), but it also the richest continent of natural resources. According to Wikipedia (Africa), Africa has a large quantity of natural resources including diamonds, salt, gold, iron, cobalt, uranium, copper, bauxite, silver, petroleum and cocoa beans, but also woods and tropical fruits. Much of its natural resources are undiscovered or barely harnessed. How did Africa become this way? The answer is now known today. Due to exploitation by other countries and nations, Africa is left without the necessary means of reaching their natural resources and selling/using them to create wealth. Nonetheless, most people do not know this information. In our schools, we are not being taught that Africa was a wealthy and powerful nation both monetarily and culturally. I find myself wondering, why? Why didn't I learn more about Mansa Musa? Why is it not being taught in our public schools that the first human came from Africa?

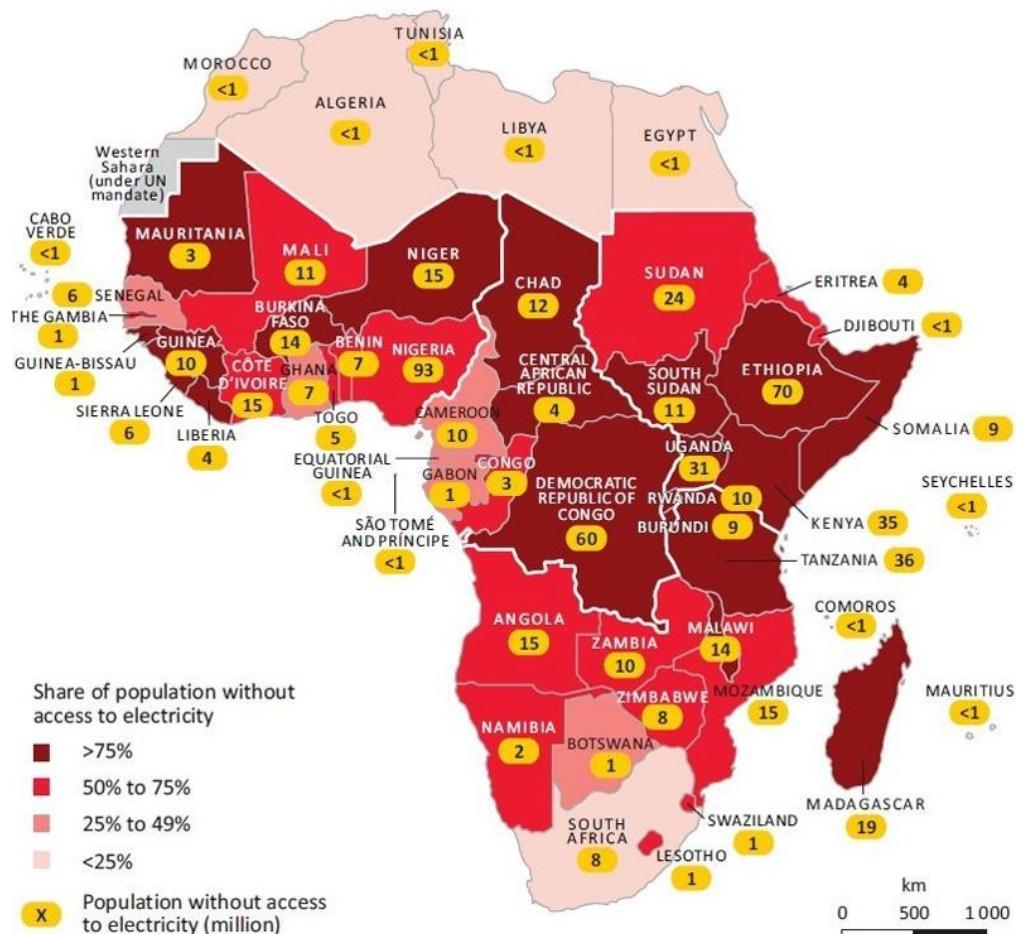
We learn about the Civil Rights movement and emergent leaders such as Martin Luther King Jr. and Malcom X, but why do not we learn about notable people who were born in Africa themselves. For example, Hannibal Barca of Carthage who is considered to be one of the greatest military strategists of all time. According to Wikipedia, he was born in 247 B.C. Hannibal began serving in the military at the age of 17, soon after his father was killed in battle. He once led an army in a battle known as, "the Battle of Cannae", where he lost 6,000 troops to Rome's 70,000 (according to atlantablackstar.com).

Another question I often find myself thinking is, why doesn't our education system want the legacy of Africans and the beauty of their culture to be taught in depth? It is normal to say that it could be coincidence, but it is remarkable to me that I went through middle school and high school with no knowledge about the greatness/prosperity along with the brutality/exploitation Africa has faced throughout the course of time. It seems to me that we are not being taught these types of things for a reason, and knowing America and its history towards Africans, the reason is not a good one.



2.3. Electricity adoption in Africa

The International Energy Agency is out with an in-depth analysis of Africa's energy sector. One key theme? There are 620 million people in sub-Saharan Africa who do not have any electricity at all – and fixing that could require burning a lot more fossil fuel.

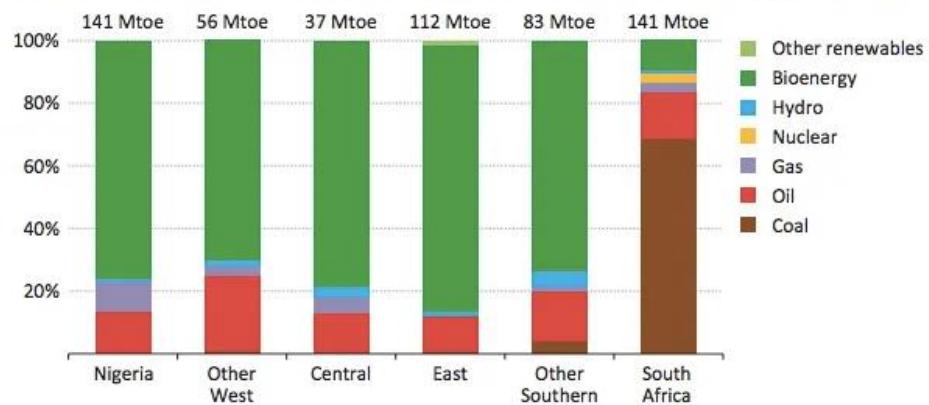


These numbers are from 2012, and the 620 million in Africa made up about half of the 1.2 billion people worldwide who did not have electricity in their homes that year. Here are 9 key points from the IEA report:

- 1) In some ways, the picture has improved over time. Back in 2000, just 23 percent of sub-Saharan Africa had electricity. In 2012, it was about 32 percent. But the population is growing so rapidly that the total number of people without power has increased.
- 2) About 80 percent of those without electricity live in rural areas, away from the grid. So, at first glance, it might seem like this problem will take care of itself as more people move to cities. But the IEA notes that, unlike other parts of the world, Africa is actually expected to see its rural population grow in the coming years.

- 3) Even those who do get electricity do not get a lot of it. Ghana, for instance, had to ration its electricity just to make sure people could watch the World Cup. And the average consumption in sub-Saharan Africa is about 317 kWh per year – or less than a modern American refrigerator.
- 4) The most popular energy source, by far, is "bioenergy" – mainly the burning of wood, charcoal, and dung. That, in turn, produces a lot of indoor air pollution, which is currently killing millions of people per year:

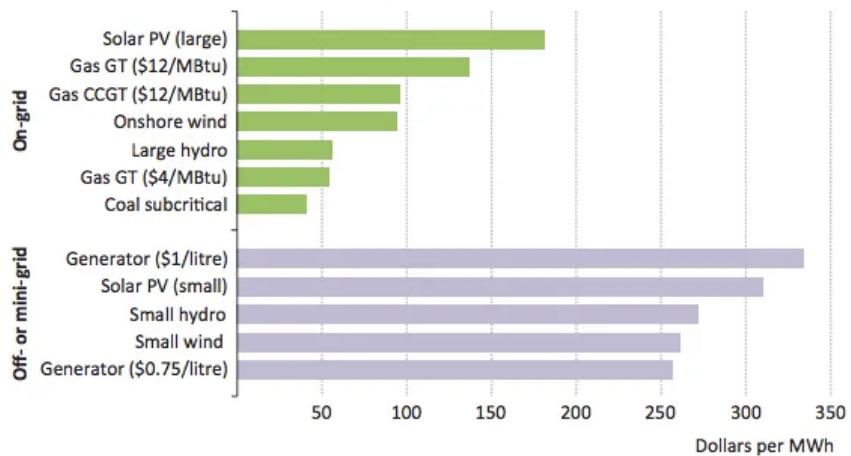
Figure 1.12 ▷ Sub-Saharan Africa primary energy mix by sub-region, 2012



- 5) The IEA thinks that the most promising areas of growth in the future are in natural gas and large-scale hydropower. The report notes that Africa still has a lot of untapped hydropower potential – although note that dams can also be hugely controversial in some parts of Africa, particularly when they displace people.
- 6) Some energy experts have argued that a great way to provide power to rural Africa is through "off-grid" solar panels and wind turbines. The IEA report suggests that there is something to this. On the one hand, off-grid options are still much more expensive than traditional centralized power plants (see chart below). So, for areas that are already connected to the grid or close by, fossil fuels are usually cheaper.

But in places where grid connection is too hard or costly, off-grid solar power and "small wind" are quickly becoming competitive with off-grid diesel generators. That suggests renewables could play a major role in big areas:

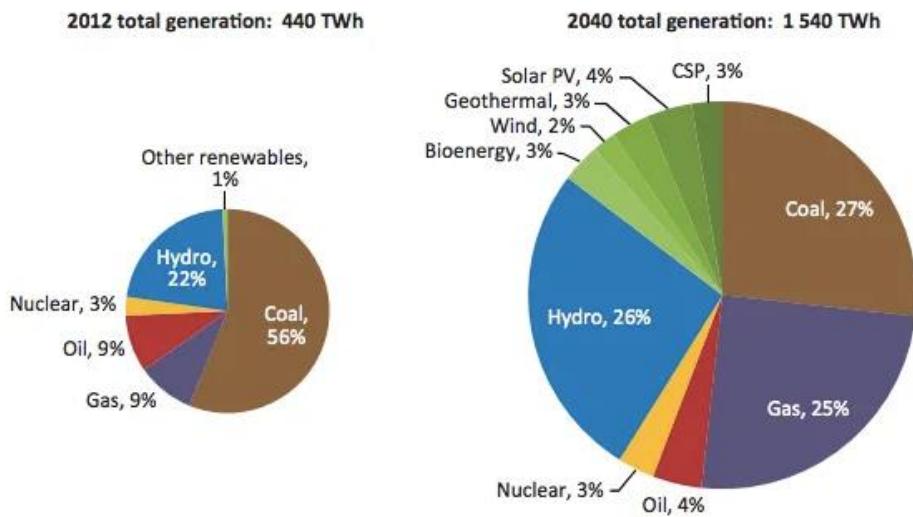
Figure 1.25 ▷ Indicative levelised costs of electricity for on-grid and off-grid technologies in sub-Saharan Africa, 2012



Notes: Costs are indicative and figures for specific projects could vary significantly, depending on their detailed design. GT = gas turbine; CCGT = combined-cycle gas turbine; MBtu = million British thermal units.

- 7) The IEA sketches out a "new policies" scenario that would involve a major push to electrify Africa between 2012 and 2040, based on existing plans by various countries. Most of the growth in electricity generation would come in hydropower and natural gas, although solar power would also grow significantly:

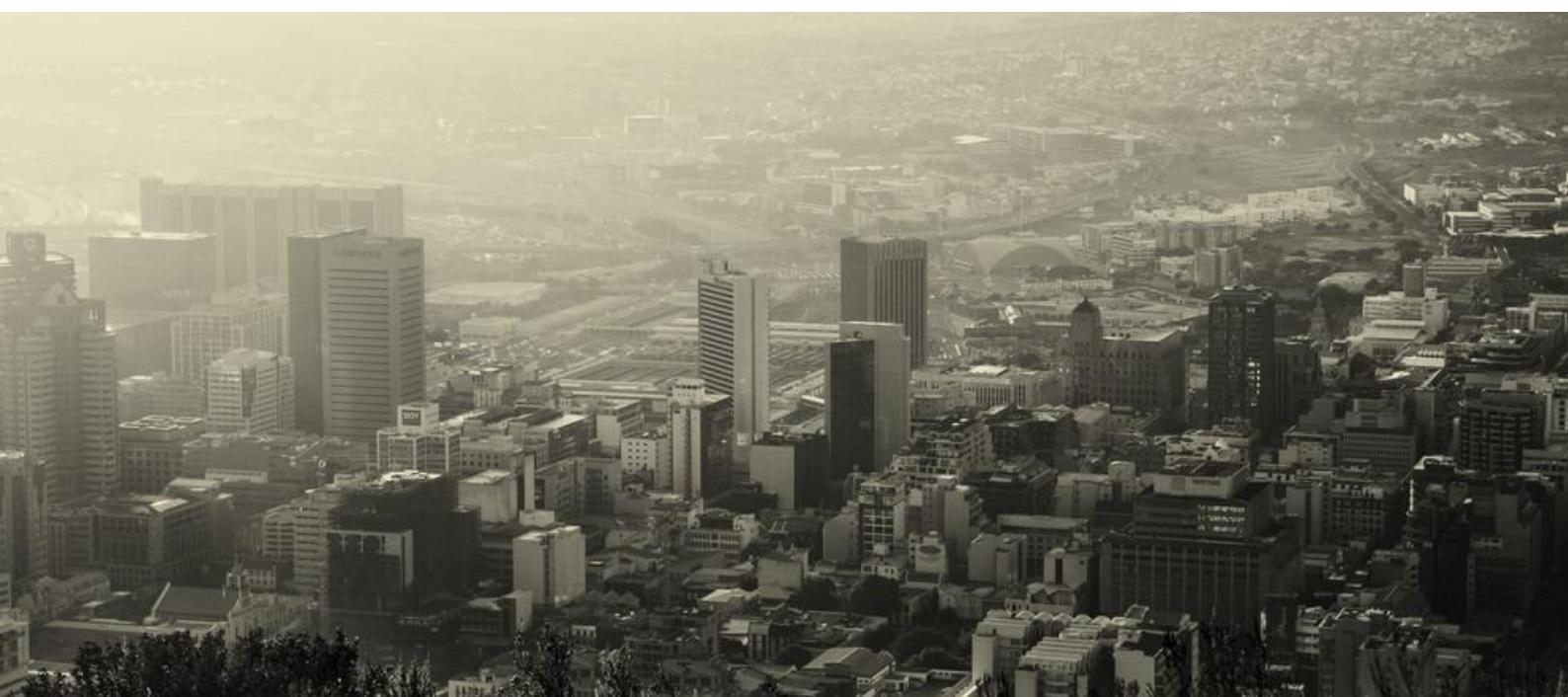
Figure 2.6 ▷ Electricity generation by fuel in sub-Saharan Africa in the New Policies Scenario, 2012 and 2040



- 8) That said, as Alex Trembath of the Breakthrough Institute points out on Twitter, the IEA defines "energy access" as about 50 to 100 kWh per person per year – again, way less than a modern American fridge. So, getting the rest of sub-Saharan Africa up to, say, South African levels of electricity consumption would require a much more radical push.

- 9) The charts above are a good reminder that there's potentially some tension between reducing global greenhouse-gas emissions and expanding energy access in poorer parts of the world.

Africa needs a lot more energy to lift itself out of poverty. And, right now, fossil fuels are still the cheapest way to do that in grid-connected areas; note that coal plants and gas turbines cost just one-third of what solar panels do. (In rural areas far from the grid, it is a closer call, and wind and solar power are becoming competitive.) Until clean energy gets significantly cheaper, fossil fuel use is almost certain to rise in the decades ahead.



2.4. Analysis of the African internet & mobile market

At the end of 2016, there were 420 million unique mobile subscribers in Sub-Saharan Africa, equivalent to a penetration rate of 43%. The region continues to grow faster than any other region; the CAGR of 6.1% over the five years to 2020 is around 50% higher than the global average. The region will have more than half a billion unique mobile subscribers by 2020, by which time around half the population will subscribe to a mobile service.



The total number of SIM connections in the region reached 731 million at the end of 2016 and will rise to nearly 1 billion by 2020. Less than a fifth of under-16 year-olds (who account for more than 40% of the population in most countries in the region) have a mobile subscription, while women were 17% less likely than men to own a mobile phone in 2016. The uptake of mobile services by these underserved groups will, in large part, drive subscriber growth in the future.

Four of the most populated markets in the region – DRC, Ethiopia, Nigeria and Tanzania – will account for nearly half the 115 million new subscribers expected by 2020. The number of mobile broadband connections will reach half a billion by 2020, more than double the number at the end of 2016, and will account for nearly two thirds of total connections in the region. 3G will remain the dominant mobile broadband technology for the foreseeable future, but 4G adoption is rising rapidly following increasing network rollout. As of March 2017, there were 97 live 4G networks in 39 countries across Sub-Saharan Africa. Smartphone connections in Sub-Saharan Africa have doubled over the past two years to nearly 200 million, accounting for a quarter of mobile connections in 2016. Key factors supporting the growth of smartphone adoption in the region include the increasing affordability of new devices and a growing market for second-hand devices.

This trend, along with the uptake of mobile broadband services, is driving demand for digital content and, consequently, an increase in mobile data traffic. Traffic is forecast to grow twelvefold across Africa as a whole over the next five years.

Africa is connected in 2021

3/4

of the population have a SIM connections

747

million phone users

44%

mobile subscriber penetration behind a global average of 66%

444

million internet subscribers

In 2016, mobile technologies and services generated \$110 billion of economic value in Sub-Saharan Africa, equivalent to 7.7% of GDP. Mobile's contribution to GDP is expected to rise to \$142 billion, equivalent to 8.6% of GDP, by 2020 as countries benefit from improvements in productivity and efficiency brought about by increased take-up of mobile services. The mobile ecosystem also supported approximately 3.5 million jobs in Sub-Saharan Africa in 2016. In addition to the mobile sector's impact on the economy and labor market, it makes a substantial contribution to the funding of the public sector,

with \$13 billion raised in 2016 in the form of taxation. Sub-Saharan Africa will transition to higher levels of mobile engagement in the coming years, underpinned by growing access to mobile data services and smart devices as well as a youthful population that almost entirely relies on mobile for digital services, according to the GSMA Intelligence Global Mobile Engagement Index (GMEI).



Consequently, mobile has become the preferred platform for creating, distributing and consuming digital content and services, including those that help address various social challenges in the region. Opportunities in mobile-based innovation are attracting talent and investment to the tech startup ecosystem in Sub-Saharan Africa. Some 77 tech start-ups across the region raised just over \$366.8 million in funding in 2016, growth of 33% compared to the previous year. Mobile operators also play a central role in the tech start-up ecosystem through collaborative ventures with innovators and tech hubs, providing direct investments and access to key network APIs and distribution channels.



2.5. African-European trading & commerce analysis

In a context of increasing attention to EU relations with Africa, on 9 March 2020 the European Commission presented a Joint Communication to the European Parliament and the Council, which contained proposals for defining a new strategy. This communication is another step in on-going discussions to define a new comprehensive EU Strategy with Africa, jointly with African Partners, at the upcoming 6th EU-African Union (AU) Summit.

This Summit is scheduled to be held in Brussels during October 2020, but likely to be postponed because of the coronavirus crisis. The Communication contains initial elements of a future Strategy and proposes building a strategic alliance with Africa based on partnerships in five key global trends: green transition and energy access, digital transformation, sustainable growth and jobs, peace, and governance along with migration and mobility. It proposes ten actions, related to the five partnerships as shown below (Table 1).

Table 1: EC Joint Communication proposals (2020)

Partnerships/key areas	Proposed actions
I. Green transition and energy access	#1 Partner with Africa to maximise the benefits of green transition and minimise environmental threats in full compliance with the Paris Agreement
II. Digital transformation	#2 Partner with Africa to boost the continent's digital transformation
III. Sustainable growth and jobs	<p>#3 Partner with Africa: to bring about substantial increases in environmentally, socially and financially sustainable investments that are resilient to the impacts of climate change; to promote investment opportunities by scaling up the use of innovative financing mechanisms; and to boost regional and continental economic integration, particularly through the African Continental Free Trade Agreement.</p> <p>#4 Partner with Africa to attract investors by supporting African States in adopting policies and regulatory reforms that improve the business environment and investment climate, including a level-playing field for business.</p> <p>#5 Partner with Africa to produce rapid enhancements in learning, knowledge and skills, research and innovation capacities, particularly for women and the youth, protecting and improving social rights and eradicating child labour.</p>
IV. Peace and governance	<p>#6 Partner with Africa to adapt and deepen the EU's support to African peace efforts through a more structured and strategic cooperation, with a particular focus on regions where tensions and vulnerabilities are at their highest</p> <p>#7 Partner with Africa on integrating good governance, democracy, human rights, the rule of law and gender equality in action and cooperation</p> <p>#8 Secure resilience by linking humanitarian, development, peace and security interventions at all stages of the conflicts and crises cycle.</p>

2.5.1. Other general ideas from the proposal

- ❖ The continent is demonstrating economic expansion and a growing potential to boost social and human development.
- ❖ Young people and African women are the main drivers for sustainable growth, development, and peace.
- ❖ Other world players' increasing interest in Africa is welcome, offering more opportunities for synergies and broadening Africa's options.
- ❖ As the EU and Member States are already Africa's main partners in many respects, the partnership must be translated into a strong political alliance.
- ❖ Common action is needed on global multilateral affairs.

Specifically, regarding trade and investments as well as other economic related issues, the main ideas refer to:

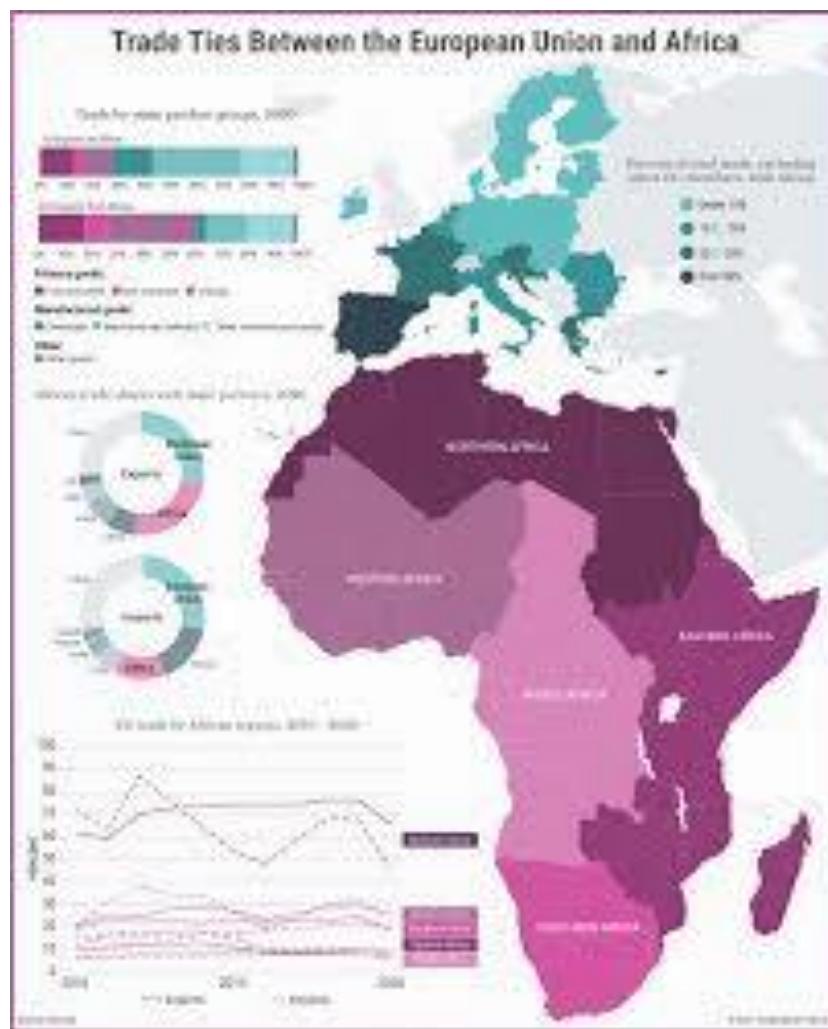
- ❖ A proposal covering joint action to launch a decent job creation scheme (Partnership III) could be enhanced by
 - (i) boosting trade and sustainable investments (public and private),
 - (ii) improving the investment environment,
 - (iii) quality education, skills, innovation (among others) along with
 - (iv) regional and continental economic integration.
- ❖ A proposal to turn the Africa-Europe Alliance for Sustainable Investment and Jobs of 2018 into the main pillar of EU-Africa economic relations.
- ❖ A more coordinated approach by EU financial instrument controllers and European development finance institutions to increase the mobilization of private investors and encourage development of the private sector in Africa.
- ❖ The message that the EU and Africa share a common interest in a stable multilateral trading system ruled by the World Trade Organization (WTO).

Special attention is given in the Communication to digital transformation (the impact of applying new technologies to business on people and firms). Although the development of Africa's digital economy is evolving quite fast, it still faces many constraints. Digital sector jobs require specific education and skills. Also, African countries need to continue progress in access to electricity and broadband connectivity.

In addition, access to capital for African investors and public investment is needed. In specific sectors, as e-commerce, postal services reliability, and many African cities lack of an address system. In brief, proposals in the EC's Joint Communication towards a comprehensive Strategy with Africa place at the top of its agenda the promotion of sustainable investments. Partnering with Africa to attract investors, thereby boosting regional and continental integration are specific actions to attain sustainable growth and jobs in African countries.

This emphasis is not new and is in line with the EU's trend to shift from the Donor recipient model to a relationship based on cooperation in pursuing common interests and mutual benefits. In this sense, development cooperation continues to play a role, but trade and investments have been commonly agreed by both sides to play a more important role in the future.

Although the EU-Africa Strategy has yet to be defined, the current COVID-19 crisis, that will hit hard Europe and Africa, is revealing different needs and will create new priorities for both Africa and the EU. Although there are good grounds for some needed issues, like gender and youth, some old 'topics that were on top of the African agenda, such as tackling illicit finance flows, are missing. In the post-COVID-19 scenario, new priorities will arise, not only related to health infrastructure, but also the need for transformation of the continent by building regional value chains, economic diversification, and industrialization. Special attention will be also needed in the services sector, which paradoxically receives the least capital but creates the most jobs, and other sources of job creation.



2.5.2. Economic ties between Europe and Africa

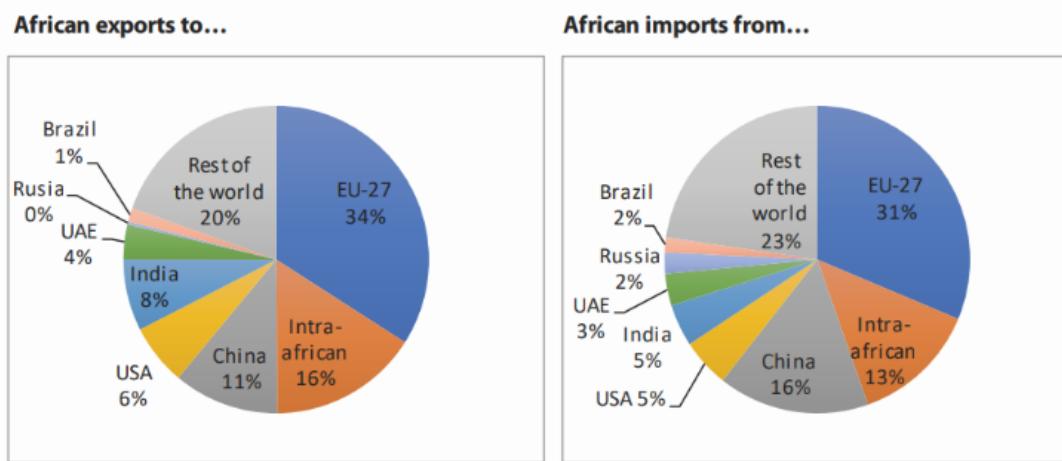
The EU is still Africa's biggest trading partner, but other global actors are racing to catch up. The EU and Member States also account for most Foreign Direct Investments (FDI flows) in Africa, but companies from other developing economies are becoming increasingly active.

2.5.3. EU-Africa trade relations and regional trends

From a continental perspective, Africa's main trading partner is by far the EU, both for export and imports of goods. In 2018, total trade in goods between the 27 EU Member States and Africa was worth EUR 235 billion – more than 30 % of Africa's total. This compares to EUR 125 billion for China and EUR 46 billion for the United States of America (USA). According to Eurostat, the EU's four biggest economies, France, Germany, Spain, and Italy are the largest exporters of goods to Africa and the most important importers. Most EU countries have trade surplus with Africa, except Sweden, Slovenia, Italy and Spain.

Over 65% of goods imported to the EU from Africa were primary goods (raw materials, food and drinks, and energy). Raw materials account for 49% of total imports, and among these imports we encounter some included in the EU critical raw material list (fluorspar, Helium, natural rubber, phosphate rock, tantalum, vanadium, and platinum). This list helps to enhance recycling activities and, also, achieve secure supply through diversification. From a geopolitical perspective, it also contributes to understand the strategic interest of the EU in African countries in view of the access to raw materials.

Table 2: African main trade partners (2018)

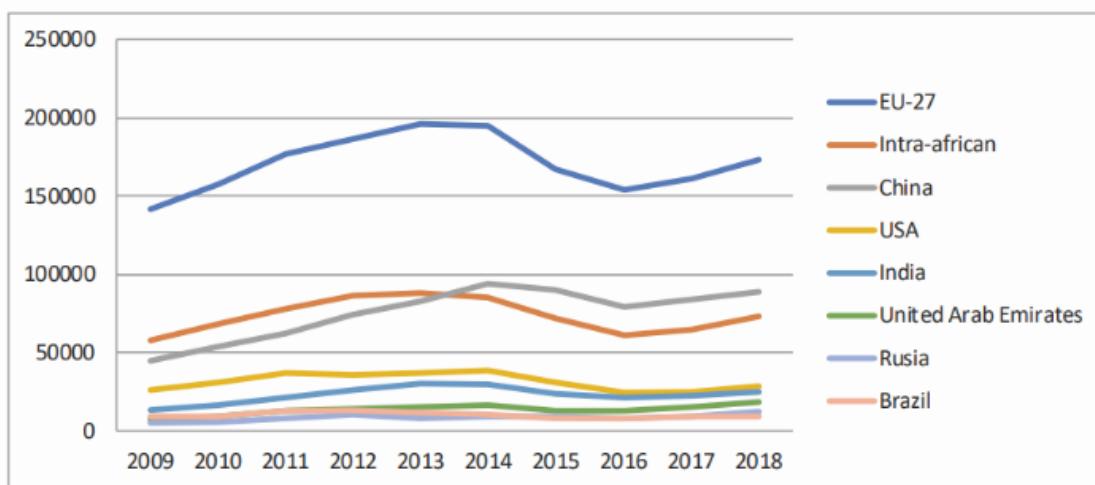


Source: own elaboration from UNCTAD

China is Africa's second largest partner both for exports and imports. Despite the current severe disruption in trade relations, according to most experts and following the last decade's trends (Table 3), China's commercial presence in the continent will continue to grow. Accordingly, European companies will continue to face sharply increasing competition in African markets (Table 6).

Conversely, while two-way US trade is waning (in some cases, due to US energy self-sufficiency), other emerging economies, such as India, show upward trends regarding both exports and imports. The upward trend in Russian exports to Africa is also significant, with the country currently accounting for 2% of total African imports, albeit still a small share but having more than doubled over the last 10 years.

Table 3: African imports (goods) by origin. (Millions of USD)



Source: own elaboration from UNCTAD

Currently, as many factories and businesses in the EU and China have closed due to the COVID-19 pandemic, demand for many African export products have declined. Prices of base metals such as copper, aluminum or manganese (basic in industrial processes) have weakened, mainly due to lower Chinese demand. Similarly, as European demand is falling, commodity supply chains and exports to the European market are being severely affected. Lower global demand and the reduction in oil prices will have an ambiguous effect in African countries. It will hit the budget of oil exporters hard (such as Nigeria and Angola, the main African producers), but will help other net importers' trade balances (such as Malawi and Ethiopia).

2.5.4. Regional trends

Intra-African trade, defined as the average of exports and imports, is still extremely low at around 14% of the total. It is generally regarded as the lowest intra-regional trade in the world when compared with other areas, such as Europe, Latin America or Asia. Despite the proliferation of Regional Economic Communities (RECs) since African countries gained their independence, intra-regional trade remains sluggish. However, a closer look reveals more dynamic behavior regarding certain regional trends, for instance the East African Community (EAC) and the Southern African Development Community (SADC) (20 % and 19 % respectively).

As observed in the continental trend, most RECs' main trading is with Europe, except in SADC (equal trade with China and Europe) and the Economic Community of Central African States (ECCAS). The disruption in international supply chains that the coronavirus pandemic is causing (particularly with China, but also with the EU), has shown the importance of regional African producers to fill these gaps and the need to increase intra-African commercial relations.

Table 4: Exports by destiny (%) in main African RECs (2010-2017)

	Intra-regional	China	USA	European Union	Rest of Africa	Rest of the world
ECCAS (Economic Community of Central African States)	2	34	15	20	4	25
SADC (Southern African Development Community)	19	20	8	20	3	30
AMU (Arab Maghreb Union)	3	5	8	63	2	19
ECOWAS (Economic Community of West African States)	9	3	12	29	7	40
COMESA (Common Market for Eastern and Southern Africa)	9	12	4	37	8	30
EAC (East African Community)	20	5	4	19	18	34

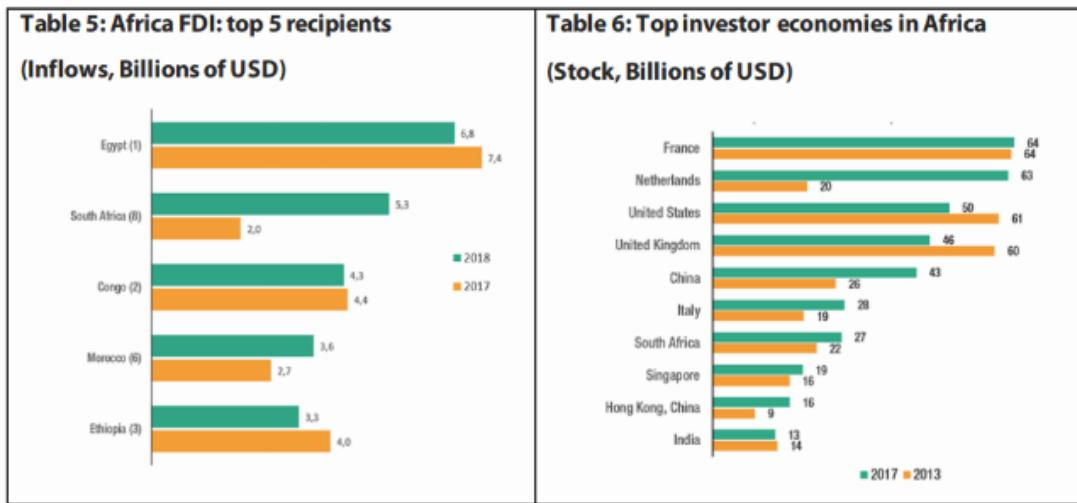
Source: UNECA (2019)

2.5.5. Trends in foreign direct investment to Africa

Until the spread of coronavirus worldwide, Africa had escaped the global decline in Foreign Direct Investment (FDI) and flows to the continent were rising steadily. Though total investment remained small in global terms, they were significant in relation to Africa's economic size. The top five recipients of investments are: (1) Egypt, (2) South Africa, (3) Congo, (4) Morocco and (5) Ethiopia (UNCTAD, 2019).

Though FDI in some large economies, such as Egypt and Nigeria, is contracting, this is being balanced by a surge in other African countries, with best examples being South Africa and Ethiopia. In terms of top investor countries (in capital), France is still the largest, albeit with no stock increases since 2013. The Netherlands, the United States, The United Kingdom (UK) and China follow on the top investor list.

Following Brexit, of significance was the recent (and first) UK-Africa Summit, held in January 2020, which is looking to strengthen trade and investment for British companies after leaving the EU. South Africa is the main African country investing in other African economies, followed by Morocco, which is increasing its investment in the continent quite rapidly.



Investments in Africa can also be viewed in terms of projects, jobs created and capital. Regarding the number of projects during 2014 to 2018, the USA and France are the largest investors, followed by the United Kingdom and China. For this period, China accounts for the largest share of jobs created and capital inflows to Africa. Although not noticeable in absolute figures, Portugal and Brazil are important investors in Portuguese-speaking countries, such as Angola or Mozambique.

Looking at African countries investing in their own continent, South Africa is by far the largest and most geographically extended in a large variety of sectors. In more local terms, Egypt and Morocco are important investors in the North region, whilst Nigeria and Kenya are the main investors in their own regions (West and East Africa respectively).

Table 7: 10 largest investors (2014-2018)

Country	Projects	Jobs created	Capital USD m
USA	463	62 004	30 855
France	329	57 970	34 172
UK	286	40 949	17 768
China	259	137 028	72 235
South Africa	199	21 486	10 185
UAE	189	39 479	25 278
Germany	180	31 562	6 887
Switzerland	143	13 363	6 432
India	134	30 334	5 403
Spain	119	13 837	4 389

Source: EY (2019)

The extractive sector continues to be key in terms of inbound capital, but there is a shift towards other sectors, such as industry and services. Moreover, flows into Sub-Saharan Africa are increasingly targeting consumers instead of extractive industries. It is important to note that despite services receiving the least capital, specific services (e.g., financial/business and tourism) are creating more jobs than other sectors and furthermore account for most new projects coming into Africa.

Under the services heading, the consumer sector is prominent due to urbanization trends (increasing need for clothing and feeding) and the rise in incomes. It has recently overtaken financial services, according to the EY Africa Attractiveness Report. During 2020, the pandemic is likely to bring about a drop in investments globally. Hence, Africa will also experience reduced foreign investment. Chinese infrastructure projects, for instance, will face delays. Earlier, opportunities available on the African continent in terms of natural resources, urbanization, demographic trends, outstanding economic growth, infrastructure and energy needs had been boosting international initiatives to facilitate business investment in African Markets.

Among this groundswell of initiatives, probably the most well-known is the China Belt & Road Initiative and, since 2013, the Forum on China-Africa Cooperation (FOCAC), the G20 Compact with Africa pushed by the German Government and the US initiative Prosper Africa. Russia also celebrated an inaugural Summit in 2019 whilst India had planned (but probably will postpone) a fourth India-Africa Summit for September 2020.



Whilst the coronavirus will probably cause disruptions to international investment in Africa, some countries like China or the EU, have deep-rooted interests in Africa, so it is certainly feasible that investment will recover and could then focus on new areas such as healthcare infrastructure. Europe could make a valuable contribution in developing local and regional value chains, green economy, supporting small and medium sized economies, knowledge transfer and development of human capital in the new post-COVID-19 context and needs.

2.5.6. EU trade and investment policy towards Africa

EU trade policy towards Africa has traditionally divided the continent into two regions: the North African countries and Sub-Saharan Africa (Under the umbrella of the Africa, Caribe and Pacific (ACP) Group. With the North African countries, Algeria, Egypt, Morocco and Tunisia, the EU has had bilateral free trade agreements (FTA) since the 1990s and 2000s. Under these FTAs, duty-free and quota-free access is granted for most goods (except for agricultural products exported by the African countries). Following the establishment of these agreements, whilst North African imports from the EU have increased over the years, North Africa's exports have not followed the same pattern and are still modesty comparison.

Prior to 2011, the EU had been negotiating a trade agreement with Libya. However, according to the European Commission, the absence of political settlement within the country is still preventing trade discussions. The EU started negotiations with Tunisia and Morocco to strive for more ambitious agreements, called Deep and Comprehensive Free Trade Areas (DCFTAs), that entail abandoning low-grade free trade and opening more integration with the European Market. These DCFTAs build on existing agreements and look to liberalize most good and services, to cover most trade-related areas, including technical barriers to trade and legislative approximation.

Table 8: Free Trade agreements between the EU and North African countries

Country	In force since:
Tunisia	December 1997 (Negotiating a DCFTA since 2015)
Morocco	March 2000 (Negotiating a DCFTA since 2013)
Egypt	June 2004
Algeria	September 2005

Source: European Commission (2020)

They are also aimed at facilitating European investments in these countries. The EU-Tunisia DCFTA negotiations moved quickly, and substantial progress was being made in many areas until May 2019. Regrettably, since then negotiations have stalled, which according to the EC is due to civil society protests and a change of government. In contrast, whilst EU-Morocco DCFTA talks had been on hold since 2014, both parties committed to relaunch negotiations in 2019.

Negotiations have yet to resume, but meanwhile the Agreement faces a critical controversy regarding the Western Sahara conflict. Although the EU has never formally recognized Moroccan sovereignty over Western Sahara, it nevertheless decided to include these territories in the DCFTA with Morocco. This impression of Morocco's political legitimacy in the area has provoked a legal challenge from the Polisario Front, which represents the indigenous Sahrawi population who are seeking to break free of Moroccan rule.

The EU's trade regime with the remaining 49 Sub-Saharan African countries has evolved over time. Over the last 15 years, the EU has worked to transition from a non-reciprocal regime under Lomé Conventions (that gave free market access to most African exports into European markets) into a partnership model based on reciprocal market access under the umbrella of the Cotonou Agreement. Since the entry into force of the Cotonou Agreement in 2003, the European Commission has been negotiating Economic Partnership Agreements (EPAs) with African countries.

The EPAs are FTAs with a predevelopment orientation. In practice, as with other conventional FTAs, they give European companies preferential access to African markets. However, these EPAs remain controversial and as a result they have to date been applied to only 10 individual countries and one regional grouping (SADC). The main concerns raised by civil society and some African Governments regarding the EPAs are related to:

- (i) tariff reductions and loss of government revenue,
- (ii) negative impact of European companies' competition in local producers,
- (iii) the threat to African regional integration efforts, and in general,
- (iv) the argument that EPAs are designed to benefit the EU side rather than pursue African interests.



For the remaining Sub-Saharan African countries (non-EPA signers), there are three different trade regimes. For those considered as Least Developed Countries, imports are duty-free and quota-free under the regime Everything but Arms. This highly preferential treatment does not require reciprocity and it also applies to other non-African LDCs. For the rest, the Generalized Scheme of Preferences (GSP) is applied. This is a broad treatment granting preferential tariffs to imports from developing countries worldwide. The GSP is the less preferential treatment applied by the EU to African Countries, whilst still implying some tariff reductions. A summary of all these various trade regimes follows (Table 9):

Table 9: Summary of EU trade regimes with African countries

Trade regime ⇒	Everything but Arms (EBA)	Economic Partnership Agreements (EPAs)	Free trade Agreements (FTAs) with North Africa	Generalised Scheme of Preferences Plus (GSP+)	Generalised Scheme of Preferences (GSP)
Beneficiary countries	31 Least Developed Countries (LDCs)	16 countries: Cameroon, Ivory Coast, Ghana, Mauritius, Seychelles, Zimbabwe, Madagascar, Comoros, Kenya, Rwanda and the SADC group: Botswana, Lesotho, Mozambique, Namibia, South Africa and Eswatini	4 North African countries: Algeria, Egypt, Morocco and Tunisia	1 vulnerable country, but not considered LDC: Cabo Verde	2 countries, not vulnerable, not LDCs: Nigeria and Congo-Brazaville
Market access to the EU	100 % duty and quota free (except arms)	100 % duty and quota free (except arms)	Duty and quota free (exceptions for agri-food and fisheries)	Duty and quota free for 66 % of products	Lower tariffs for 66 % of products
	More preferential				Less preferential

Source: own elaboration from EC (2017) and EC (2020)

In short, although to a different extent from country to country, these trade regimes make the European market the most open to African exporters. Nevertheless, at the same time, these plethora of trade regimes divide the continent and pose a challenge to the African ambitions to establish a continental free trade area. A one and only trade regime between the EU and the African Continents would be more coherent and push more effectively the African Agenda of economic integration and the ambition of establishing a pan African market.

2.5.7. The EU and the African Continental Free Trade Area (AfCFTA)

On 21 March 2018, African economic integration reached a milestone when the African Continental Free Trade Area (AfCFTA) agreement was signed off by 44 of the African Union's (AU) 55 members. The AfCFTA entered into force in May 2019 and has to date been signed by all African countries (except Eritrea) with 30 having reached the stage of full ratification. It has been agreed that Ghana will hold the AfCFTA's secretariat, which will develop the working program and the annual budget. In 2020, Wamkele Mene, South Africa's Chief Negotiator in the AfCFTA negotiations and former diplomat at the WTO, was appointed Secretary-General.

AfCFTA is one of the African Union's flagship projects of Agenda 2063 and if fully implemented would put in place one of the largest free trade areas in the world. According to the AU, the AfCFTA aims to 'significantly accelerate growth of Intra-Africa trade and use trade more effectively as an engine of growth and sustainable development by doubling intra-Africa trade, strengthening Africa's common voice and policy space in global trade negotiations' (African Union, 2018).

Map of signatories and state of ratification of the AfCFTA (March 2020)



AU Member States which ratified the AfCFTA

Algeria	eSwatini	Mauritania	Sierra Leone
Burkina Faso	Equatorial Guinea	Mauritius	South Africa
Cameroon	Ethiopia	Namibia	The Gambia
Chad	Gabon	Niger	Togo
Republic of Congo	Ghana	Rwanda	Uganda
Côte d'Ivoire	Guinea	Saharawi Republic	Zimbabwe
Djibouti	Kenya	São Tomé & Príncipe	
Egypt	Mali	Senegal	

Source: Africa-EU Partnership (www.africa-eu-partnership.org)

For those countries that have already ratified the Agreement, trading under the AfCFTA regime has been scheduled to begin on 1 July 2020, but due to the coronavirus pandemic, will probably be pushed to January 2021. Whenever this new trading regime does start, the AfCFTA will effectively remove 90% of trade tariffs, thereby allowing free access to most goods and services across a significant number of countries throughout the continent. Over a 5 to 10-year period, there will be an additional 7 % of liberalization for 'sensitive products' that have not previously been liberalized. A special group of countries, the G6 (Ethiopia, Madagascar, Malawi, Sudan, Zambia and Zimbabwe), have demanded a further 15 years' extension period, on the grounds that they face specific development challenges.



As with other international institutions, the EU has announced its formal support for the AfCFTA, which is summarized in two EC Communications:

1. On December 2018, former Commission President Juncker presented the Communication on a new Africa-Europe Alliance for Sustainable Investment and Jobs, (the 'Africa-Europe Alliance') that confirms 'full' support to the AfCFTA, announcing EUR 50 million funding and technical assistance over a large number of areas (such as data collection and analysis, Technical Barriers to Trade, Intellectual Property Rights, investment and e-commerce, among others). Regarding EU trade regimes, this Communication explains that the long-term goal is to create a continent-to-continent free trade agreement. It adds that EPAs, FTAs with North African countries together with other trade regimes between the EU and Africa countries should be 'building blocks to the benefit of the African Continental Free Trade Area' (EC, 2018).



2. The recent 2020 Communication Towards a comprehensive Strategy with Africa 'welcomes the African Continental Free Trade Agreement' and again promises technical and financial support as top priorities. It also reaffirms the former strategy, outlined in the Africa-Europe Alliance, of a comprehensive continent-to-continent free trade area. Furthermore, it reinforces the idea of EPAs and other EU trade regimes as tools for this goal.

The European Commission states that financial support for the AfCFTA goes through three channels: the Pan-African Program (that supports negotiations, the establishing of an African Trade Observatory and strategic dialogue on investment climate reforms, among others), the EU Aid for Trade and the EU External Investment Plan. From these three instruments, only the Pan-African Program is focused exclusively on the AfCFTA, as other channels relate to general trade and investment issues, rather than boosting intra African trade and investment, as will be explained later.

The High Representative of the African Union with the EU, Carlos Lopes, has expressed his thoughts on the convenience of EPAs not progressing further and that achieving the AfCFTA will force a rethink on the external relations of Africa with the EU. It is clear that EPAs fragment Africa and according to Lopes trade preferences with third countries (in general) cannot build regional value chains and boost intra-African trade. This is evidence that despite the EC's statements about EPAs contributing to regional integration, there is no common understanding on how in practice they feed (positively or negatively) regional and continental integration through the AfCFTA.

2.5.8. EU initiatives for mobilizing investments

There is as yet no single EU framework for investment in Africa. However, there are three main institutional initiatives for mobilizing such investments: (a) the Africa-Europe Alliance, (b) the external investment plan and (c) instruments related to the European Investment Bank, such as the ACP investing facility and the External Lending mandate:

- (a) The Africa-Europe Alliance: as already mentioned, this was announced by former President Jean Claude Juncker in September 2018. It has committed EUR 4.2 billion for the period 2017-2020 in the expectation of leveraging new investments of EUR 41.5 billion (total expected investments in 2020: EUR 44 billion). The financial arm of this Alliance is the EU External Investment Plan.
- (b) The External Investment Plan (EIP): was established in 2017, being designed to attract private investments in Africa and the European neighborhood (North Africa included in this group and other countries such as Georgia, Jordan and Moldova). Its original hope was to attack the 'root causes of migration' and stimulate investment in 'more difficult' countries. It replicates the idea of the 'Juncker Plan' for Europe, with the key issue to be recognized in understanding the EIP being the use of public money to diminish the risk of private investment. The EIP has three dimensions:
 - (i) Financing guarantees through the European Fund for Sustainable Development,
 - (ii) Technical assistance and,
 - (iii) Dialogue and communication with the private sector (in Africa, this has been done under the title 'Sustainable Business for Africa (SB4A) Platform' which is focused on improving the investment climate).
- (c) European Investment Bank-related instruments: such as the ACP Investment Facility provided under the Cotonou Agreement since 2003, or the External Lending mandate to support investments in North Africa and South Africa (plus Asia and Latin America) and in pre-accession countries, which enables the European Investment Bank to increase its lending outside the EU, thereby reducing risk exposure for the EIB by shifting it to the EU.



2.5.9. Conclusions & Recommendations for improvement

The new European Commission is placing EU-African relations to the fore. The Joint Communication towards a comprehensive Strategy with Africa stresses the African Continent's strategic importance and the need to strengthen the EU partnership with (and not for) Africa.

There are two possible interpretations of the EU's renewed interest in Africa. Either it is the consequence of China's increasing economic and political influence along with other international actors on the continent and the resulting loss of political and diplomatic ground. Alternatively, it could stem from the EU's ambition to become an influential international actor by means of a stronger and more articulated external policy.

No matter which interpretation is correct, the continent has become a crucial arena for competition between states and companies as a source for global demand of natural resources, and for the EU in particular, a key market for critical raw materials supply.

The Parliament shall consider that due to COVID-19 health crisis, the new Africa strategy proposals have fallen off the radar and become obsolete (Laporte, 2020). Africa and Europe will be confronted with loss of jobs and economic recession and the list of priorities and actions will need to be revised. It is the time to build something new, and to review priorities based on the need to tackle the social impact of the crisis and the recovery of African economies, focusing on the EU making a useful contribution to this ambition.

As the EU stresses repeatedly, Europe is still the main trading partner and largest source of foreign direct investment in Africa. According to their current performance in Africa, European companies still maintain an important level of competitiveness, but upward trends of activity from other international actors challenge the EU's economic leadership on the African continent.



Competitiveness of an individual firm (usually related to its ability to survive in the market and make profits in the medium terms) is driven not only by internal factors, but also external factors such as the number of competitors and types of competition. In this sense, European companies are facing growing pressure from Chinese competition and as a consequence access to finance, among other issues, becomes a key instrument in maintaining European Companies presence in Africa. Despite all the Communication's emphasis on investment promotion, it does not include any new investment or financing commitments from the EU.

Moreover, apart from COVID_19 related packages, prospects of additional funding for Africa in the next long-term Budget (2021-2027) are slim. In that sense, the Parliament shall address the gap between strategic consideration of the continent and the financial compromises needs to be fulfilled.

The EU is the world's most open market for African exporters, but still holds as many as five different trade regimes with African countries. The Joint Communication makes specific promises in regard to developing the African Continental Free Trade Area and regional economic integration. It reinforces the message that EPAs and other trade regimes are tools for a future continent-to-continent free trade area, but EPAs remain controversial for African leaders and have created regional tensions.

The future partnership needs to recognize diverging views on EPAs and find concrete solutions suitable for both parties. Desirably, and as soon as possible, a one and only trade regime, negotiated between the EU and the African Union, should be put in place. This will reassure that the EU is supporting in practice the pan African integration agenda that African leaders are pushing forward with the AfCFTA.



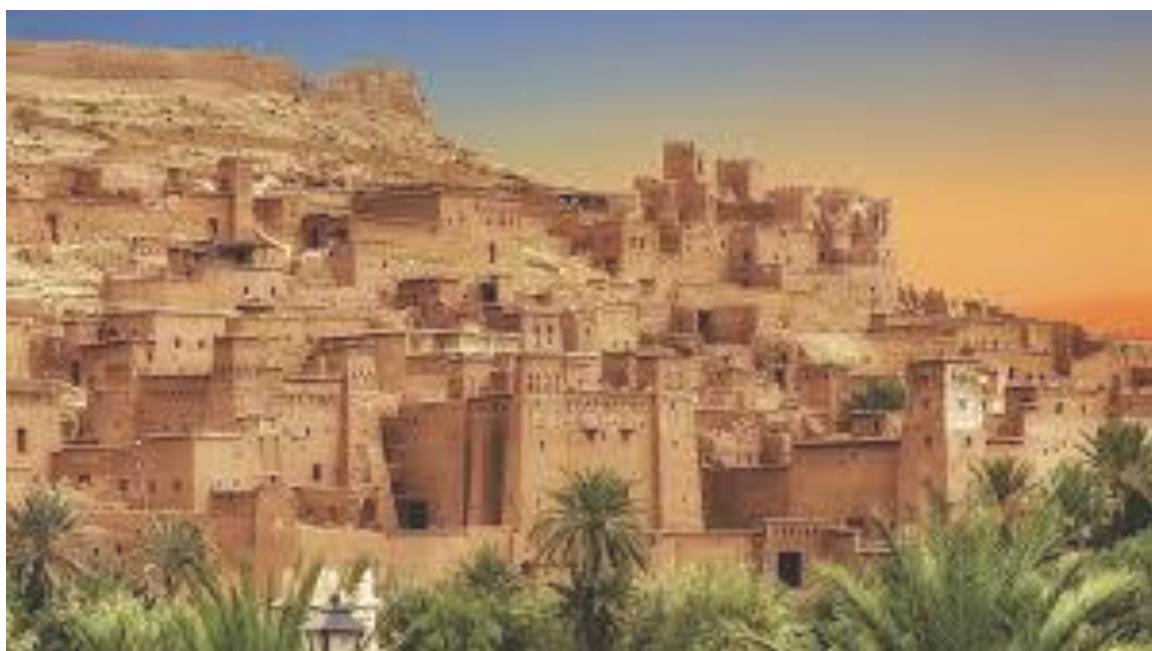
Whilst it is true that this time on-going discussions with African actors have been announced, it is nevertheless important to remember that the EU has often been accused in the past of setting instruments and timings with limited involvement from African Actors. In this sense, some (but not all) of the EC's proposals are built on an agenda jointly agreed with the African Union in 2017. In order to pursue an African understanding of common interests and legitimate partnership, effective and visible engagement in the next months with all African actors (including African Think Tanks) must be undertaken before the final EU-Strategy with Africa is adopted.

Another challenge facing the future EU-Africa Strategy is how the proposed partnerships will be set up institutionally. While the role of the European Commission speaking on behalf of EU members is clear, there are many references to 'Africa', and very few regarding regional organizations and their roles (Byers). Considering the EU commitment to strengthen regional and continental integration, the African Union and RECs' respective roles need to be specific and enlarged in the future Strategy. For example, some voices have called for a Joint Continental Investment Platform, developed by the EU and the AU working together, to construct International financial institutions and jointly design investment programs (Medinilla and Teevan, 2020).

Regarding digital transformation, there is a common understanding between the EU and the African Union that it could be a game-changer and an opportunity to boost economic growth and job creation, and that it should be pushed among the top priorities of the agendas. Proposals included in the EC communication are in the line of the recommendations of the Digital Economy Task Force (formed of 20 African and EU decision makers and representatives on international organizations, private sector and civil society) for a New Africa-Europe Digital Economy Partnership.

The European Parliament shall consider that the digital agenda is a double-edged sword. It can also create more inequalities in poor populations left aside of technology access and become an instrument to control population by undemocratic leadership. The EU-Africa partnership needs to stress and help to develop legal frameworks to avoid these threats.

The EU's endeavors to go climate-neutral by 2050, as part of the Green Deal Strategy, will have an impact on all EU trading partners in general and Africa in particular. Firstly, if fully advanced Europe will import less oil and gas from African countries. Secondly, European Green Deal related legislation could also directly affect African exports to the EU. As pointed out by Oxfam, some legal initiatives such as the Carbon Border Adjustment Mechanism (that could burden African exports) should be carefully considered, to respect the 'do no harm' principle. In light of the above, the new African Strategy needs to address these concerns related to Green Deal legislation and impact assessments with African counterparts would be desirable for a stronger partnership.



Finally, as the COVID-19 takes hold in Africa, it is becoming more certain that Africa will be hit not only by the spill-over effect on global economic growth, but also as a consequence of the temporal breakdown of trade and investment with the EU and China. It is feasible that more resources to tackle the pandemic's consequences will be demanded in the context of EU-Africa negotiations towards the new strategy. It could also be that EU support will be solicited as a result of emerging calls from African leaders, for example to alleviate debt burden, by means of global action and solidarity. It is becoming more urgent for EU and African relations post COVID-19 to be tailored to a new scenario and show tangible action along with partnership rhetoric.



On the other hand, outside of the relation between Africa and Europe, the best empowering strategy is to trade with itself; 54 countries, rich in agriculture, cattle raising, commodities, textile and many manufacturing products trading between them with a common competitive currency in a new unified and strong African economy.

2.6. Africa needs to trade with itself

Trade does not aid. It is an idea we hear quite a bit in reference to Africa. Last summer, when Barack Obama addressed the African Union – the first US president to do so – he made sure to bring it up: “So many Africans have told me, we don’t want just aid, we want trade that fuels progress.”

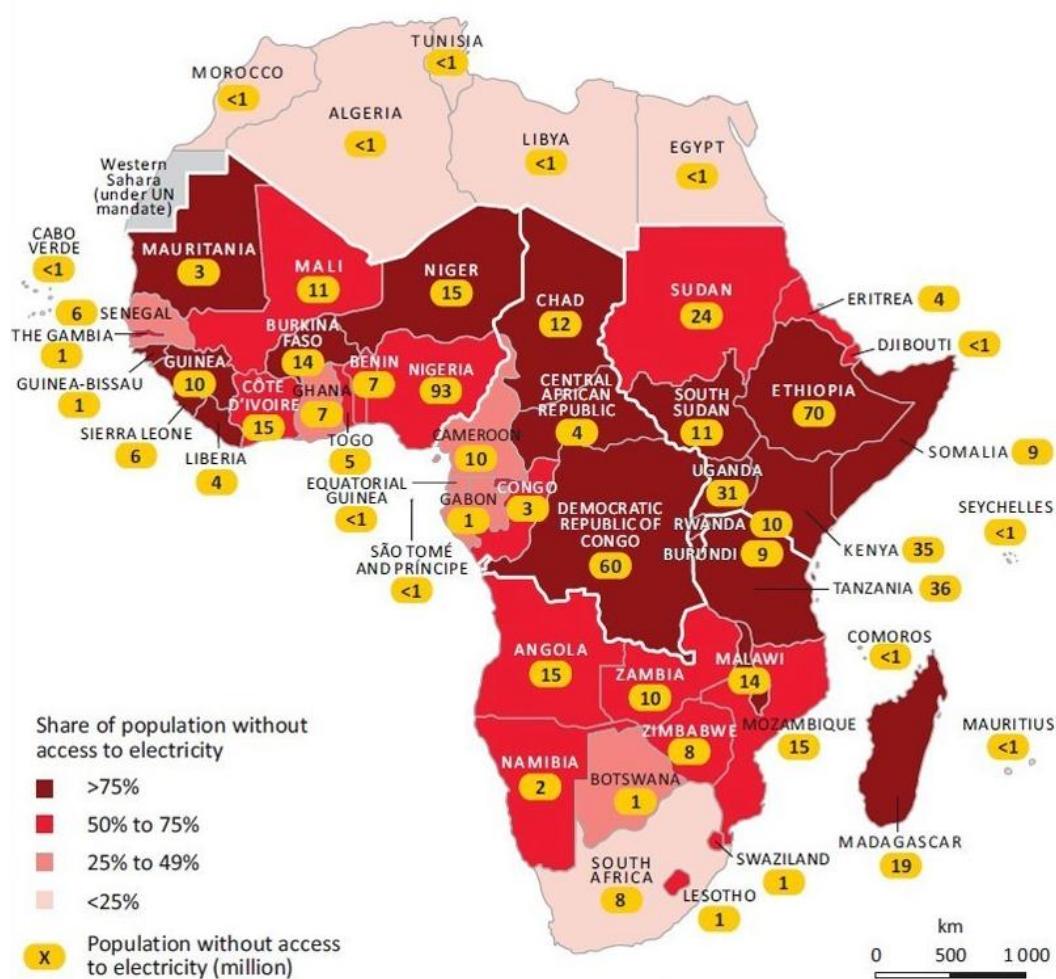
And yet, while trade might be the gateway to development, the statistics in Africa are not too impressive, especially when it comes to one of the biggest opportunities for growth: trade among African countries. In 2014 in Europe, for example, 69% of exports were to other countries on the continent. In Asia, that figure stood at 52% and in North America at 50%. Africa had the lowest level of intra-regional trade, at just 18%.

Movement from political will to policy action as far as improving regional cooperation is ongoing but remains slow to materialize. Customs procedures are onerous, visa restrictions are high, while failure to produce value-added goods and to diversify from natural resources and goods different from neighboring countries continues to stifle trade.

There is one way of boosting intra-regional trade, and with it economic growth and development: technology. But for technology to be able to transform trade in Africa, there are a few important steps we must first take.

2.6.1. Getting the right infrastructure

Infrastructure development is a top developmental priority in Africa, particular in two critical areas: electricity and transport. Access to electricity forms the basis of an industrialized economy and hence trade; yet less than 30% of Africans have access to electricity, compared to about 40% in similar low-income countries from other regions. Unless we can do something to tackle this issue, we have no hope of increasing intra-regional trade in Africa.



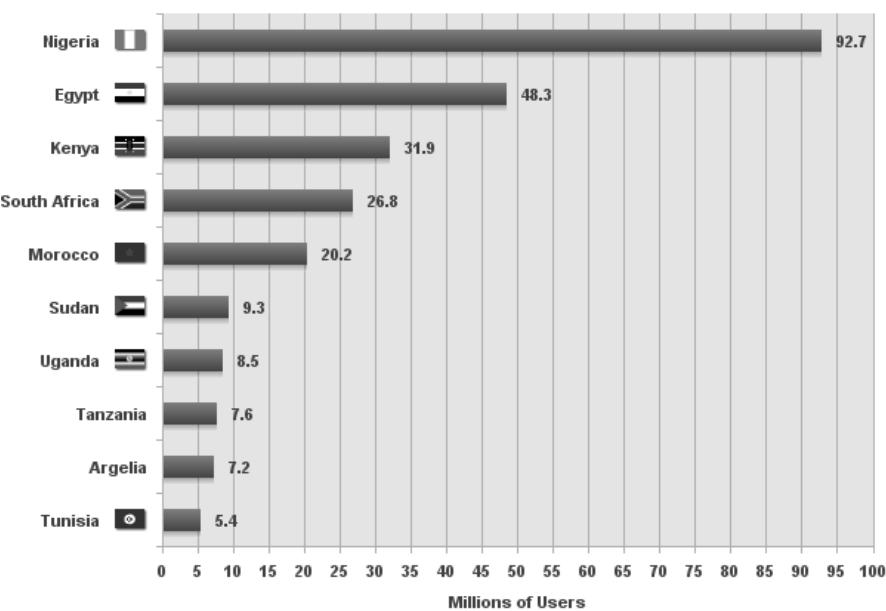
More progress is being made in another area: transport. Africa is huge – far bigger than you'd think from looking at a map. Connecting this vast continent is not without its challenges, but already great investments are being made in major carriage ways and regional railway projects, such as the Standard Gauge Railway that will connect Kenya, Uganda, Rwanda and South Sudan.

That is good but not good enough. In Africa, 90% of trade happens by sea, which means ports also need to be modernized, expanded and maintained so as to push greater trade volumes, enable government to collect more taxes and curb illegal activities.
Internet for all

It is not just with electricity access that Africa lags behind. It's also with one of the most powerful tools for boosting trade, opening up new economic opportunities and fostering innovation and entrepreneurialism: the internet.

Some countries are leading the way – Nigeria, Egypt and Kenya, for example – but most countries on the continent are still far behind when it comes to internet penetration rates. While the global average stands at almost 50%, penetration rates in Africa were just 28.6% at the end of 2015. It's such a priority issue that the Forum has launched an online conversation, #internetforall.

African Top 10 Internet Countries in 2015



If we were able to connect more people on the continent, the boost to trade could be enormous. Apps such as M Farm, which connects buyers with farmers and enable farmers to sell goods at the correct market value, platforms such as Google's, which allows entrepreneurs to use Google products to build their businesses, or Konga, an ecommerce platform known as Nigeria's biggest online mall, are just two examples of how the internet could fuel trade.

But unlocking the power of the internet is about more than giving people a modem and letting them get on with it. The internet can only kickstart intra-regional trade if connection goes hand in hand with improved education and understanding of the numerous possibilities the internet can offer all levels of entrepreneurs.

There is a long-standing discussion in Africa and beyond about the importance of STEM subjects. That is not the issue here. As we have seen in other regions, you do not need a PhD in computer sciences to make the most of everything the internet has to offer. Instead, what matters is giving people opportunities to learn, create and innovate through affordable and consistent internet access, thereby fostering an entrepreneurial ecosystem. Africans need to go from being consumers of online content to being mass producers of it.

Governments must promote competition in the telecommunications sector, harmonize regional laws to ensure digital payments can be made across borders, and facilitate the movement, release and clearance of goods across borders. Technological solutions such as drones might be one way to go.



2.6.2. Trade that fuels progress

We know all too well the opportunities trade can offer for development and growth. Africa is in a unique position in that it has the chance to trade with an untapped market: itself. Nobody is saying that will be easy. But technology will go a long way to making this ambition a reality.



2.7. Emigration of Africa

During the period of 1965 - 2021, an estimated 440,000 people per year emigrated from Africa; a total number of 17 million migrants within Africa was estimated for 2005.[1] The figure of 0.44 million African emigrants per year (corresponding to about 0.05% of the continent's total population) pales in comparison to the annual population growth of about 2.6%, indicating that only about 2% of Africa's population growth is compensated for by emigration.

During the 2000s, North Africa had been receiving large numbers of Sub-Saharan African migrants "in transit", predominantly from West Africa, who plan to enter Europe.

An annual 22,000 illegal migrants took the route from either Tunisia or Libya to Lampedusa in the 2000-2005 period. This figure has decreased in 2006, but it has increased greatly as a result of the 2011 Tunisian revolution and the 2011 Libyan civil war. In 2005, 10,000 West African migrants heading for Europe were stranded in the Mauritanian port of Nouadhibou, and 20,000 sub-Saharan African migrants were waiting for an opportunity to cross to Europe in the Spanish enclaves in North Africa.

The World Bank Migration and Remittances Factbook of 2011 gives separate regional summaries for Sub-Saharan Africa on one hand and the Middle East and North Africa on the other. For both regions, there is a surplus of emigrants, even though a substantial part of migration takes place within each region.

For the Middle East and North Africa, there was an estimated stock of 18.1 million (5.3% of population) emigrants vs. 12.0 million (3.5% of population) immigrants. 31.5% of migration took place intra-regional, 40.2% was to high-income OECD countries. The main migration corridors for North Africa were identified as Egypt-Saudi Arabia, Algeria-France Egypt-Jordan, Morocco-France, Morocco-Spain, Morocco-Italy, Egypt-Libya. The portion of refugees was estimated at 65.3% of migrants.

For Sub-Saharan Africa, the World Bank report estimated a stock of 21.8 million (2.5% of population) emigrants vs. 17.7 million (2.1% of total population) immigrants. 63.0% of migration was estimated as taking place intra-regionally, while 24.8% of migration was to high-income OECD countries. The top ten migration corridors were 1. Burkina Faso-Côte d'Ivoire, 2. Zimbabwe-South Africa, 3. Côte d'Ivoire-Burkina Faso, 4. Uganda-Kenya, 5. Eritrea-Sudan, 6. Mozambique-South Africa, 7. Mali-Côte d'Ivoire, 8. Democratic Republic of Congo-Rwanda, 9. Lesotho-South Africa, 10. Eritrea-Ethiopia.



2.7.1. Emigration to Europe

There is significant migration from Africa to Europe. As of 2007, there were an estimated seven million African migrants living in OECD countries. Of these, about half are of North African origin, mostly residing in France, Italy, Belgium, Spain and the Netherlands, while the other half are of Sub-Saharan African origin, present throughout Western Europe, with significant concentrations in Belgium, France, Italy, the Netherlands, Portugal, Spain and the United Kingdom. The rate of migration is projected to increase in the coming decades, according to Sir Paul Collier, a development economist.

African immigration to the United States has been comparatively slight, totaling around 3,183,104 individuals as of 2010.



Some of this migration is illegal. The European Union Frontex agency's "Operation Hermes" is also monitoring the Mediterranean between North Africa and Italy. Due to increased border controls along the Mediterranean, there has been a shift of preferred migration routes towards Greece.

2.7.2. African populations in Europe

Approximate populations of African origin in Europe:

- ❖ Arabs and Berbers (including North African and Middle Eastern Arabs): approx. 5 million, mostly in France, Italy, the Netherlands, Austria, Belgium, Germany, United Kingdom, Sweden, Spain, Norway, Denmark, Switzerland, Greece and Russia.
- ❖ Sub-Equatorial Africans: approx. 5 million; mostly in Italy, France, the United Kingdom, Germany, Austria, Spain, the Netherlands and Portugal.
- ❖ Horn Africans: approx. 1 million, mostly Somalis and Eritreans, mostly in United Kingdom, Germany, Sweden, Austria, the Netherlands, Norway, Denmark, Finland
- ❖ Ethnic Europeans with colonial roots: approx. 8 million; mostly in France, United Kingdom, Greece, Romania and Belgium.
- ❖ North African Jews: approx. 500 thousand; mostly in France.

2.8. African Foreign Exchange (FX) rates against U\$D

* Data from [wikipedia.com](#) ** Population from [worldbank.com](#) *** FX rates from [google finance.com](#) Q2-2021

	Currency	FX Symbol	1 USD rate	Currency sign	Flag	Country	
41	Algerian dinar	DZD	133.30	آ (Arabic) or DA (Latin)		Algeria	54
40	Angolan kwanza	AOA	642.22	Kz		Angola	53
39	Botswana pula	BWP	10.63	P		Botswana	52
38	Burundian franc	BIF	1,971.19	FBu		Burundi	51
37	Cape Verdean escudo	CVE	90.46			Cape Verde	50
CFA franc[a]		XAF	538.15	FCFA		Cameroon	49
						Central African Republic	48
						Chad	47
						Republic of the Congo	46
						Equatorial Guinea	45
						Gabon	44
						Benin	43
						Burkina Faso	42
						Guinea-Bissau	41
						Ivory Coast	40
						Mali	39
						Niger	38
						Senegal	37
						Togo	36
35	Comorian franc	KMF	404.38	CF		Comoros	35
34	Congolese franc	CDF	2,002	FC		Democratic Republic of the Congo	34
33	Dalasi	GMD	51.18	D		Gambia	33
32	Djiboutian franc	DJF	177.95	Fdj		Djibouti	32
31	Egyptian pound	EGP	15.67	££ or £ or L.E.		Egypt	31
30	Eritrean nakfa	ERN	15.08	Nfk (Latin script) ኦብ (Ge'ez script) ﷼ (Arabic script)		Eritrea	30
29	Ethiopian birr	ETB	43.53	Br (Latin Script) ዘር (Ethiopic Script)		Ethiopia	29
28	Ghanaian cedi	GHS	5.79	GHC		Ghana	28
27	Guinean franc	GNF	9,800.93	FG		Guinea	27
26	Kenyan shilling	KES	107.71	KSh, /-,/-, K		Kenya	26
25	Lesotho loti	LSL	13.78	L or M (pl.)		Lesotho	25
24	Liberian dollar	LRD	171.65	\$, L\$, LD\$		Liberia	24
23	Libyan dinar	LYD	4.45	LD and ₲		Libya	23
22	Lilangeni	SZL	13.76	L or E (pl.)		Eswatini	22
21	Malagasy ariary	MGA	3,753.68	Ar		Madagascar	21
20	Malawian kwacha	MWK	797.58	K		Malawi	20

* Data from [wikipedia.com](#) ** Population from [worldbank.com](#) *** FX rates from [google.finance.com](#) Q2-2021

	Currency	FX Symbol	1 USD rate	Currency sign	Flag	Country	
19	Mauritian rupee	MUR	40.45	Rs		Mauritius	19
18	Moroccan dirham	MAD	8.85	DH		Morocco	18
17	Mozambican metical	MZN	60.96	MT, MTn		Mozambique	17
16	Namibian dollar	NAD	13.78	\$, NS		Namibia	16
15	Nigerian naira	NGN	410.76	#		Nigeria	15
14	Ouguiya	MRU	36.12	UM		Mauritania	14
13	RTGS Dollar	ZWD	361.90			Zimbabwe	13
12	Rwandan franc	RWF	997.59	FRw, RF, RF		Rwanda	12
11	S�o Tom� and Pr�ncipe dobra	STN	20.05	Db		Sao Tome and Principe	11
10	Seychellois rupee	SCR	15.45	SR or SRe		Seychelles	10
9	Sierra Leonean leone	SLL	10,250	Le		Sierra Leone	9
8	Somali shilling	SOS	585.00	Sh.So.		Somalia	8
7	South African rand	ZAR	13.75	R		South Africa	7
6	South Sudanese pound	SSP	130.26	SS		South Sudan	6
5	Sudanese pound	SDG	419.50	SDG or 		Sudan	5
4	Tanzanian shilling	TZS	2,319.11	TSh		Tanzania	4
3	Tunisian dinar	TND	2.73	 (Tunisian Arabic) or DT (Latin)		Tunisia	3
2	Ugandan shilling	UGX	3,546.35	USh		Uganda	2
1	Zambian kwacha	ZMW	22.51	K		Zambia	1

2.9. Solving the African currency liquidity problem

Some 41 currencies serve the African continent. Many of these are characterized by their illiquid and rarely traded status on the global financial market, as well as their volatility. So, for those wishing to do business with Africa, these currencies – as difficult and expensive to source – can pose a real problem.

From the Namibian dollar to the Seychellois rupee, it is vital that organizations are able to source emerging market currencies reliably, on time, and at competitive prices. Yet such necessities often elude those trading with Africa, who view currency concerns as one of the biggest barriers to the development of Africa as an emerging – and therefore high growth – opportunity for international investors.

2.9.1. Funding development

But currency concerns go deeper than simply lost investment opportunities. When one considers the prospect of an international charity responding to a humanitarian or environmental crisis, the importance of currency sourcing becomes especially clear.

Many charities operating in Africa are funded by one or more of the G10 currencies, such as the American dollar or British pound. Yet providing Ebola relief on the ground in Sierra Leone, for example, would mean sourcing the Leone. Without a means to reliably exchange funds into local currencies, NGOs and government aid agencies are unable to pay local staff, execute operations or even fund projects in those areas most in need of help. And unfortunately, the situation is more acute than it first appears.



Tightening regulations have caused many correspondent banks to cut ties with African countries deemed high risk, with respect to financial crime or terrorist funding. This process, known as "de-risking", has left many African countries all but cut off from international banking – including currency conversion, which is a particular concern of the anti-money laundering (AML) regulations but of vital concern to aid agencies operating in the region.

2.9.2. One currency, one Africa?

So, what are the potential solutions? One enduring proposition is a single African currency. First mooted in 1963, and most recently in 2018 by South African President Ramaphosa, a continent with its own currency would boost trade and attract foreign investment. Or so say those advocating it.



However, Africa's 54 sovereign states are diverse. A monetary union would require converging differing economic aims with regards to inflation and interest rates. Not only would Africa struggle to achieve this in the current economic climate, but it would also likely create a myriad of new, unpredictable problems. Countries would lack the ability to respond individually to asymmetric shocks, for example. And the alternative – a unilateral monetary policy – would be unable to serve the economic needs of all equally.

Given the structural concerns a single currency is likely to create, its implementation – at least for now – looks to be out of reach.

2.9.3. Combining technology and experience

Clearly, a medium-term solution is vital – if investors, NGOs, development agencies, trading companies, and remittance firms are to continue their operations on the continent. But adhering to international AML regulations means ensuring compliance is key. This can be best achieved by working alongside local African banks to ensure that their compliance procedures meet international standards.

Such a process could remove risk without having to remove partnerships – and result in improved AML procedures, IT system implementation, staff training and upgrading client Due Diligence information management.

FX trading, in particular, has innovative responses to compliance-related challenges. So new FX online trading platforms are helping fill the gap for local African currencies: at Crown Agent's Bank we have our own, Empower FX, for example. With offerings granting nimble access to over 500 currency pairs – and live integrated news feeds to track market fluctuation – such modern currency trading technologies allow for greater liquidity at more competitive prices.

In turn, innovative compliance solutions, new FX trading technology, and sector expertise can begin to offset the disadvantages of an illiquid currency market and – ultimately – help to ensure quick and efficient access to local funds across the African continent.



2.10. African economy table overview

The following table shows the (i) population, (ii) GDP per capita, (iii) Inflation Rate, Trade Balance in US Dollars billions, and the GDP in USD billions, as well, of each of the fifty four (54) African countries.

* Data from tradingeconomics.com Q2-2021

	Country	Population (million people)	GDP per capita (USD)	Inflation Rate (%)	Interest Rate (%)	Trade Balance (billion USD)	GDP (USD billion)
1	Algeria	43.05	4,711	3.86	3	-1.40	170
2	Angola	31.83	3,104	24.82	15.5	2.81	94.64
3	Benin	11.80	1,260	-0.5	4	-0.53	14.39
4	Botswana	2.30	8,093	5.6	3.75	-0.09	18.34
5	Burkina Faso	20.32	822	4.6	4	0.06	15.75
6	Burundi	11.53	208	7.8	6.6	-0.07	3.01
7	Cameroon	25.88	1,523	2.15	3.25	-0.28	38.76
8	Cape Verde	0.55	3,908	0	0.25	-0.05	1.98
9	Central African Republic	4.75	384	1.9	3.25	-0.15	2.22
10	Chad	15.95	814	-0.5	3.25	1.06	11.31
11	Comoros	0.85	1409	-4.69	2.44	-0.23	1.19
12	Congo	86.79	424	6.23	10.5	0.40	47.32
13	Djibouti	0.97	34,102	0.3	1.05	-0.14	3.32
14	Egypt	100.40	3009	4.1	8.25	-3.34	303
15	Equatorial Guinea	1.36	9238	3	3.25	-5.60	11.03
16	Eritrea	3.21	20224	4.7	7.02	-0.40	6.5
17	Ethiopia	112.10	602	19.2	7	-2.65	96.11
18	Gabon	2.17	9129	1.7	3.25	3.16	16.66
19	Gambia	2.44	809	7.26	10	-0.07	1.76
20	Ghana	30.42	1884	8.5	13.5	0.17	66.98
21	Guinea	12.77	921	12.41	11.5	0.21	11.4
22	Guinea Bissau	1.92	635	0.7	4	0.00	1.34
23	Ivory Coast	25.72	1736	3.9	4	0.00	58.79
24	Kenya	52.57	1238	5.87	7	-1.10	95.5

25	 Lesotho	2.13	1384	6.7	3.5	-0.26	2.46
26	 Liberia	4.94	516	12.92	25	-0.04	3.22
27	 Libya	6.78	8122	2.8	3	3.32	52.08
28	 Madagascar	26.97	500	5.1	9.5	-0.18	14.08
29	 Malawi	18.63	524	9.2	12	-0.11	7.67
30	 Mali	19.66	794	4	4	-0.42	17.51
31	 Mauritania	4.53	1756	2.4	5	0.62	7.59
32	 Mauritius	1.27	10949	0.2	1.85	-0.25	14.18
33	 Morocco	36.47	3396	1.4	1.5	-1.99	119
34	 Mozambique	30.37	587	5.19	13.25	0.43	14.93
35	 Namibia	2.50	5766	3.9	3.75	-0.25	12.37
36	 Niger	23.31	558	3.9	4	-0.14	12.93
37	 Nigeria	201.00	2387	18.12	11.5	-1.43	448
38	 Republic of the Congo	5.38	2613	2.2	3.25	-0.23	10.82
39	 Rwanda	12.63	905	2.7	4.5	-0.19	10.12
40	 Sao Tome and Principe	0.22	1304	9.1	9	-0.01	0.43
41	 Senegal	16.30	1584	0.3	4	-0.29	23.58
42	 Seychelles	0.10	29056	10.68	3	-0.06	1.7
43	 Sierra Leone	7.81	1718	8.95	14	-0.88	3.94
44	 Somalia	15.44	950	4.21	8	-0.32	7.7
45	 South Africa	58.56	7346	4.4	3.5	0.51	351
46	 South Sudan	11.06		18.3	15	0.02	1
47	 Sudan	42.81	1724	363	16.3	-0.56	18.9
48	 Swaziland	1.16	4819	3.9	3.75	0.03	4.41
49	 Tanzania	59.73	986	3.3	5	-0.82	63.18
50	 Togo	8.28	696	3	4	-0.01	5.46
51	 Tunisia	11.81	4405	5	6.25	-0.49	38.8
52	 Uganda	45.74	957	1.9	7	-0.35	34.39
53	 Zambia	17.88	1658	23.2	8.5	0.36	23.06
54	 Zimbabwe	14.86	1183	162	40	0.02	21.44
		1,257.39	209,329.67	14.85	7.11	154.17	2,437.25
		Total Population (million people)	Average GDP per capita (USD)	Average Inflation Rate (%)	Average Interest Rate (%)	Foreign Yearly Trading Volume	Total GDP (USD billion)

African economy has an amazing potential in an unify economy with a common trading digital currency. Besides, this digital currency will be correlated to the US Dollar in order to maintain African market competitive, secure and accessible to the international demand.

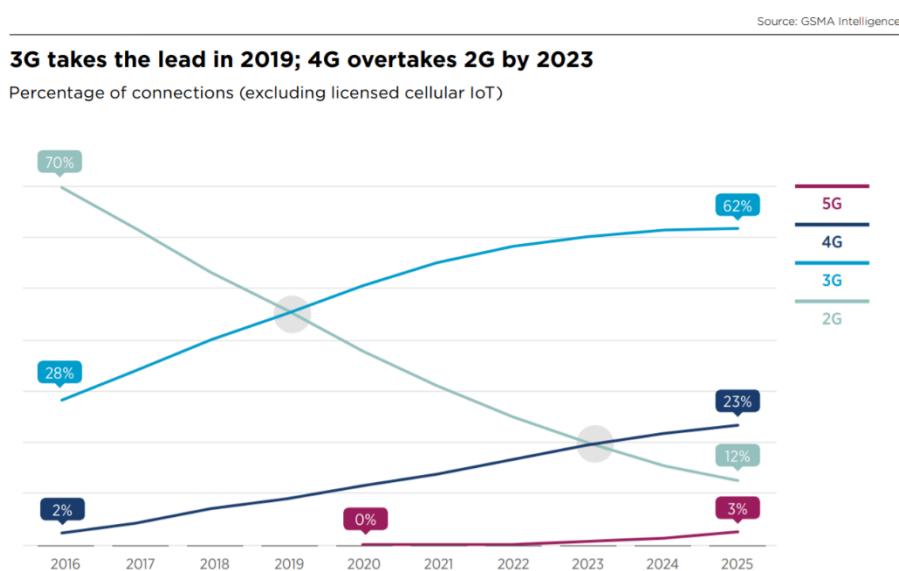
2.11. Deploying a Decentralized application (Dapp) in Africa

In the mid-1990s, the use of mobile phones started its swift spread across much of the developed world. At that time, very few thought of Africa as a potential market.

Today, the GSMA's recently-released report *The Mobile Economy: Sub-Saharan Africa 2019* predicts that sub-Saharan Africa will remain the world's fastest-growing region, adding 167 million unique mobile subscribers between 2018 and 2025. This will take the total subscriber base to just over 600 million, representing around half the population.

In fact, 3G adoption has doubled over the last two years as a result of network coverage expansion and the availability of cheaper devices that connect to the internet.

The GSMA's report also highlights the large number of young consumers becoming adults and owning a mobile phone for the first time. This segment of the population will account for the majority of new mobile subscribers and, as 'digital natives', will significantly influence mobile usage patterns in the coming years.



It is not all roses, however. More than 800 million people in Africa still don't have access to the internet, with the lowest penetration rate in the world at just under 40 percent.

Also, when we talk about Africa, we tend to think of a single 1 billion-strong geographic entity. But Africa has 54 countries with more than 2,000 languages, while urban Africa is vastly different from rural Africa. As a result, it is very unlikely that a mobile app can meet the needs of all Africans. Still, one can draw parallels and learn from patterns, trends, and data. These can better inform those looking to thrive in the African continent.

2.11.1. How best to operate in such a complex market?

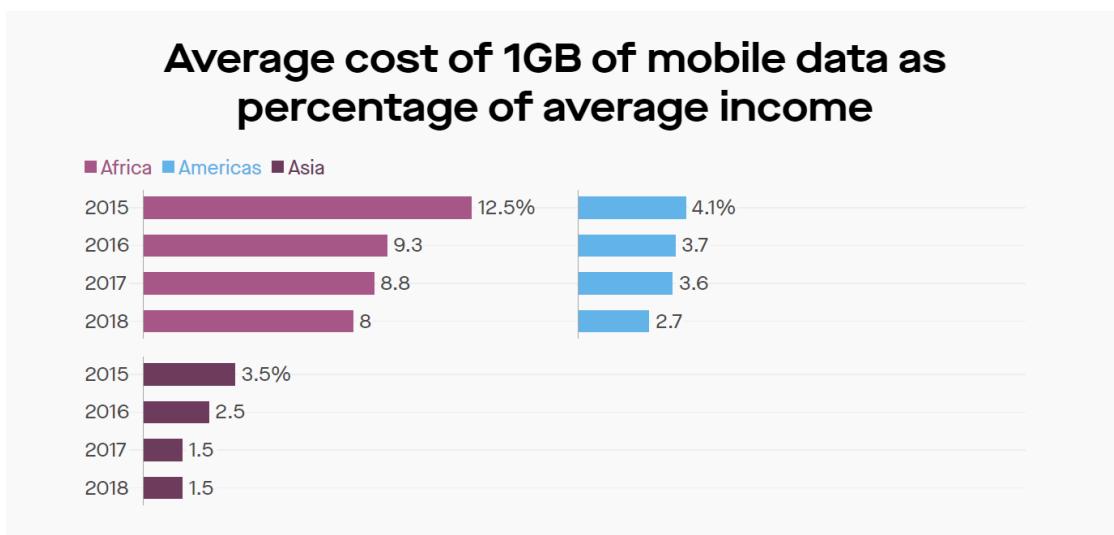
When it comes to the African continent, there is a lot to learn from WhatsApp's success. This ease and flexibility of use makes WhatsApp the most popular messaging app in most African countries, marking the third year in a row atop the charts.

WhatsApp is used by 73% of internet users in Kenya, 53% of internet users in Nigeria, and 49% of internet users in South Africa. In 2018, WhatsApp accounted for almost half of all mobile data used in Zimbabwe.

WhatsApp boasts the following features that make it so wildly successful in this region:

- ❖ The app adjusts to spotty internet service.
- ❖ It works on inexpensive feature phones.
- ❖ It can transmit anything from photos to videos to documents to spreadsheets.
- ❖ It allows people to use it for free - which is important in regions where money can be an obstacle.
- ❖ It lets people send audio messages - key in countries with high illiteracy rates.
- ❖ It is simple - you only need to know a contact's mobile phone number.

The Sion Blockchain Ecosystem (SBE) must have the following key points when its development and deployment of the Sion Dapps:



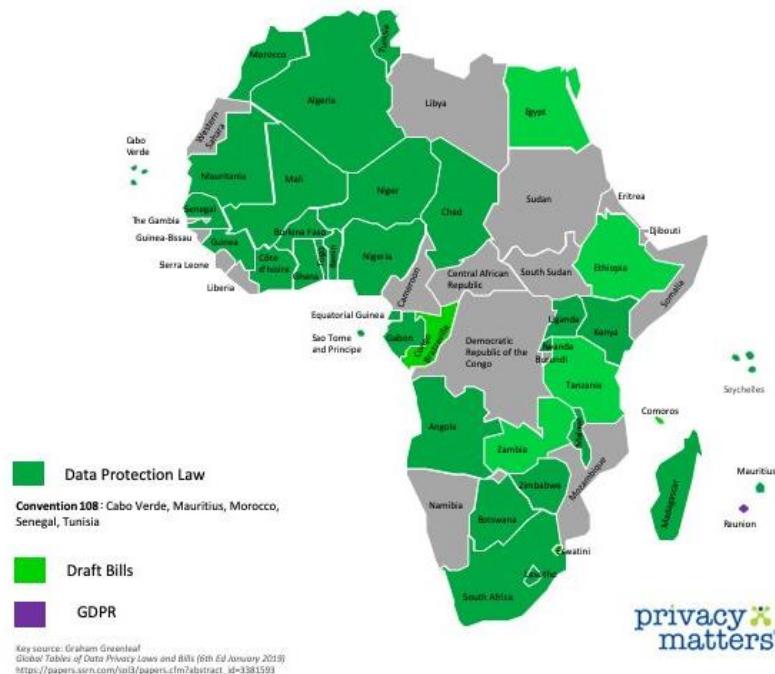
2.11.2. It will have to use data-light content.

The majority of mobile internet activity in Africa comes from web pages and not apps, due to cost.

The Internet remains prohibitively expensive: on average, a gigabyte of mobile internet data costs 8% of average income across the continent – more than anywhere else globally. The reason for the lingering cost of access largely lies in the lack of competition between internet providers in markets across the continent. Aside from cost, internet speed also poses a problem as projections show Africa is at least five years away from faster 4G mobile networks having a major impact.

As a result, services such as Twitter and WhatsApp tend to be more heavily trafficked than the data rich ones like YouTube and Vine.

Data Protection Laws and Bills - Africa



When launching an app in Africa, it is crucial to recognize the African user. To acknowledge their experience is to recognize the high cost of data in Africa that limits their desire to engage with data-heavy content and campaigns. If you want to reach a larger and broader audience, cater to users with a slower connection that focuses on text and links as opposed to video and photos.

2.11.3. We must build apps that add instrumental value

While this is pretty much the case anywhere in the world, it is especially important in Africa.

To succeed in the continent, you must not only build power and data-efficient apps, but also develop apps that deliver real value that a consumer with limited storage space and limited data will want to use.

This is why some predict that for African consumers, the super app model (similar to WeChat in China) could likely enjoy much success.



Africa does not have a super app yet, although WhatsApp is closest to it. In Africa, it is common for people to use WhatsApp to chat with friends and send memes, but also to dispute a bill with their utility providers or book an appointment with a barber. It has become a default method of office communication as well, from grapevine to major planning decisions.

Therefore, for an app to be successful in Africa, it should be of instrumental rather than self-fulfilling value.

To better understand what this means, let's look at Quick Check, a mobile app that was specifically designed to solve the difficulties Nigerians face in seeking access to credit.

According to Quick Check's CEO Fabiano Di Tomaso, "We believe in double-faced businesses: economically sustainable and socially impactful at the same time - this is Quick Check, aiming at a meaningful financial inclusion of Nigerians, by enabling consumers' participation in the economy through our digital financial services.

Many Nigerians are unbanked and have no access to formal financial services for various reasons. The results of this EFInA survey reported that over 60% of the adult population were financially excluded. With their tech solution, Quick Check not only bridges the financial inclusion gap but also educates people about financial instruments and risks related to loans and amassing too much debt.



The app should be instrumental to African users and their lives, enough to give them a reason to "sacrifice" valuable phone storage space and data to use it.

Another African startup, the Eco-Warriors™ app, is the first educational mobile game that teaches kids to recycle waste with the help of gamification.

"When we launched Eco-Warriors™, we wanted to make it available to all school kids. The strategy that we applied was to get in a partnership with the Ministry of Education locally after receiving the first-ever UNESCO Patronage for an Educational Mobile game on the African Continent", explains company's founder and CEO Brian Dean.

This partnership helped the company increase the rollout speed of the mobile game and reach more children in a shorter time frame. Today, they are present in 69 schools in the Island of Mauritius. Currently, the team is rolling out the game in the 289 remaining schools.

The spread of COVID-19 has slowed their process but by the end of the semester, Eco-Warriors™ Educational mobile game will be available in all the primary schools of Mauritius and more than 80,000 kids will be able to learn waste recycling.

2.11.4. Android apps come first

In Africa, Android phones lead in terms of market share of phones and smartphones with 84% adoption rate. They are far more affordable than Apple devices and therefore more accessible to the vast majority of Africans.

When choosing between Google Play (Android), the App Store (iOS) and Windows, it is common to develop and deploy apps in as many platforms as possible. However, in the African context where financial resources are scarce and data is expensive, you should pick one platform and track early adoption before moving to additional ones.

Data suggests you should build Android apps first, get feedback, and then roll out to other platforms. If your app does not succeed on Google Play in Africa, it will not succeed on the App Store or Windows. Furthermore, the Android platform seems to provide fewer restrictions in terms of available countries, app registration, and sales.

Mobile Operating Systems	Percentage Market Share
❖ Android	83.5%
❖ iOS	14.47%
❖ Unknown	1.52%
❖ Samsung	0.14%
❖ Linux	0.12%
❖ Series 40	0.09%

*Mobile Operating System Market Share in Africa (June 2021)

2.11.5. It can be expensive

The dynamics of the African market requires you to definitely do a lot of advertising, mostly TV and radio advertising – and these often do not come cheap. However, CPIs are usually the lowest in these markets. It offers app developers a chance to acquire users at a lower cost than more developed regions.

An app can become successful over longer periods of time organically, but to drive rapid app adoption a large marketing budget is often needed to create awareness on a wider scale.

Having said that, a limited budget should never be a limitation as there are plenty of cost-efficient ways to promote your app in the market.

Let's take as an example Teheca Limited, a solution that delivers postnatal care services in Uganda.



"We have got great success in the number of installs through mostly Google Ads followed by Facebook Ads, with Facebook being the most efficient and budget-friendly", shares their experience with the app promotion Ruyonga Daniel Bosco, CEO of Teheca Limited.

For example, for Eco-Warriors™, social media was an efficient tool for brand awareness and brand image, but to get downloads and convert parents into customers, they used other channels like email marketing, partnership, etc.

Africa has shown considerable growth and made its first appearance on the Apps Flyer's Performance Index. As a result of the continued economic development, the number of smartphone owners is rising at a rapid speed, representing fertile ground for marketers vying to attract and retain new customers.

Quick Check leveraged not only digital ads but has also partnered with brands such as Jumia and Pay Attitude (to name a few) by providing loans to their existing customers. These digital partnerships support the rapid emergence of new cross-industry business models as everything becomes connected and digital. In other words, look out for unconventional means of reaching out to your target market.

Once dominated by print, radio and television, the Nigerian media landscape is now experiencing a disruption by digital platforms and for this reason, Quick Check focusses most of its marketing efforts on digital channels.



2.11.6. The market is maturing

The app economy in Africa represents a tremendous opportunity for the economic and social development in Africa, and for the businesses developing them.

The GSMA report estimated that the mobile industry will contribute \$214 billion to the GDP. Currently, the cost of basic simple smartphones is falling rapidly, and they will soon be within reach of the majority of people in the African region. Also, mobile phone coverage in Africa is rapidly improving and many areas now have access to LTE, delivering high speed and advanced functionality.

There are many unique economic contexts within Africa that create opportunities for unique African solutions, and they represent opportunities from which app development and marketing can take place.

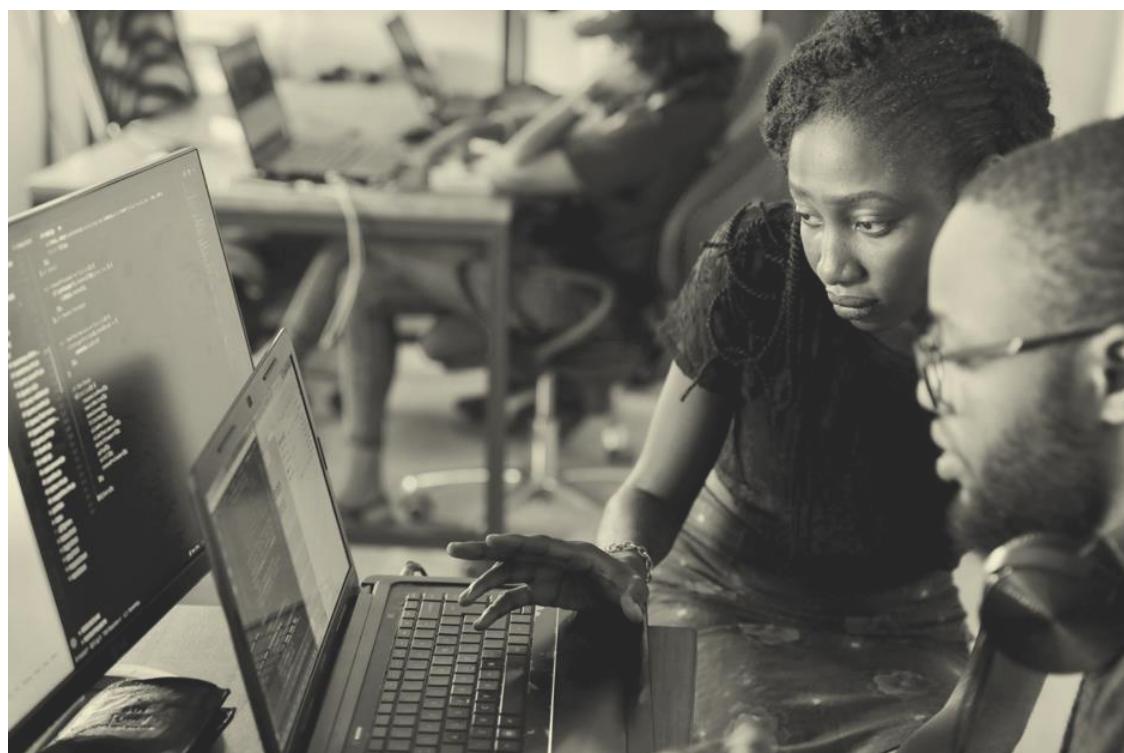
2.11.7. Conclusions on mobile apps development in Africa

There is no one-fits-all strategy when it comes to marketing an app in the African market, as it is in any other market. It is always about trial and error and finding what works best for your product and industry. Just to sum-up:

Perform market research and approach entrepreneurs and solutions already active in the market.

Check the industry benchmarks but always set up your own after a testing period. Try not to focus too much on those examples, because each business' average numbers can lead you in the wrong direction in the end.

Always speak to your customers. Try to set up a process when you communicate with at least 5 customers per month. The market size is enormous thus, even a small piece of it can give us fairly good returns on your investment.





2.12. Cryptocurrency adoption in Africa

According to the report, Africa's on-chain cryptocurrency activity has consolidated further onto the 10 largest services in the region by volume, with those services' share of overall activity in the region rising from 67 per cent in October 2019 to 78 per cent in 2020.

Most of the activity from Africa is going to Binance – the largest cryptocurrency exchange in the world in terms of trading volume. It provides platform for trading various cryptocurrencies.

Binance's share of all cryptocurrency activity in Africa has risen sharply since the beginning of 2020, the report says. Retail-sized transfers (transfers under \$10,000) make up a larger share of Africa's cryptocurrency activity than any other region, and the need for remittances is a big part of this.

Yet, the Nigerian Central Bank recently directed banks to stop offering services to cryptocurrency providers.

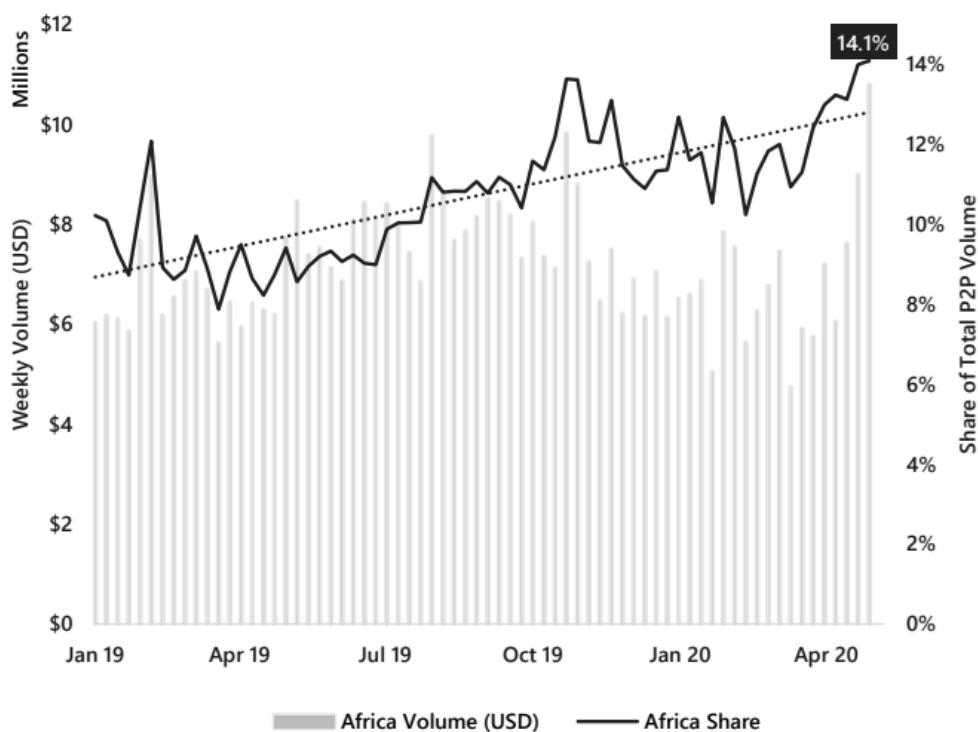
"Adoption was just beginning to take off in Africa, and in Nigeria specifically things were blowing up last year," says Buchi Okoro, co-founder and CEO of Quidax, a platform that allows people to buy and sell cryptocurrencies. "Trades are still happening on exchanges [where] you'll see trickles but it's nothing close to the volumes we saw."

With Nigeria excluded from what Mr. Okoro calls "the global prosperity," a lot of its people are now diverting to peer-to-peer (P2P) exchanges instead. Unfortunately, a lack of regulation in some of the countries could create problems when it comes to ownership of assets.

"We're seeing a lot of activity through P2P exchanges, and then other exchanges also trying to navigate the issues around getting money," he says. "But essentially, it's still about being able to find a way to be compliant."

Indeed, P2P trading is a major trend in Kenya as well. Even though the country's central bank issued a cautionary notice warning investors about cryptocurrency platforms, that did not stop a few people from diving in headfirst.

"A lot of people tweeted about banks shutting their accounts with their funds still there because they were in one way or another facilitating a cryptocurrency transaction," says Roselyne Wanjiru, Director of Growth and User Acquisitions at Pesabase, a platform that allows people to send money and make payments. "But people also felt that if they could make money from this in the middle of a pandemic, it's something they were going to do."



2.12.1. Understanding the world of cryptocurrency

Part of the problem surrounding cryptocurrency adoption in Africa, besides the lack of reliable and affordable internet, particularly beyond urban areas, is the varying level of financial literacy.

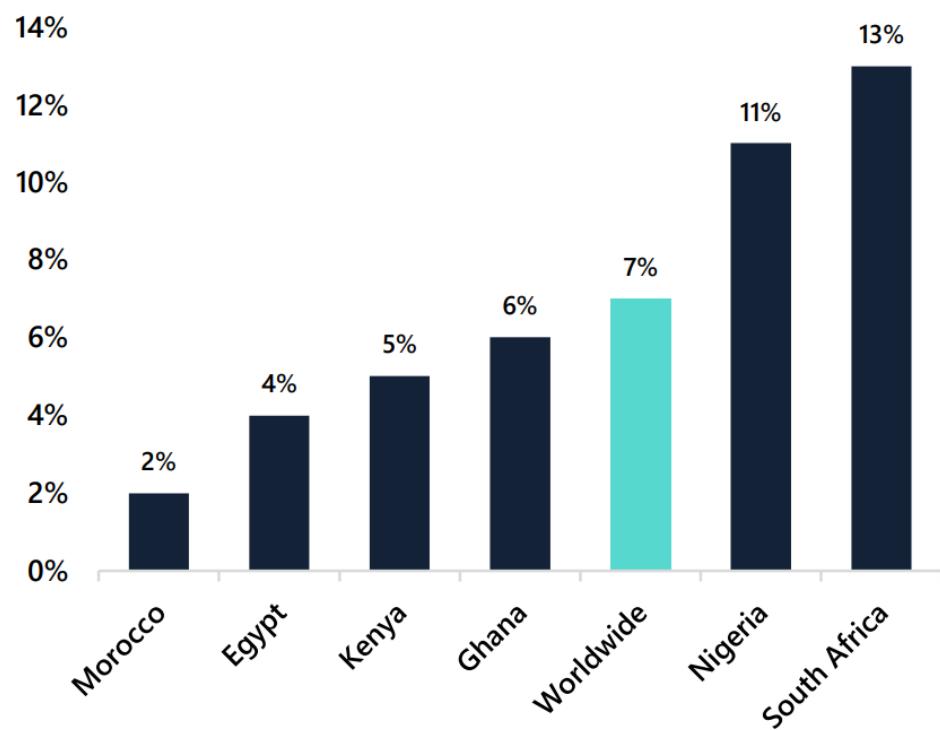
Most people are not conscious of investment types beyond the basics like real estate or stocks. Even those who hear about certain billionaires probably don't know much about how they built their wealth, beyond thinking that it has something to do with money.

"The longer it takes this information to get to the general public, especially the younger generation, the less likely they will be to aspire to this in the first place," Ms. Wanjiru says. "That means decentralized finance and cryptocurrency could be at risk of being extremely niche in the future."

Making cryptocurrency more mainstream starts with breaking down the concepts into one's local language. But although Ms. Wanjiru has seen some efforts to translate educational material into Kiswahili, there are still hundreds of other languages and dialects across the continent.

"More needs to be done to translate this to different local languages so that the elder population and those who may not be in urban areas can have access to the information," she says., "At the same time, various platforms need to make it easier for people who are completely new to cryptocurrency understand it better.

Africa Overview: Ownership of Cryptocurrency Percentage of Internet Users Aged 16 to 64



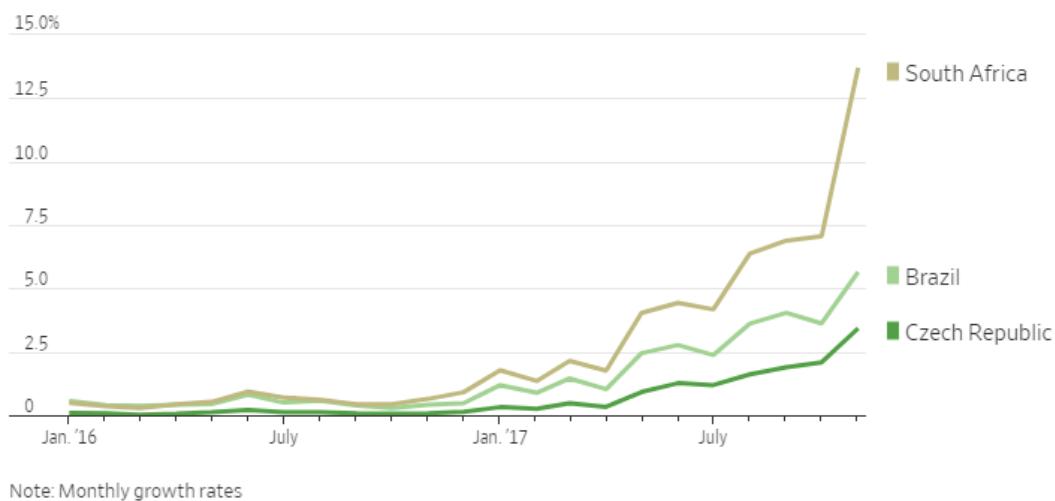
2.12.2. The need for regulation and trust

Given the constantly changing nature of the cryptocurrency world, one of the biggest risks is lack of proper regulation in some African countries. This could put companies out of business overnight through no fault of their own, yet regulation is exactly what the industry needs most.

"We have no regulatory framework. We follow the policies given to banks about things like minimum capital and transaction limits," Mr. Okoro says. "But anything can happen at any point in time. So, in terms of what we've been doing right now, we've written several letters begging for regulation."

Emerging Bitcoin

Bitcoin trading has surged in several countries amid political and economic instability



Note: Monthly growth rates
Source: eToro platform

Tied to the need for regulation is the need for trust. As someone who's spoken about cryptocurrency for years, Ms. Wanjiru has seen her friends go from mild curiosity to a strong desire to get involved.

Ms. Wanjiru believes that achieving mainstream adoption, especially when there are so many conflicting views on the subject, requires more consistency from the industry. "If they didn't trust me or didn't see my consistency, that trust wouldn't have been worth much," she says.

Bitcoin vs. Oil, Gold & Dow Jones performance in 2020

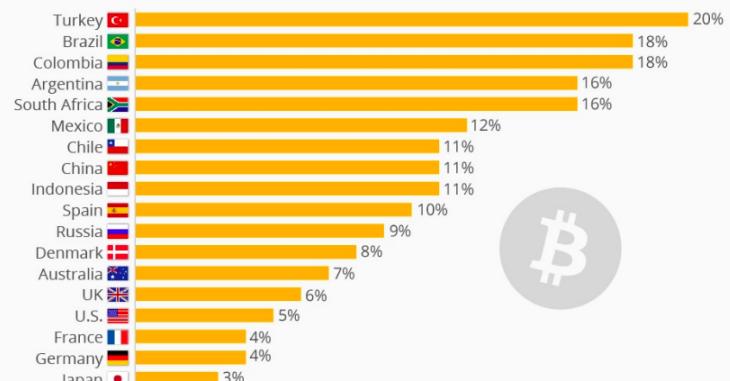


If people do not buy into your platform, or download your app, or sign up to be part of your community, you must still be present in terms of being an authority by engaging with them and answering any questions they may have, says Ms. Wanjiru: "Just be present, be consistent and build the trust that will allow these people to come (even if it's two or three years down the line) and be some of your most loyal customers.

Although the continent still has the smallest cryptocurrency economy of any region analyzed in the report, with just \$8.0 billion worth having been received and \$8.1 billion sent on-chain that year, that relatively small amount of activity is creating life-changing value for users in the region facing economic instability, offering low-fee remittances and an alternative way to save.

How Common Are Crypto Currencies Around the World?

Share of respondents who said that they used or owned crypto currencies





A large, silhouetted acacia tree stands prominently in a vast savanna landscape under a dramatic, cloudy sky. The scene is bathed in the warm, golden light of either sunrise or sunset, casting long shadows and creating a serene atmosphere.

SION COIN

| CHAPTER III

Sion Coin

“Only two things are infinite, the universe and fiat currencies, and I’m not sure about the universe.”

- Albert Einstein *remix*

3. Sion Coin

3.1. Sion origins

Sion (also variously transliterated Zion, Tzion, Tsion, Tsiyyon) is a placename in the Hebrew Bible used as a synonym for Jerusalem as well as for the Land of Israel as a whole (see Names of Jerusalem). The name is found in 2 Samuel (5:7), one of the books of the Hebrew Bible dated to before or close to the mid-6th century BCE. It originally referred to a specific hill in Jerusalem (Mount Sion), located to the south of Mount Moriah (the Temple Mount). According to the narrative of 2 Samuel 5, Mount Sion held the Jebusite fortress of the same name that was conquered by David and was renamed the City of David. That specific hill ("mount") is one of the many squat hills that form Jerusalem, which also includes Mount Moriah (the Temple Mount), the Mount of Olives, etc. Over many centuries, until as recently as the Ottoman era, the city walls of Jerusalem were rebuilt many times in new locations, so that the particular hill known as Mount Sion is no longer inside the city wall, but its location is now just outside the portion of the Old City wall forming the southern boundary of the Jewish Quarter of the current Old City. Most of the original City of David itself is thus also outside the current city wall. The term Tzion came to designate the area of Davidic Jerusalem where the fortress stood, and was used as well as synecdoche for the entire city of Jerusalem; and later, when Solomon's Temple was built on the adjacent Mount Moriah (which, as a result, came to be known as the Temple Mount) the meanings of the term Tzion were further extended by synecdoche to the additional meanings of the Temple itself, the hill upon which the Temple stood, the entire city of Jerusalem, the entire biblical Land of Israel, and "the World to Come", the Jewish understanding of the afterlife.

3.1.1. Etymology

The etymology of the word Sion (šiyōn) is uncertain. Mentioned in the Old Testament in the Books of Samuel (2 Samuel 5:7) as the name of a Jebusite fortress conquered by David, its origin seems to predate the Israelites. If Semitic, it may be derived from the Hebrew root šiyōn ("castle") or the Hebrew שִׂיר šiyya ("dry land" or "desert", Jeremiah 51:43). A non-Semitic relationship to the Hurrian word šeya ("river" or "brook") has also been suggested as also one of Hittite origin.

The form צִיּוֹן (Tzion, Tiberian vocalization: Šiyôn) appears 108 times in the Hebrew Bible, and once with article, as HaTzion. Tsade is usually rendered as z in English Bible translations, hence the spelling Zion (rather than Tzion). This convention apparently originates in German orthography,[10] where z is always pronounced [ts].



3.1.2. African Zionism

African Zionism, (also "amaSioni" from Sulu "people of Sion") is a religious movement with 15-18 million members throughout Southern Africa, making it the largest religious movement in the region. It is a combination of Christianity and African traditional religion. Zionism is the predominant religion of Eswatini, and forty percent of Swazis consider themselves Zionist. It is also common among Zulus in South Africa. The amaZioni are found in South Africa, Eswatini, Mozambique, Malawi, Zimbabwe, Botswana, and Namibia

The Zionist churches of southern Africa were founded by Petrus Louis Le Roux, an Afrikaner faith healer. He was a former member of the Dutch Reformed Church who joined John Alexander Dowie's Christian Catholic Church based in Zion, Illinois. In 1903 Dowie sent a Daniel Bryant to South Africa to work alongside Le Roux. In 1908 Daniel Nkonyane became the leader of the church. By the 1920s the church in Africa was entirely separated from its American version. In the mid-1980s the church in Zion, Illinois (now called Christ Community Church) began reestablishing a connection with the Zion movement in Southern Africa. The church works through an agency called Zion Evangelical Ministries of Africa or ZEMA. In South Africa, churches were established at Wakkerstroom and Charlestown on the Transvaal-Natal border.

3.1.3. Hebrew Bible

Zion is mentioned 152 times in the Hebrew Bible (Tanakh), most often in the Prophetic books, the Book of Psalms, and the Book of Lamentations, besides six mentions in the Historical books (Kings, Samuel, Chronicles) and a single mention of the "daughters of Zion" in the Song of Songs (3:11). Out of the 152 mentions, 26 instances are within the phrase of "Daughter of Zion" (Hebrew "bat Tzion").

This is a personification of the city of Jerusalem, or of its population. In Psalm 137, Zion (Jerusalem) is remembered from the perspective of the Babylonian Captivity. "[1] By the rivers of Babylon, there we sat down, yea, we wept, when we remembered Zion. [2] We hanged our harps upon the willows in the midst thereof.

For there they that carried us away captive required of us a song; and they that wasted us required of us mirth, saying, Sing us one of the songs of Zion." In verse 8, the phrase "Daughter of Babylon" appears as a personification of Babylon or its population: "[8] O daughter of Babylon, who art to be destroyed; happy shall he be, that rewarded thee as thou hast served us." Psalm 147 uses "Jerusalem" and "Zion" interchangeably to address the faithful: The Lord doth build up Jerusalem: he gathered together the outcast of Israel. [...] Praise the Lord, O Jerusalem; praise thy God, O Sion."



3.1.4. Judaism

The location of the Temple, and in particular its Holy of Holies (innermost sanctum), is the most holy place in the world for the Jewish people, seen as the connection between God and humanity. Observant Jews recite the Amidah three times a day facing the Temple Mount in Jerusalem, praying for the rebuilding of the Holy Temple, the restoration of the Temple service, the redemption of the world, and for the coming of the Messiah. In Kabbalah, the more esoteric reference is made to Tzion being the spiritual point from which reality emerges, located in the Holy of Holies of the First, Second and Third Temple.



Zionism Main articles: Zionism, Types of Zionism, Labor Zionism, Religious Zionism, Post-Zionism, and Neo-Zionism A World War I recruitment poster. The Daughter of Zion (representing the Hebrew people): "Your Old New Land must have you! Join the Jewish regiment." The term "Zionism", coined by Austrian Nathan Birnbaum, was derived from the German rendering of Tzion in his journal Selbstermanzipation ("self-emancipation") in 1890. Zionism as a political movement started in 1897 and supported a "national home", and later a state, for the Jewish people in the Land of Israel (the region of Palestine).

The Zionist movement declared the re-establishment of the State of Israel in 1948, following the United Nations Partition Plan for Palestine. Since then, and with varying ideologies, Zionists have focused on developing and protecting this state. The last line of the Israeli national anthem Hatikvah (Hebrew for "The Hope") is "... Eretz Zion, ViYerushalayim", which means literally "The land of Zion and Jerusalem".

3.1.5. Islamic tradition

Şahyūn (Arabic: صهيون, Şahyūn or Şihyūn) is the word for Zion in Arabic and Syriac.[14][15] Drawing on biblical tradition, it is one of the names accorded to Jerusalem in Arabic and Islamic tradition. A valley called Wādī Sahyūn seemingly preserves the name and is located approximately one and three-quarter miles from the Old City's Jaffa Gate. For example, the reference to the "precious cornerstone" of the new Jerusalem in the Book of Isaiah 28:16 is identified in Islamic scholarship as the Black Stone of the Kaaba. This interpretation is said by ibn Qayyim al-Jawziyya (1292–1350) to have come from the People of the Book, though earlier Christian scholarship identifies the cornerstone with Jesus.

3.1.6. Latter Day Saint

Within the Latter Day Saint movement, Sion is often used to connote a peaceful ideal society. In the Latter Day Saints belief system, the term Sion is often used to determine a place of gathering for the saints. It is also often used to determine an area or city of refuge for the saints.

3.1.7. Rastafari movement

In Rastafari, "Zion" stands for a utopian place of unity, peace and freedom, as opposed to "Babylon", the oppressing and exploiting system of the materialistic modern world and a place of evil.



It proclaims Zion, as reference to Ethiopia, the original birthplace of humankind, and from the beginning of the movement calls to repatriation to Sion, the Promised Land and Heaven on Earth. Some Rastafari believe themselves to represent the real Children of Israel in modern times, and their goal is to repatriate to Ethiopia, or to Zion. The Ge'ez-language Kebra Nagast serves as inspiration for the idea that the "Glory of Zion" transferred from Jerusalem to Ethiopia in the time of Solomon and Sheba, c. 950 BC.



Rastafari reggae contains many references to Zion; among the best-known examples are the Bob Marley songs "Zion Train", "Iron Lion Zion", the Bunny Wailer song "Rastaman" ("The Rasta come from Zion, Rastaman a Lion!"), The Melodians song "Rivers of Babylon" (based on Psalm 137, where the captivity of Babylon is contrasted with the freedom in Zion), the Bad Brains song "Leaving Babylon", the Damian Marley song featuring Nas "Road to Zion", The Abyssinians' "Forward Unto Zion" and Kiddus I's "Graduation in Zion", which is featured in the 1977 cult roots rock reggae film Rockers, and "Let's Go to Zion" by Winston Francis.

Reggae groups such as Steel Pulse and Cocoa Tea also have many references to Zion in their various songs. The Jewish longing for Zion, starting with the deportation and enslavement of Jews during the Babylonian captivity, was adopted as a metaphor by Christian black slaves in the United States. [citation needed] [year needed] Thus, Zion symbolizes a longing by wandering peoples for a safe homeland. This could be an actual place such as Ethiopia for Rastafari or Israel for the Jews.

3.1.8. Mount Zion today

Today, Mount Zion refers to a hill south of the Old City's Armenian Quarter, not to the Temple Mount. This apparent misidentification dates at least from the 1st century AD, when Josephus calls Jerusalem's Western Hill "Mount Zion".[20] The Abbey of the Dormition is located upon the hill currently called Mount Zion.

3.2. Possible impacts in the African & foreign markets

Introducing a new asset into any market massively always implies volatility. African Stock Markets will be injected by a massive volume of liquidity. SION COIN will offer access to stocks and derivatives financial trading to all African users, also international users will be able to invest in African companies through a legitimate crypto-currency.

A possible long trend in most African stocks, especially technological stocks, will be started in the next years. Besides, the strong liquidity injection expected in the following years, United States Stock Market should be facing an exhaustion on their over-bought prices soon.



On the other hand, European Equity Markets recovery from the last 2020, even most of the stocks have evolve positively, most of the bullish trends, also in US Financial Markets, have been caused by a massive injection from the European Central Bank (ECB), the Federal Reserve (FED), the Bank of England (BOE), also in Asian markets, the Bank of Japan (BOJ) and the Bank of China (BOC), have printed an exorbitant amount of cash to bypass the global COVID crisis of 2020.



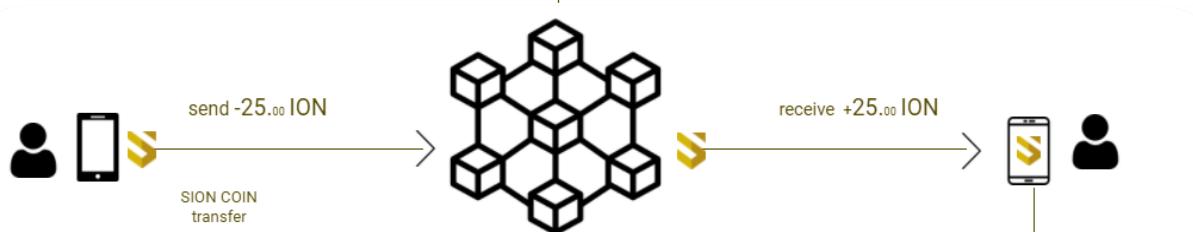
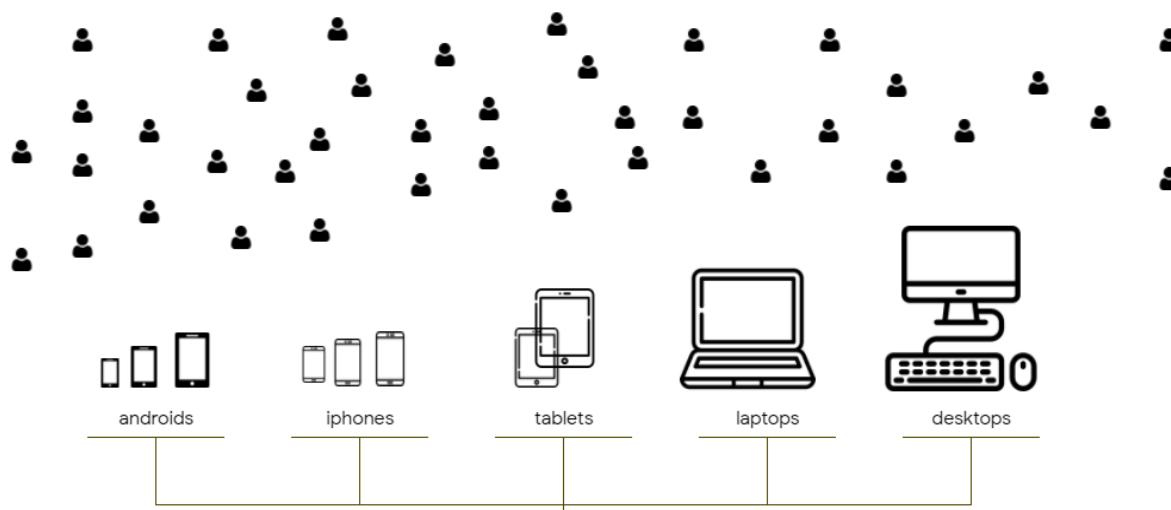
Creating an African official crypto-currency will have more benefits for Africa than losses. A strong decentralized digital currency that provides a limited offer, like in the old days - before Bretton Woods in the 73 - where Central Banks printed their bills, notes and coins based on their Gold, Silver or any valued commodity. However, the freedom of the currency foreign exchange market, and the anarchy on the global credit market in the last decades, has result in inflated ghost economy based on the trust and ignorance of the citizens but that in the recent years has been proof to be insolvent.

Main global Financial Institutions, Tier-1 banks and big investment firms will have to adapt in the new blockchain era and will have to find ways to invest in productive new industries in order to return back the big worldwide debt.

3.3. A visual introduction to Sion's ecosystem

Main global Financial Institutions, Tier-1 banks and big investment firms will have to adapt in the new blockchain era and will have to find ways to invest in productive new industries in order to return back the big worldwide debt.

Everything starts with people using technology...



Send and receive
money 100% free
anywhere in the world in seconds.

Buy in your
local
stores.

Buy & Sell
online
securely.

Charge your clients via QR code
or contactless and generate
automatic invoices and accounting.

For everybody. To anybody.



3.4. Sion Coin Maximum Supply (MS)

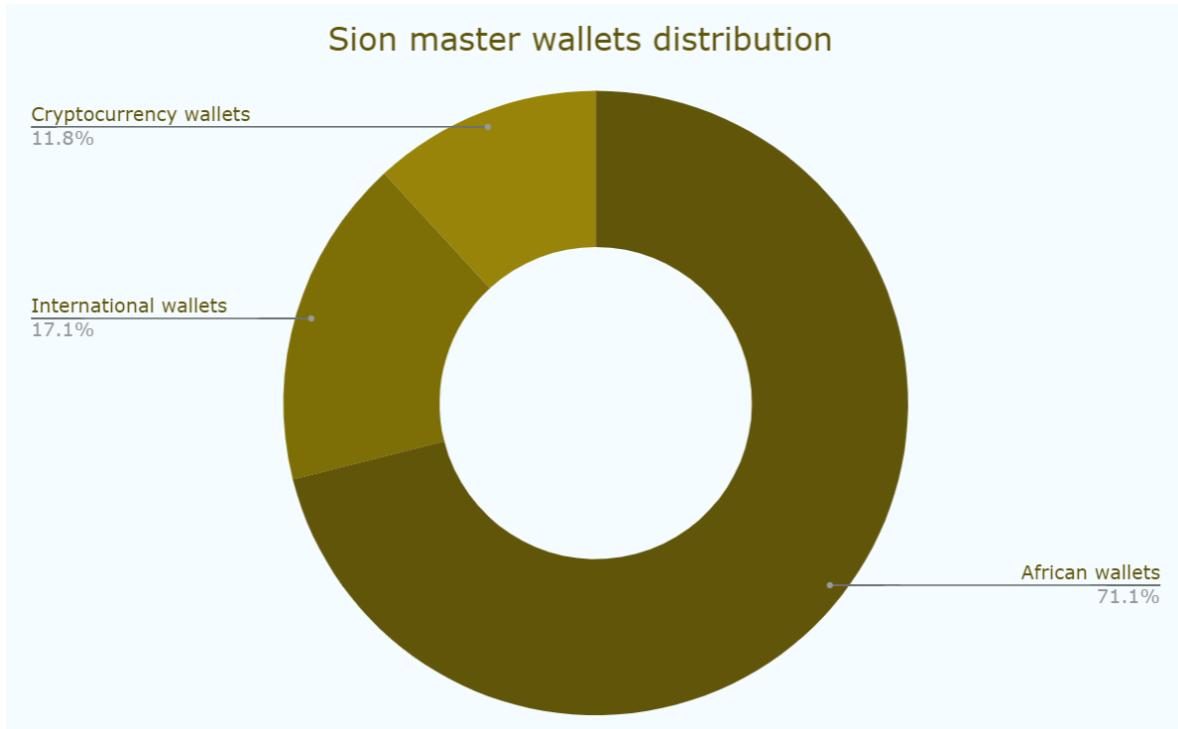
The current African GDP-PPP (in \$USD), the growth of the African economy in the last decades and, from a long term point of view, with the aim of a wealth performing African economy in the next century (around 2030), twenty two (22) trillion it's a fair amount for the future economy of Africa. That's why SION BLOCKCHAIN stamps ION (\$i) 22,000,000,000,000 (\$i22 trillion) digital coins as its maximum supply (maximum offer) and this is irrevocable after the Initial Coin Offering (ICO) is started. SION COIN RESERVES will divide the supply between each African country in relation of its central bank currency reserves balance accordingly to its \$(USD) exchange rate. Three (3) trillion ION will be destined to foreign international market.

\$1,970	\$2.6 trillion	\$6.7 trillion	ION 22 trillion
Africa's GDP per capita	Africa's nominal GDP	Africa's GDP-PPP (Purchasing Power Parity)	SION COIN maximum supply

* Growth Domestic Product (GDP) comparisons using Purchasing Power Parity (PPP) arguably more useful than those using nominal GDP when assessing a nation's domestic market because PPP takes into account the relative cost of local goods, services and inflation rates of the country, rather than using international market exchange rates, which may distort the real differences in per capita income.

3.5. Sion Coin Master Wallets (SCMW) distribution

Sion maximum supply will be distributed in four (4) blocks during the next 10 years. Although, fifty four (54) wallets will be created for each African country, thirteen (13) wallets for each international fiat-currency counterparty and nine (9) wallets for the main cryptocurrencies counterparty. The private & public keys of these wallets will be custodied by the Sion Foundation (Switzerland). The following chart shows the master wallets distribution after the deployment of Sion blockchain:





3.6. Sion Coin Initial Coin Offering (ICO)

SION COIN Initial Coin Offering (ICO) will be priced at the rate of one (1) United States Dollar (USD). The SION COIN Initial Coin Offering model will be based in empowering African economies by providing in every Coin Offering an extra discount in other to provide more expending power to Africans. On the other hand, to compensate the international market will provide a lower discount, however a Referee Bonus will be provided to foreign users and businesses that help to expand Sion network by providing an Introducing Code (IC) to their family and friends.

1 S = **1 \$**

SION COIN

US DOLLAR

Official Initial Coin Offering on December 2021

3.7. African distribution strategy by African Central Banks

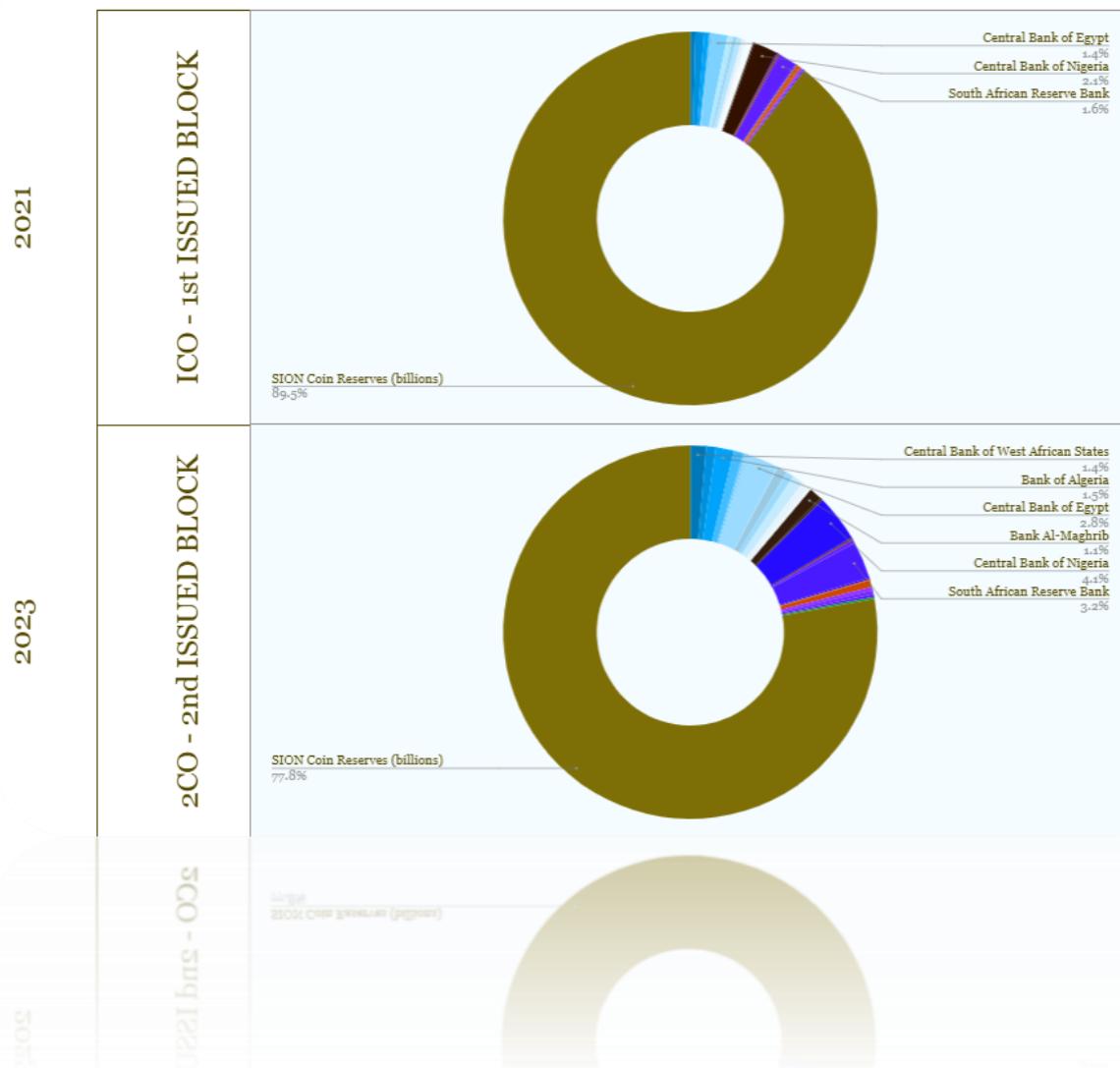
There are two African currency unions associated with multinational central banks: the West African Banque Centrale des États de l'Afrique de l'Ouest (BCEAO) and the Central African Banque des États de l'Afrique Centrale (BEAC). Members of both currency unions use the CFA Franc as their legal tender.

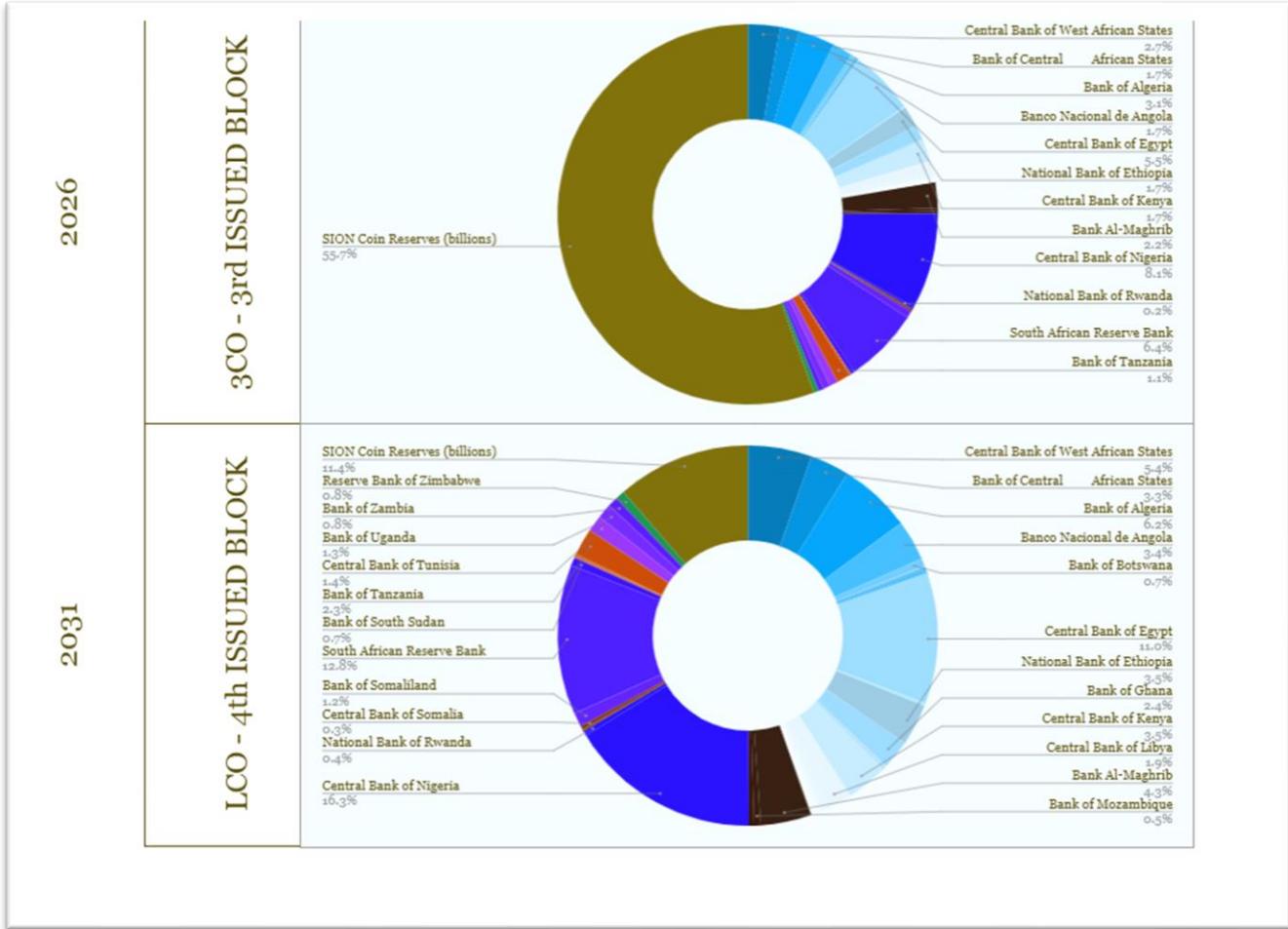
Country	Currency	Central bank	ICO 1st ISSUING BLOCK (billion IONs)	2CO 2nd ISSUING BLOCK (billion IONs)	3CO 3rd ISSUING BLOCK (billion IONs)	LCO 4th ISSUING BLOCK (billion IONs)	International Trading Volume Expected yearly (billion IONs)	
 Benin	 West African CFA franc	Central Bank of West African States	149.75	299.50	599.00	1,198.00	1.16	
								
								
								
								
								
								
								
	 Central African CFA franc	Bank of Central African States	90.80	181.60	363.20	726.40	10.49	
								
								
								
								
								
	Algerian dinar	Bank of Algeria	170.00	340.00	680.00	1,360.00	1.40	
	Angola	Angolan kwanza	Banco Nacional de Angola	94.64	189.28	378.56	757.12	2.81
	Botswana	Botswana pula	Bank of Botswana	18.34	36.68	73.36	146.72	0.09
	Burundi	Burundian franc	Bank of the Republic of Burundi	3.01	6.02	12.04	24.08	0.07
	Cape Verde	Cape Verdean escudo	Bank of Cape Verde	1.98	3.96	7.92	15.84	0.05
	Comoros	Comorian franc	Central Bank of the Comoros	1.19	2.38	4.76	9.52	0.23
	Democratic Republic of the Congo	Congolese franc	Central Bank of the Congo	10.82	21.64	43.28	86.56	0.23
	Djibouti	Djiboutian franc	Central Bank of Djibouti	3.32	6.64	13.28	26.56	0.14
	Egypt	Egyptian pound	Central Bank of Egypt	303.00	606.00	1,212.00	2,424.00	3.34

	Eritrea	Eritrean nakfa	Bank of Eritrea	6.50	13.00	26.00	52.00	0.40
	Ethiopia	Ethiopian birr	National Bank of Ethiopia	96.11	192.22	384.44	768.88	2.65
	Gambia	Gambian dalasi	Central Bank of The Gambia	1.76	3.52	7.04	14.08	0.07
	Ghana	Ghanaian cedi	Bank of Ghana	66.98	133.96	267.92	535.84	0.17
	Guinea	Guinean franc	Central Bank of the Republic of Guinea	11.40	22.80	45.60	91.20	0.21
	Kenya	Kenyan shilling	Central Bank of Kenya	95.50	191.00	382.00	764.00	1.10
	Lesotho	Lesotho loti	Central Bank of Lesotho	2.46	4.92	9.84	19.68	0.26
	Liberia	Liberian dollar	Central Bank of Liberia	3.22	6.44	12.88	25.76	0.04
	Libya	Libyan dinar	Central Bank of Libya	52.08	104.16	208.32	416.64	3.32
	Madagascar	Malagasy ariary	Central Bank of Madagascar	14.08	28.16	56.32	112.64	0.18
	Malawi	Malawian kwacha	Reserve Bank of Malawi	7.67	15.34	30.68	61.36	0.11
	Mauritania	Mauritanian ouguiya	Central Bank of Mauritania	7.59	15.18	30.36	60.72	0.62
	Mauritius	Mauritian rupee	Bank of Mauritius	14.18	28.36	56.72	113.44	0.25
	Morocco	Moroccan dirham	Bank Al-Maghrib	119.00	238.00	476.00	952.00	1.99
	Mozambique	Mozambican metical	Bank of Mozambique	14.93	29.86	59.72	119.44	0.43
	Namibia	Namibian dollar	Bank of Namibia	12.37	24.74	49.48	98.96	0.25
	Nigeria	Nigerian naira	Central Bank of Nigeria	448.00	896.00	1,792.00	3,584.00	1.43
	Rwanda	Rwandan franc	National Bank of Rwanda	10.12	20.24	40.48	80.96	0.19
	São Tomé and Príncipe	São Tomé and Príncipe dobra	National Bank of São Tomé and Príncipe	0.43	0.86	1.72	3.44	0.01
	Seychelles	Seychellois rupee	Central Bank of Seychelles	1.70	3.40	6.80	13.60	0.06
	Sierra Leone	Sierra Leonean leone	Bank of Sierra Leone	3.94	7.88	15.76	31.52	9
	Somalia	Somali shilling	Central Bank of Somalia	7.70	15.40	30.80	61.60	0.32
	Somaliland	Somaliland shilling	Bank of Somaliland	33.09	66.18	132.36	264.72	0.07
	South Africa	South African rand	South African Reserve Bank	351.00	702.00	1,404.00	2,808.00	0.51
	South Sudan	South Sudanese pound	Bank of South Sudan	18.90	37.80	75.60	151.20	0.56
	Sudan	Sudanese pound	Bank of Sudan	4.41	8.82	17.64	35.28	0.03
	Eswatini	Swazi lilangeni	Central Bank of Swaziland	4.41	8.82	17.64	35.28	0.03
	Tanzania	Tanzanian shilling	Bank of Tanzania	63.18	126.36	252.72	505.44	0.82
	Tunisia	Tunisian dinar	Central Bank of Tunisia	38.80	77.60	155.20	310.40	0.49
	Uganda	Ugandan shilling	Bank of Uganda	34.39	68.78	137.56	275.12	0.35
	Zambia	Zambian kwacha	Bank of Zambia	23.06	46.12	92.24	184.48	0.36
	Zimbabwe	Various	Reserve Bank of Zimbabwe	21.44	42.88	85.76	171.52	0.02
SION COIN SUPPLY		SION Coin Reserves (billions)	ION 19,562.75	ION 17,125.50	ION 12,251.00	ION 2,502.00	ION 37.28	
		Offer available (billions)	billion ION 22,000.00					
		Total issued (billions)	ION 2,437.25	ION 4,874.50	ION 9,749.00	ION 19,498.00	Volume International Expected (billions IONs)	
		Block issued year	2021	2023	2026	2031		

3.8. Sion Coin allocation by every block in the next decade

The distribution of the SION COIN into African's economy will take time to be integrated in the Africans daily basis. However, we value in a revalorization of the digital currency, meaning that for keep being competitive we will have to issue different massive offer blocks into African Central Banks. This injection of the full supply of SION COIN will take around 10 years, in four (4) offering blocks. The ICO will be delivered in December 2021, when the SION Blockchain clients are deployed in web Dapp, android Dapp and iOS Dapp. The 2CO will be delivered on 2023, after 2 years of the first offering. The 3CO will be injected in 2026, 3 years after the 2CO. The last block, LCO, will be provided in 2030, 4 years after the 3CO. An integration of 2, 3 and 5 years.





SION COIN will be introduced into Africa's economy during a time period of 10 years approximately until at least 80% of the active internet devices and IOTs users will be into SION's Decentralized Economy (ZDE), an economy free and scalable, for everybody and favoring nobody but its own users. ZDE model will provoke a revolution in the future of Africa and the world. By deleting intermediaries, unnecessary financial cost, cross-border limitation, and the reduce the hangover of the colonization. At the end of the massive distribution during years, in the Last Coin Offering (LCO), SION ROYAL COIN RESERVES will hold 500B IONs against a global market of 19,500 IONs. So, 97,5% will be delivered to the African and international market. SION will make the revolution in the Mother Earth, that hopefully, will benefit millions of families and businesses.

Can you imagine how powerfull and competitive will be Africa with a common digital currency in a unified economy?

3.9. African exchange rates by ICO's 4 blocks & country

[1] ICO (Initial Coin Offering), [2] 2CO (2nd Coin Offering), [3] 3CO (3rd Coin Offering), [4] LCO (Last Coin Offering)

	Flag	Country	Currency	FX Symbol	1 ION = 1 USD (Official ICO rate)	ICO[1] ION rate	2CO[2] ION rate	3CO[3] ION rate	LCO[4] ION rate
					Block Discount	80%	60%	40%	20%
1		Algeria	Algerian dinar	DZD	133.30				
2		Angola	Angolan kwanza	AOA	642.22				
3		Botswana	Botswana pula	BWP	10.63	4.00 ION	3.00 ION	2.00 ION	1.50 ION
4		Burundi	Burundian franc	BIF	1,971.19				
5		Cape Verde	Cape Verdean escudo	CVE	90.46				
6		Cameroon							49
7		Central African Republic							48
8		Chad							47
9		Republic of the Congo							46
10		Equatorial Guinea							45
11		Gabon							44
12		Benin							43
13		Burkina Faso							42
14		Guinea-Bissau							41
15		Ivory Coast							40
16		Mali							39
17		Niger							38
18		Senegal							37
19		Togo							36
20		Comoros	Comorian franc	KMF	404.38				35
21		Democratic Republic of the Congo	Congolese franc	CDF	2,002				34
22		Gambia	Dalasi	GMD	51.18				33
23		Djibouti	Djiboutian franc	DJF	177.95	4.00 ION	3.00 ION	2.00 ION	1.50 ION
24		Egypt	Egyptian pound	EGP	15.67				31
25		Eritrea	Eritrean nakfa	ERN	15.08				30
26		Ethiopia	Ethiopian birr	ETB	43.53				29
27		Ghana	Ghanaian cedi	GHS	5.79				28
28		Guinea	Guinean franc	GNF	9,800.93	4.00 ION	3.00 ION	2.00 ION	1.50 ION
29		Kenya	Kenyan shilling	KES	107.71				26
30		Lesotho	Lesotho loti	LSL	13.78				25

31		Liberia	Liberian dollar	LRD	171.65					24
32		Libya	Libyan dinar	LYD	4.45					23
33		Eswatini	Lilangeni	SZL	13.76	4.00 ION	3.00 ION	2.00 ION	1.50 ION	22
34		Madagascar	Malagasy ariary	MGA	3,753.68					21
35		Malawi	Malawian kwacha	MWK	797.58					20
36		Mauritius	Mauritian rupee	MUR	40.45					19
37		Morocco	Moroccan dirham	MAD	8.85					18
38		Mozambique	Mozambican metical	MZN	60.96	4.00 ION	3.00 ION	2.00 ION	1.50 ION	17
39		Namibia	Namibian dollar	NAD	13.78					16
40		Nigeria	Nigerian naira	NGN	410.76					15
41		Mauritania	Ouguiya	MRU	36.12					14
42		Zimbabwe	RTGS Dollar	ZWD	361.90					13
43		Rwanda	Rwandan franc	RWF	997.59	4.00 ION	3.00 ION	2.00 ION	1.50 ION	12
44		Sao Tome and Principe	São Tomé and Príncipe dobra	STN	20.05					11
45		Seychelles	Seychellois rupee	SCR	15.45					10
46		Sierra Leone	Sierra Leonean leone	SLL	10,250					9
47		Somalia	Somali shilling	SOS	585.00					8
48		South Africa	South African rand	ZAR	13.75	4.00 ION	3.00 ION	2.00 ION	1.50 ION	7
49		South Sudan	South Sudanese pound	SSP	130.26					6
50		Sudan	Sudanese pound	SDG	419.50					5
51		Tanzania	Tanzanian shilling	TZS	2,319.11	4.00 ION	3.00 ION	2.00 ION	1.50 ION	4
52		Tunisia	Tunisian dinar	TND	2.73					3
53		Uganda	Ugandan shilling	UGX	3,546.35					2
54		Zambia	Zambian kwacha	ZMW	22.51					1

Fifty four (54) African countries and forty three (43) currencies with its Central Bank. The 1st ICO will be delivered on December 2021, only 1/4 of the maximum supply will be distributed accordingly between African and International demand. Each country's Central Bank will receive the passwords of its Sion Coin 1st block supply. Each country representative will deliver its Sion offer between country's commercial banks and currency exchange houses. Also, Sion ambassadors will be able to share a referee link to their loved ones and will earn 30% on their introduced users deposits during the first year.

Depending on the regulation of each African country, users will be able to buy and sell Sion Coin through Sion Exchange platform which is owned by the Sion Foundation NPO (Switzerland), a non-profitable organization (see Chapter VI – Sion Foundation) responsible of creation Sion blockchain and its ecosystem.

3.10. International exchange rates by ICO block

Sion's international demand will be satisfied through Sion Exchange web platform and the easy access connection between the exchange and Sion People & Business app explained in the next chapter.

Sion Coin counterparty will be traded against thirteen (13) G20 FX currencies. On the other hand, nine (9) cryptocurrencies from the top 10 most capitalized ones, will be tradeable as well.

In 2022, Sion Exchange will incorporate derivatives financial contracted (futures and options) for Sion Coin and its counterparty.

One of the main goals of the Sion Foundation is to maintain a strict counterparty to Sion markets in order to maintain a fix liquidity low and keep the Sion Coin market rate peg to US Dollar. Each of the Sion Exchange instruments will be market made by passive algorithms and aggressive ones that will take each Sion Coin quote offered under one US Dollar (\$1,00).

[1] Referee Bonus for introducing people to SION COIN

Currency		1 ION = 1 USD (Official ICO rate)	ICO (Initial Coin Offerig) ION rate	2CO (2nd Coin Offering) ION rate	3CO (3rd Coin Offering) ION rate	LCO (Last Coin Offering) ION rate	Referee Bonus [1]
		Block Discount	-50%	-30%	-20%	-10%	
INTERNATIONAL FIAT-CURRENCIES	United States Dollar (USD)	1.00					
	Euro (EUR)	0.83					
	Great British Pound (GBP)	0.71					
	Switzerland Franc (CHF)	0.90					
	Chinese Yuang (CNY)	6.25					
	Japanese Yen (JPY)	110.29					
	Australian Dollar (AUD)	1.31	ION 2.00	ION 1.50	ION 1.25	ION 1.00	15%
	New Zealand Dollar (NZD)	1.40					
	Canadian Dollar (CAD)	1.21					
	Hong Kong Dollar (HKD)	7.76					
	Singapore Dollar (SGD)	1.33					
	Mexican Dollar (MXN)	20.14					
	Brazilian Real (BRL)	5.08					
MAIN CRYPTO-CURRENCIES	SION (ION)	1.00					
	Bitcoin (BTC)	0.000026					
	Ethereum (ETH)	0.000358					
	EOSio (EOS)	0.16					
	Ripple (XRP)	0.97	ION 2.00	ION 1.70	ION 1.30	ION 1.10	20%
	Bitcoin Cash (BCH)	0.0014					
	Tether (USDT)	1.00					
	Cardano (CAR)	0.55					
	Stellar (STE)	4,437.94					

3.11. Sion Coin expected adoption in Africa (2021-2031)

As mentioned earlier, Sion Coin adoption into Africans daily life's is expected to last around 10 years. In the following charts it's shown a simulation of the four (4) coin offerings from 2021 to 2031,

In the following tables we can see the four (4) Sion Coin offering blocks over each African central bank during the next decade.

African Central Banks reserves in billions ION	SION Coin Reserves (billions)	1 Central Bank of West African States	2 Bank of Central African States	3 Bank of Algeria	4 Banco Nacional de Angola	5 Bank of Botswana	6 Bank of the Republic of Burundi	7 Bank of Cape Verde	8 Central Bank of the Comoros	9 Central Bank of the Congo	10 Central Bank of Djibouti	11 Central Bank of Egypt	12 Bank of Eritrea	13 Bank of Uganda
2021	ION 17,562.75	149.75	90.80	170.00	94.64	18.34	3.01	1.98	1.19	10.82	3.32	303.00	6.50	34.39
2023	ION 15,125.50	299.50	181.60	340.00	189.28	36.68	6.02	3.96	2.38	21.64	6.64	606.00	13.00	68.78
2026	ION 10,251.00	599.00	363.20	680.00	378.56	73.36	12.04	7.92	4.76	43.28	13.28	1,212.00	26.00	137.56
2031	ION 502.00	1,198.00	726.40	1,360.00	757.12	146.72	24.08	15.84	9.52	86.56	26.56	2,424.00	52.00	275.12

African Central Banks reserves in billions ION	14 National Bank of Ethiopia	15 Central Bank of The Gambia	16 Bank of Ghana	17 Central Bank of the Republic of Guinea	18 Central Bank of Kenya	19 Central Bank of Lesotho	20 Central Bank of Liberia	21 Central Bank of Libya	22 Central Bank of Madagascar	23 Reserve Bank of Malawi	24 Central Bank of Mauritania	25 Bank of Mauritius	26 Bank Al-Maghrib	27 Bank of Mozambique	28 Bank of Zambia
2021	96.11	1.76	66.98	11.40	95.50	2.46	3.22	52.08	14.08	7.67	7.59	14.18	119.00	14.93	23.06
2023	192.22	3.52	133.96	22.80	191.00	4.92	6.44	104.16	28.16	15.34	15.18	28.36	238.00	29.86	46.12
2026	384.44	7.04	267.92	45.60	382.00	9.84	12.88	208.32	56.32	30.68	30.36	56.72	476.00	59.72	92.24
2031	768.88	14.08	535.84	91.20	764.00	19.68	25.76	416.64	112.64	61.36	60.72	113.44	952.00	119.44	184.48

	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
African Central Banks reserves in billions ION	Bank of Namibia	Central Bank of Nigeria	National Bank of Rwanda	National Bank of São Tomé and Príncipe	Central Bank of Seychelles	Bank of Sierra Leone	Central Bank of Somalia	Bank of Somaliland	South African Reserve Bank	Bank of South Sudan	Bank of Sudan	Central Bank of Swaziland	Bank of Tanzania	Central Bank of Tunisia	Reserve Bank of Zimbabwe
2021	12.37	448.00	10.12	0.43	1.70	3.94	7.70	33.09	351.00	18.90	4.41	4.41	63.18	38.80	21.44
2023	24.74	896.00	20.24	0.86	3.40	7.88	15.40	66.18	702.00	37.80	8.82	8.82	126.36	77.60	42.88
2026	49.48	1,792.00	40.48	1.72	6.80	15.76	30.80	132.36	1,404.00	75.60	17.64	17.64	252.72	155.20	85.76
2031	98.96	3,584.00	80.96	3.44	13.60	31.52	61.60	264.72	2,808.00	151.20	35.28	35.28	505.44	310.40	171.52

In 2031, all Sion Coin supply will be distributed in the African and global market, meaning that the Sion Foundation fund will not be able to control the price as the maximum allocation of the market is already distributed between multiple parties, which is call a market. At that time Sion Foundation will not be able to guarantee a Sion Coin peg to one US Dollar (\$1,00).

However, in 2031 we can say that the Lion is free and global traders will decide the fair value of the first official African cryptocurrency.

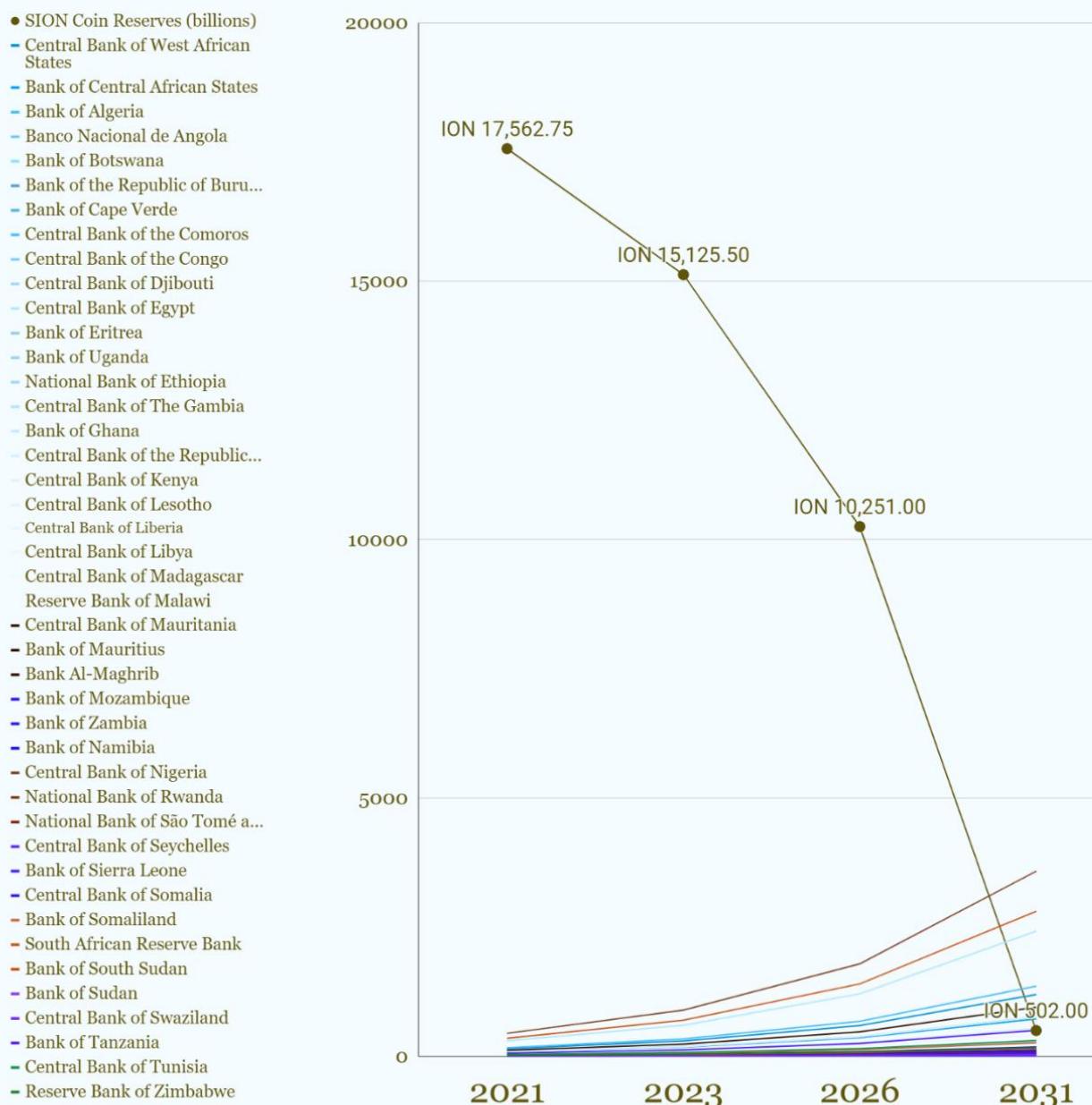
3.12. Chart of Sion Coin distribution in Africa in the next decade

The next decade Sion Foundation will execute the marketing strategy in order to make the adoption of Sion new economy for its African citizens and international users successful. We believe that making the rights moves the next three years are crucial for the project landing.

However, we strongly think that now, after COVID's crisis which opened the eyes of many people when after over a decade of Quantitative Easing (QE), main global Central Banks (FED, ECB, BOE, BOJ, etc.) leveraging first economies balances by printing 'infinite' amount of credit.

The world must wake up, fiat money is unvaluable, we need to come back to value, like productive companies stocks, commodities, mainly precious metals, and of course, cryptocurrencies. Supporting other crypto projects worldwide is one of our motivation in order to make a more fair, secure, and free economy for our children. Governments and authorities have failed us, we need to stand up to make the right movements for our future and those who we love most.

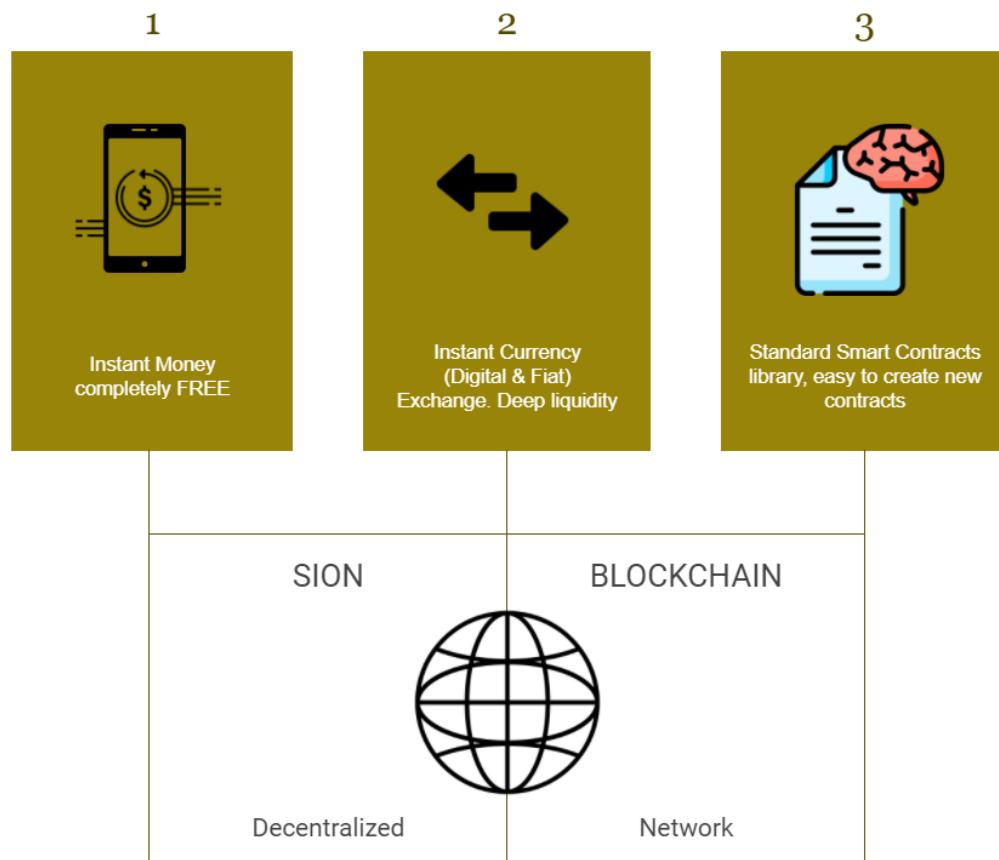
SION COIN distribution by African Central Banks in billion ION



3.13. Sion Coin 3 key strategic values

Sion Coin main keys strategic values are:

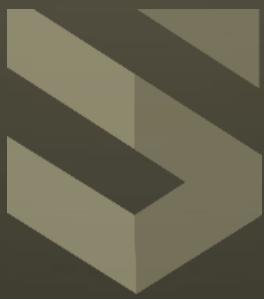
1. Cross border limitations and expensive transfer costs between countries in the traditional centralized financial system controlled by few hands are deleted. Within Sion decentralized mobile and web application users can send money to their contacts through Sion blockchain with 0% fees and instantly anywhere in the world with an internet connection.
2. Liquidity problems between African currencies are solved, with Sion Exchange you can change your currencies between forty three (43) African fiat currencies, thirteen (13) G20 FX fiat currencies and last but not less, nine (9) crypto currencies instantly. Deep liquidity for everybody with market maker algorithms and liquidity policy defined in Sion Exchange official whitepaper realized in October 2021.



3. Thanks to EOSIO open source project Sion blockchain will be able to deploy Smart Contracts on Sion's blockchain. Which means, providing to users a trustable financial and contractual system with no intermediaries in between. Business accounts will be able to contract its company employers through Smart Contracts that guarantees the employer liquidity to satisfy employer's salaries specified in the Smart Contract signed between the parties.

On the other hands, through Sion applications, users will be able to access to a credit free market where Sion users will be able, through Smart Contracts render and borrow its money with no intermediaries. Credit offering will be created by 3 parameters: credit amount, contract maturity (expiration) and interest rate (%). With these 3 parameters, a bid (offer) book will be aggregated, and borrowers will be able to access to direct liquidity with no intermediaries. The amount of the credit will be limited by user's rating and experience.

The next Chapter IV - Sion Dapps, explains the Sion client's mobile and web decentralized applications.



| CHAPTER IV

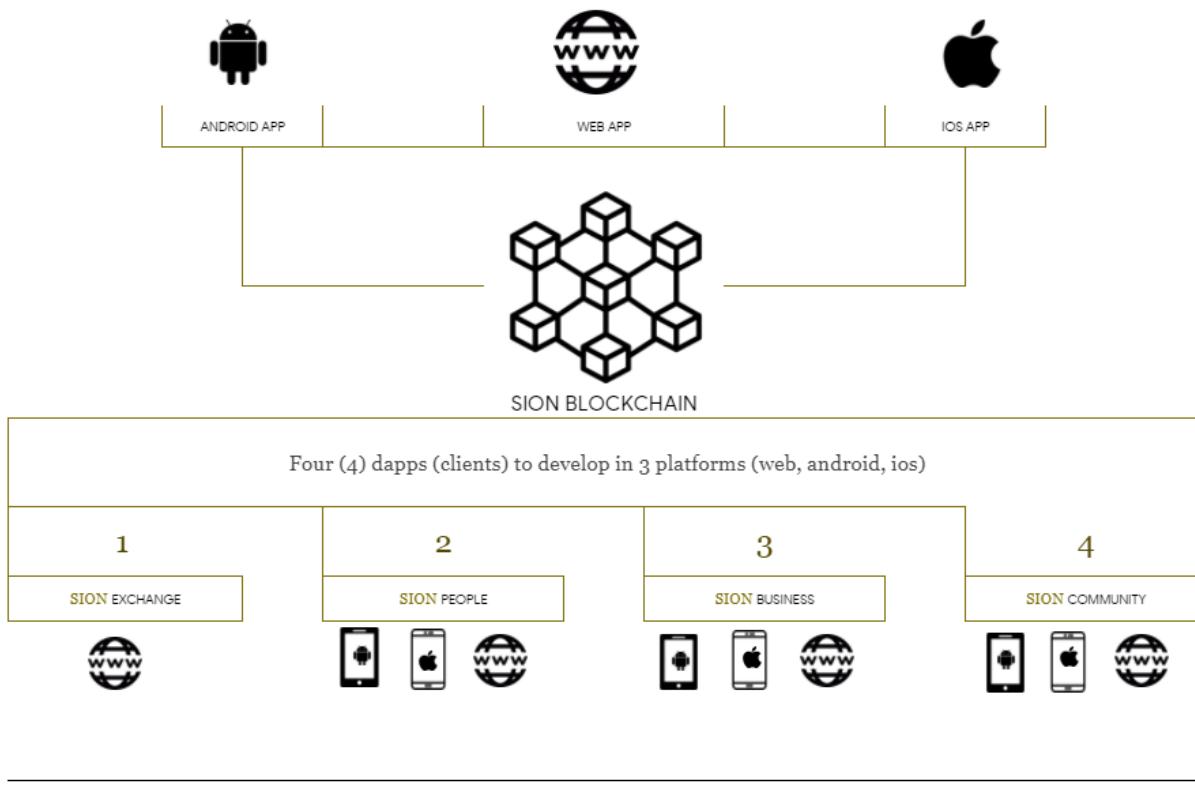
Sion Dapps

“The thing is not about having ideas; it is about making them happen.”

- Scoot Belsky

4. Sion Dapps

Sion's Decentralized Applications



"Three things cannot be long hidden: the sun, the moon, and the truth."

Your work is to discover your world and then with all your heart give yourself to it.

We are what we think. All that we are arises with our thoughts. With our thoughts, we make the world.

Do not dwell in the past, do not dream of the future, concentrate the mind on the present moment.

The mind is everything. What you think you become.

You only lose what you cling to.

Health is the greatest gift, contentment the greatest wealth, faithfulness the best relationship.

You, yourself, as much as anybody in the entire universe, deserve your love and affection.

No one saves us but ourselves. No one can and no one may. We ourselves must walk the path.

Peace comes from within. Do not seek it without."

— Gautama Buddha

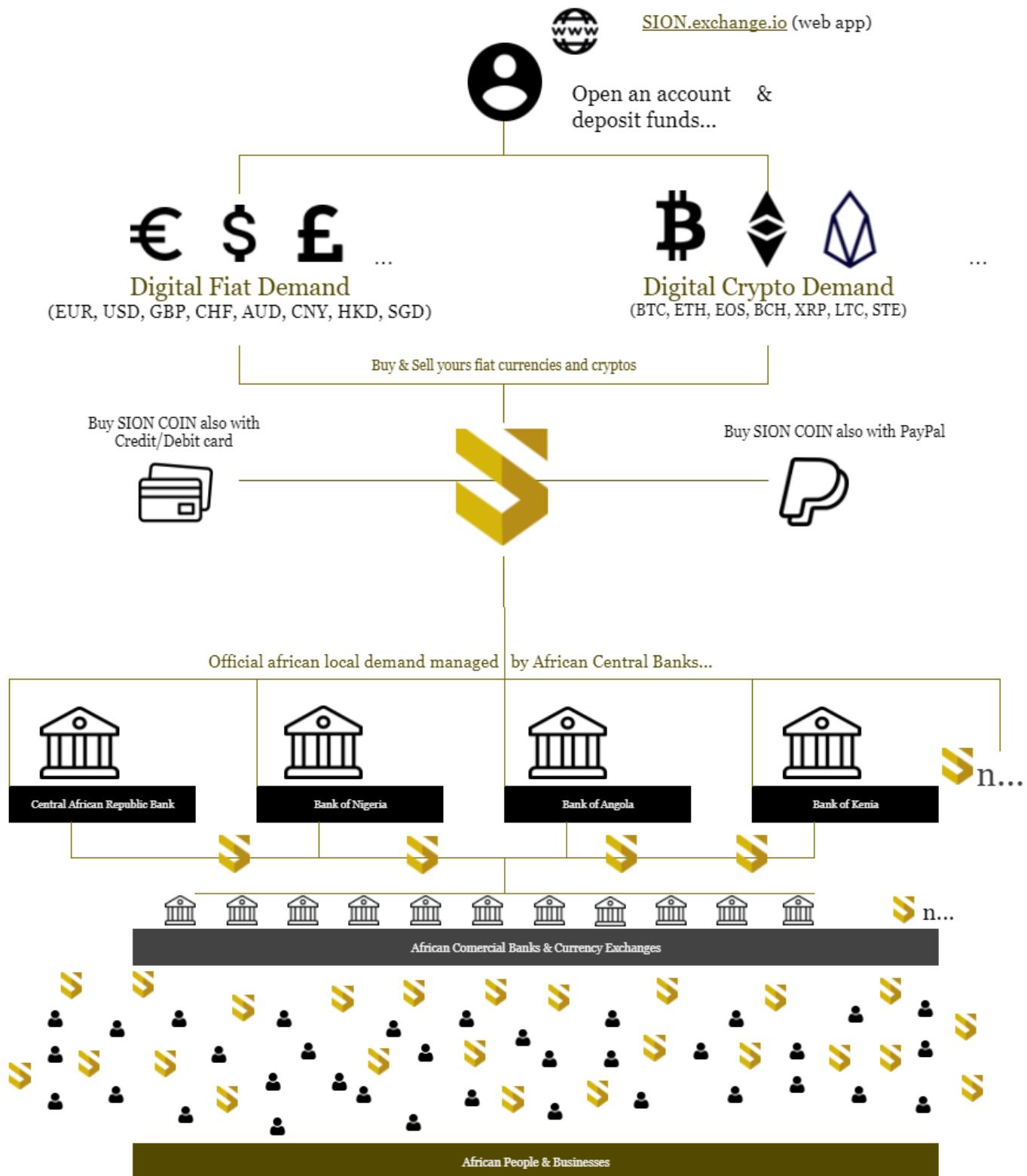


4.1. Sion Exchange

SION EXCHANGE In order to have a standardized system to buy and sell SION COIN between other crypto & fiat-currencies, we must create a SION OFFICIAL EXCHANGE. This exchange will be the first development. It consists in a web application where user can deposit fiat (EUR, USD, GBP) and crypto (BTC, ETH, EOS) and exchange it to SION COIN or even between the 6 currencies allowed. Also, users will be able to buy and sell its coins through credit/debit cards. This way we open and create the SION COIN official market.

For African users we will provide to each African Central Bank a wallet and its keys with x Sion Coin amount depending on the country \$GDP (Growth Domestic Product). Each African Central Bank will be able to provide the coins to commercial banks and national exchange houses in order to sell the coin to its citizen again cash with the local currency.

African citizen will be able to access the SION EXHANGE web Dapp with its passport, or any other identification, in order to exchange their African currencies (cash or banking) in their local exchange houses, commercial banks and the central bank of the country, and start using SION COIN in their daily basis and get the benefit of a decentralized, secure and reliable economy with SION PEOPLE.





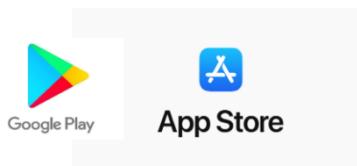
4.2. Sion People

SION PEOPLE Dapp is the SION blockchain client for private or individual users. This app (available in android, IOS or web) allows users to safe funds, store smart contracts, make transfers worldwide costless, etc. The app will be issued to Google Play market, IOS Apple Store and via website. The goal of SION PEOPLE is to be the main application for decentralized banking for Africans and foreign visitors, allowing people to interact with the app easily on a daily basis. Unlike other banking and finances applications, Sion People is a decentralized application (a client that interacts with a decentralized network), which means that all the data generated by its users is stored on **SION BLOCKCHAIN** securely, anonymously and not controlled by any third-party entity. Also, the application allows users to interact with the blockchain creating accounts, borrowing smart contracts, along others things.

SION PEOPLE will provide access to decentralized financial services to all Africans, including pay with the app and transfer fast digital money around the world completely free.

4.2.1. How to get started

Download the free app
SION PEOPLE



or SION.people.io
(web app)



1



Sign up /
register

2



Upload a photo
of your
passport

3



Upload a photo
of yourself

4



You are ready
to go!

4.2.2. How to get SION COINS



1

With PayPal or
Credit & Debit Card
in the app



2

With Bitcoin,
Ethereum or EOS in
the app



3

With cash in a
local exchange



4

Inserting a SION
receiving code

Sion Receiving Code (SRC) is a function that make transactions more secure than ever, every time that 2 users want to transfer funds, the Dapp generate a random and temporally (i.e. 5 min.) code (#hash code) of 64-124 bytes (very, very secure), and sends it to the user that wishes to transfer funds, so the receiver does not need to send his account or wallet code, so the 'account numbers' of the users keep hired. With no number account, you don't know where to hack. Simple and clever.

4.2.3. The SION PEOPLE power



1

Receive money easily, fast and securely



2

Send money worldwide securely, freely & costless



3

Pay with your phone in your local stores



4

Pay your bills & invoices digitally



5

Borrow money and receive the interests securely thanks to smart contracts. Be your own free bank.



6

Fast family transfers. Send money free to your contacts, everywhere in earth.



7

Exchange your coins to other african currencies.



8

Exchange your coins to foreign currencies, like EUR or USD.

4.2.4. Smart Contracts



It's important to understand the power of **Smart Contracts**, although it's a new technology, it has proved a strong protocol to automate operations between different wallets. Once deploy a smart contract in the blockchain, it cannot be change, neither deleted, the only thing we can do, it's to deploy another contract that's reverse the last. However, it promises a multiple of daily tasks in our economy that can be automated to make contracts and transactions more secure and fair for every part involved.

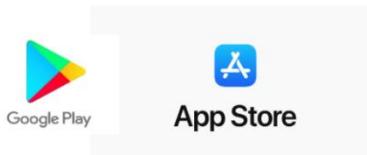
For example, an employment contract can be programmed to ensure that the employee has enough resources to fulfil its payment obligations and, in a way, it can be stamped the tasks that the employee must do to honor the contract. Don't forget that every data we insert in the blockchain can't be modified so it makes it easy to have an official control of every record in order to be used in case that a contract is not honored for any party.

4.3. Sion Business

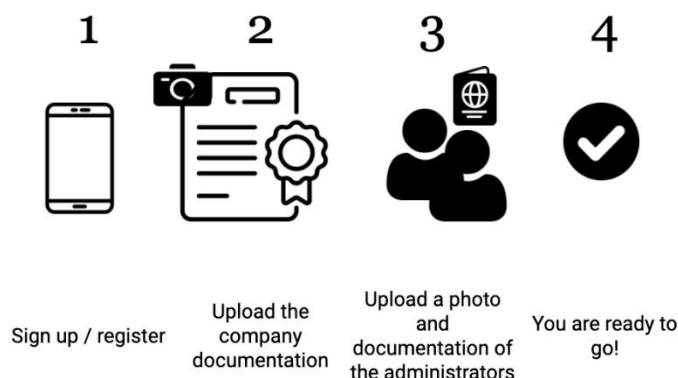
SION BUSINESS is the official Dapp for enterprises and retail businesses. The Dapp allow its users to manage their businesses, the employers, the clients, the accounting, create automatic invoices that can be paid by its hash id (blockchain transfer), via automatic QR code (image connection) or contactless (radio-frequency). Also, it will allow businesses to exchange their crypto-currencies to other African or international fiat-currencies with a low transaction fee, very attractive for international commerce. Basically, **SION BUSINESS** will be the core platform for African businesses (or worldwide) to manage the finance in a professional, complete and user-friendly interface interacting with the **SION BLOCKCHAIN** decentralized network.

4.3.1. How to get started

Download the free app
SION BUSINESS



or SION.business.io
(web app)



SION BUSINESS will make african businesses, of any side,
more competitive, professionalized, automatized and financially robusted.



4.3.2. The SION BUSINESS power



1

Receive money easily, fast and securely



2

Send money worldwide securely, freely & costless



3

Charge your clients with your favorite device, via SION RC (Receiving Code), QR code, Contactless or Smart Contracts.



4

Pay your bills & issue invoices digitally. Pay your providers automatically, saving you time and effort.



5

Borrow money and receive the interests securely thanks to smart contracts. Be your own free bank.



6

Contract your employees free through smart contracts. Pay your employees religiously every period.



7

Exchange your coins to other african currencies instantly and costless.



8

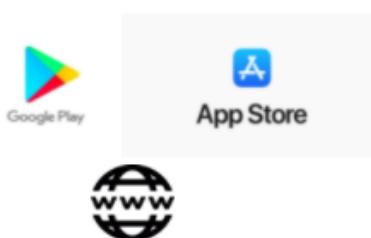
Exchange your coins to foreign currencies, like €UR or U\$D. Perfect for international commerce.

4.4. Sion Community

SION COMMUNITY will be developed on 2022 and will complete the 4 series Dapps created by SION community. This Dapp will interact in the framework of the 4 decentralized applications that interact with SION BLOCKCHAIN. In this case, SION COMMUNITY will provide to entrepreneurs, project managers, national investors and international investors to participate in a collaborative environment in development projects the African continent. The projects will go from water supplies, agricultural sustainability, climate change, educational projects and other development to do's.

4.4.1. How to get started

Download the free app
SION COMMUNITY



or SION.community.io
(web app)

1



Sign up / register
Open a Sion
Community Account

2



Upload the company
documentation (in
case of a Business
Account (BA))

3



Upload a photo or
documentation of the
administrators (in case
of BA) or your id (in
case of individual)

4



You are ready
to go!

SION COMMUNITY will help to develop equality around Africa.



4.4.2. The SION BUSINESS power



1

Invest in the Future of Africa. Access easily to thousands of projects around Africa. Invest with Sion Coins contributing to develop Africa potential.



2

Benefit from the profits of the projects you have invested through the official dapp.



3

Send funds through your Sion dapps completely free. Free and instantly withdraw so you can buy nice things for your family & friends.



4

Adopt a child. Send weekly funds to adopt orphan kids around Africa from your device. Be able to help and see the growth of a needed child. Pay for their nutrition, clothing and education until +18.

4.5. Sion ecosystem overview

SION ecosystem will be the financial services core tools for African daily lives. The four (4) free Dapps will allow everybody to have safe savings, secure labor contracts, investment capacity, self-borrowing system, a competitive discount Coin Offering, free transfer worldwide forever, liquid local and international currencies instant exchange, access to charity projects and anything that we are able to image in the next years. The goal empowers and free Africans to a controlled economy.



SION EXCHANGE



SION COMMUNITY



SION PEOPLE

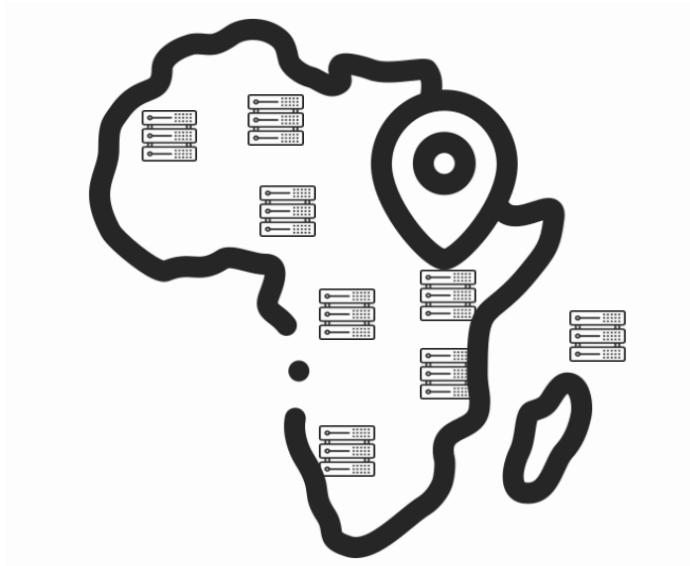


SION BUSINESS

“When something is important enough, you do it even if the odds are not in your favor.”

– Elon Musk

4.6. Sion server architecture



Sion's server architecture will be based in distributed network, secured by EOSio nodes, and with automated and balanced distributed switchers in Data Centers (DC) across Africa. Sion services will be deployed in DC around Africa. There are some big companies offering web services in the continent. Sion Foundation will pay for hosting and data storing of the decentralized Sion applications (Dapps). Maintenance and software updates will be affected by the Sion Foundation society.

"Design is not just what it looks like and feels like. Design is how it works."

Innovation distinguishes between a leader and a follower.

I want to put a ding in the universe.

Being the richest man in the cemetery doesn't matter to me. Going to bed at night saying we've done something wonderful, that's what matters to me.

Sometimes life is going to hit you in the head with a brick. Don't lose faith.

The hardest thing when you think about focusing. You think focusing is about saying "Yes." No. Focusing is about saying "No." And when you say "No," you piss off people.

It's better to be a pirate than to join the Navy.

Be a yardstick of quality. Some people aren't used to an environment where excellence is expected.

I'm as proud of what we don't do as I am of what we do.

It's rare that you see an artist in his 30s or 40s able to really contribute something amazing."

— Steve Jobs

4.7. EOSio Consensus Protocol

4.7.1. EOSio overview

An EOSIO blockchain is a highly efficient, deterministic, distributed state machine that can operate in a decentralized fashion. The blockchain keeps track of transactions within a sequence of interchanged blocks. Each block cryptographically commits to the previous blocks along the same chain. It is therefore intractable to modify a transaction recorded on a given block without breaking the cryptographic checks of successive blocks. This simple fact makes blockchain transactions immutable and secure.



4.7.2. Block Producers

In the EOSIO ecosystem, block production and block validation are performed by special nodes called "block producers". Producers are elected by EOSIO stakeholders (see 4. Producer Voting/Scheduling). Each producer runs an instance of an EOSIO node through the nodes service. For this reason, producers that are on the active schedule to produce blocks are also called "active" or "producing" nodes.

4.7.3. The Need for Consensus

Block validation presents a challenge among any group of distributed nodes. A consensus model must be in place to validate such blocks in a fault tolerant way within the decentralized system. Consensus is the way for such distributed nodes and users to agree upon the current state of the blockchain (see 3. EOSIO Consensus (DPoS + aBFT)).



4.7.4. Consensus Models

There are various ways to reach consensus among a group of distributed parties in a decentralized system. Most consensus models reach agreement through some proof. Two of the most popular ones are Proof of Work (PoW) and Proof of Stake (PoS), although other types of proof-based schemes exist, such as Proof of Activity (a hybrid between PoW and PoS), Proof of Burn, Proof of Capacity, Proof of Elapsed Time, etc. Other consensus schemes also exist, such as Paxos and Raft. This document focuses mainly on the EOSIO consensus model.

4.7.5. Proof of Work (PoW)

Two of the most common consensus models used in blockchains are Proof of Work and Proof of Stake. In Proof of Work, miner nodes compete to find a nonce added to the header of a block which causes the block to have some desired property (typically a certain number of zeros in the most significant bits of the cryptographic hash of the block header).

By making it computationally expensive to find such nonces that make the blocks valid, it becomes difficult for attackers to create an alternative fork of the blockchain that would be accepted by the rest of the network as the best chain. The main disadvantage of Proof of Work is that the security of the network depends on spending a lot of resources on computing power to find the nonces.

4.7.6. Proof of Stake (PoS)

In Proof-of-Stake, nodes that own the largest stake or percentage of some assets have equivalent decision power. In other words, voting power is proportional to the stake held. One interesting variant is Delegated Proof-of-Stake (DPoS) in which a large number of participants or stakeholders elect a smaller number of delegates, which in turn make decisions for them.

4.7.7. EOSIO Consensus (DPoS + aBFT)

EOSIO-based blockchains use delegated proof of stake (DPoS) to elect the active producers who will be authorized to sign valid blocks in the network. However, this is only one half of the EOSIO consensus process. The other half is involved in the actual process of confirming each block until it becomes final (irreversible), which is performed in an asynchronous byzantine fault tolerant (aBFT) way. Therefore, there are two layers involved in the EOSIO consensus model: Layer 1 - The Native Consensus Model (aBFT). Layer 2 - Delegated Proof of Stake (DPoS). The actual native consensus model used in EOSIO has no concept of delegations/voting, stake, or even tokens. These are used by the DPoS layer to generate the first schedule of block producers and, if applicable, update the set at most every schedule round after each producer has cycled through. These two layers are functionally separate in the EOSIO software.

4.7.8. Layer 1: Native Consensus (aBFT)

This layer ultimately decides which blocks, received and synced among the elected producers, eventually become final, and hence permanently recorded in the blockchain. It gets a schedule of producers proposed by the second layer (see 3.2. Layer 2: Delegated PoS) and uses that schedule to determine which blocks are correctly signed by the appropriate producer. For byzantine fault tolerance, the layer uses a two-stage block confirmation process by which a two-thirds supermajority of producers from the current scheduled set confirm each block twice. The first confirmation stage proposes a last irreversible block (LIB). The second stage confirms the proposed LIB as final. At this point, the block becomes irreversible. This layer is also used to signal producer schedule changes, if any, at the beginning of every schedule round.

4.7.9. EOSIO Algorithmic Finality

The EOSIO consensus model achieves algorithmic finality (differing from the merely probabilistic finality that at best can be achieved in Proof of Work models) through the signatures from the chosen set of special participants (active producers) that are arranged in a schedule to determine which party is authorized to sign the block at a particular time slot.

```
C:\Users\alexc
λ wsl
invictus@QUANTUM-ROCK:/mnt/c/Users/alexc$ cleos
ERROR: RequiredError: Subcommand required
Command Line Interface to EOSIO Client
Usage: cleos [OPTIONS] SUBCOMMAND

Options:
-h,--help                  Print this help message and exit
-u,--url TEXT=http://127.0.0.1:8888/
                           the http/https URL where nodeos is running
--wallet-url TEXT=unix:///home/invictus/eosio-wallet/keosd.sock
                           the http/https URL where keosd is running
-r,--header                pass specific HTTP header; repeat this option to pass multiple headers
-n,--no-verify              don't verify peer certificate when using HTTPS
--no-auto-keosd            don't automatically launch a keosd if one is not currently running
-v,--verbose                output verbose errors and action console output
--print-request            print HTTP request to STDERR
--print-response           print HTTP response to STDERR

Subcommands:
version                   Retrieve version information
create                    Create various items, on and off the blockchain
convert                  Pack and unpack transactions
get                      Retrieve various items and information from the blockchain
set                      Set or update blockchain state
transfer                 Transfer tokens from account to account
net                      Interact with local p2p network connections
wallet                   Interact with local wallet
sign                     Sign a transaction
push                     Push arbitrary transactions to the blockchain
multisig                 Multisig contract commands
wrap                     Wrap contract commands
system                  Send eosio.system contract action to the blockchain.
invictus@QUANTUM-ROCK:/mnt/c/Users/alexc$
```

Changes to this schedule can be initiated by privileged smart contracts running on the EOSIO blockchain, but any initiated changes to the schedule do not take effect until after the block that initiated the schedule change has been finalized by two stages of confirmations. Each stage of confirmations is performed by a supermajority of producers from the current scheduled set of active producers.

4.7.10. Layer 2: Delegated PoS (DPoS)

The Delegated PoS layer introduces the concepts of tokens, staking, voting/proxying, vote decay, vote tallying, producer ranking, and inflation pay. This layer is also in charge of generating new producer schedules from the rankings generated from producer voting. This occurs in schedule rounds of approximately two minutes (126 seconds) which is the period it takes for a block producer to be assigned a timeslot to produce and sign blocks. The timeslot lasts a total of 6 seconds per producer, which is the producer round, where a maximum of 12 blocks can be produced and signed. The DPoS layer is enabled by WASM smart contracts.

4.7.11. Stakeholders and Delegates

The actual selection of the active producers (the producer schedule) is open for voting every schedule round and it involves all EOSIO stakeholders who exercise their right to participate. In practice, the rankings of the active producers do not change often, though. The stakeholders are regular EOSIO account holders who vote for their block producers of preference to act on their behalf as DPoS delegates. A major departure from regular DPoS, however, is that once elected, all block producers have equal power regardless of the ranking of votes obtained. In other DPoS models, voting power is proportional to the number of votes obtained by each delegate.

4.7.12. The Consensus Process

The EOSIO consensus process consists of two parts: Producer voting/scheduling - performed by the DPoS layer 2 Block production/validation - performed by the native consensus layer 1 These two processes are independent and can be executed in parallel, except for the very first schedule round after the boot sequence when the blockchain's first genesis block is created.

4.7.13. Producer Voting/Scheduling

The voting of the active producers to be included in the next schedule is implemented by the DPoS layer. Strictly speaking, a token holder must first stake some tokens to become a stakeholder and thus be able to vote with a given staking power.

4.7.14. Voting Process

Each EOSIO stakeholder can vote for up to 30 block producers in one voting action. The top 21 elected producers will then act as DPoS delegates to produce and sign blocks on behalf of the stakeholders. The remaining producers are placed in a standby list in the order of votes obtained. The voting process repeats every schedule round by adding up the number of votes obtained by each producer. Producers not voted on get to keep their old votes, albeit depreciated due to vote decay. Producers voted on also get to keep their old votes, except for the contribution of the last voting weight for each voter, which gets replaced by their new voting weight.

```

README.md M README.md eos README.md eos
invictus_contract_v1.0.cpp 2 invictus_contract_v1.0.cpp 2
contracts > C invictus_contract_v1.0.cpp > eosio > token::issue(const name& const asset& const string&)
check( existing == statstable.end(), "token with symbol already exists" );
statstable.emplace( get_self(), [ ]( auto& s ) {
    s.supply.symbol = maximum_supply.symbol;
    s.max_supply = maximum_supply;
    s.issuer = issuer;
});
// Function to issue Scoin Coins to destiny account (sion @stion_master)
void token::issue( const name& to, const asset& quantity, const string& memo )
{
    auto sym = quantity.symbol;
    check( sym.is_valid(), "invalid symbol name" );
    check( memo.size() <= 256, "memo has more than 256 bytes" );
    stats statstable( get_self(), sym.code().raw() );
    auto existing = statstable.find( sym.code().raw() );
    check( existing != statstable.end(), "token with symbol does not exist, create token before" );
    const auto& st = *existing;
    check( to == st.issuer, "tokens can only be issued to issuer account" );
    require_auth( st.issuer );
    check( quantity.is_valid(), "invalid quantity" );
    check( quantity.amount > 0, "must issue positive quantity" );
    check( quantity.symbol == st.supply.symbol, "symbol precision mismatch" );
    check( quantity.amount <= st.max_supply.amount - st.supply.amount, "quantity exceeds available supply" );
    statstable.modify( st, same_payer, [ ]( auto& s ) {
        s.supply += quantity;
    });
    add_balance( st.issuer, quantity, st.issuer );
}
void token::retire( const asset& quantity, const string& memo )
{
    auto sym = quantity.symbol;
    check( sym.is_valid(), "invalid symbol name" );
    check( memo.size() <= 256, "memo has more than 256 bytes" );
    stats statstable( get_self(), sym.code().raw() );
    auto existing = statstable.find( sym.code().raw() );
    check( existing != statstable.end(), "token with symbol does not exist" );
    const auto& st = *existing;
    require_auth( st.issuer );
}

```

The screenshot shows the Visual Studio Code interface with the following details:

- Left Sidebar:** Shows the project structure with files like README.md, CMakeLists.txt, Dockerfile, and various configuration and test files.
- Central Editor:** Displays the `invictus_contract_v1.0.cpp` file containing C++ code for a blockchain contract. The code handles token issuance and retirement, validating symbols, quantities, and memo fields.
- Terminal:** Shows command-line interactions related to the EOSIO wallet and keosd. It includes commands like `cleos wallet`, `keosd`, and `cleos wallet plugin`.
- Bottom Status Bar:** Provides information about the current workspace, including file paths, line numbers, and system status.

4.7.15. Voting Weight

The voting weight of each stakeholder is computed as a function of the number of tokens staked and the time elapsed since the EOSIO block timestamp epoch, defined as January 1, 2000. In the current implementation, the voting weight is directly proportional to the number of tokens staked and base-2 exponentially proportional to the time elapsed in years since the year 2000. The actual weight increases at a rate of

$$2^{1/52} = 1.0134192$$

$$1/52 = 1.013419 \text{ per week.}$$

This means that the voting weight changes weekly and doubles each year for the same number of tokens staked.

4.7.16. Vote Decay

Increasing the voting weight produces depreciation of the current votes held by each producer. Such vote decay is intentional, and its reason is twofold: Encourage participation by allowing newer votes to have more weight than older votes. Give more voice to those users actively involved on important governance matters.

4.7.17. Producers schedule

After the producers are voted on and selected for the next schedule, they are simply sorted alphabetically by producer name. This determines the production order. Each producer receives the proposed set of producers for the next schedule round within the very first block to be validated from the current schedule round that is about to start. When the first block that contains the proposed schedule is deemed irreversible by a supermajority of producers plus one, the proposed schedule becomes active for the next schedule round.

4.7.18. Production Parameters

The EOSIO block production schedule is divided equally among the elected producers. The producers are scheduled to produce an expected number of blocks each schedule round, based on the following parameters (per schedule round):

It is important to mention that B_p (number of contiguous blocks per producer), and T_b (production time per block) are layer 1 consensus constants. In contrast, P (number of active producers) is a layer 2 constant configured by the DPoS layer, which is enabled by WASM contracts.

Therefore, the value of P , being defined at layer 2, can change dynamically in an EOSIO blockchain. In practice, however, N is strategically set to 21 producers, which means that 15 producers are required for a two-thirds supermajority of producers plus one to reach consensus.

Variable	Description	Equation
B (blocks)	Total number of blocks	B_p (blocks/producer) $\times P$ (producers)
T_p (s/producer)	Production time per producer	T_b (s/block) $\times B_p$ (blocks/producer)
T (s)	Total production time	T_p (s/producer) $\times P$ (producers)



4.7.19. Production Default Values

With the current defaults: $P=21$ elected producers, $B_p=12$ blocks created per producer, and a block produced every $T=0.5$ seconds, current production times are as follows (per schedule round):

Variable	Value
T_p : Production time per producer	$T_p = 0.5 \text{ (s/block)} \times 12 \text{ (blocks/producer)} \Rightarrow T_p = 6 \text{ (s/producer)}$
T : Total production time	$T = 6 \text{ (s/producer)} \times 21 \text{ (producers)} \Rightarrow T = 126 \text{ (s)}$

When a block is not produced by a given producer during its assigned time slot, a gap results in the blockchain.

4.7.20. Block Lifecycle

Blocks are created by the active producer on schedule during its assigned timeslot, then relayed to other producer nodes for syncing and validation. This process continues from producer to producer until a new schedule of producers is approved at a later schedule round. When a valid block meets the consensus requirements (see EOSIO, the block becomes final and is considered irreversible.

Therefore, blocks undergo three major phases during their lifespan: production, validation, and finality. Each phase goes through various stages as well.

4.7.21. Block Structure

As an inter-chained sequence of blocks, the fundamental unit within the blockchain is the block. A block contains records of pre-validated transactions and additional cryptographic overhead such as hashes and signatures necessary for block confirmation, re-execution of transactions during validation, blockchain replays, protection against replay attacks, etc. (see block schema below).

block schema

Name	Type	Description
timestamp	block_timestamp_type	expected time slot this block is produced (ends in .000 or .500 seconds)
producer	name	account name for producer of this block
confirmed	uint16_t	number of prior blocks confirmed by the producer of this block in current producer schedule
previous	block_id_type	block ID for previous block
transaction_mroot	checksum256_type	merkle tree root hash of transaction receipts included in block
action_mroot	checksum256_type	merkle tree root hash of action receipts included in block
schedule_version	uint32_t	number of times producer schedule has changed since genesis
new_producers	producer_schedule_type	holds producer names and keys for new proposed producer schedule; null if no change
header_extensions	extensions_type	extends block fields to support additional features (included in block ID calculation)
producer_signature	signature_type	digital signature by producer that created and signed block
transactions	array of transaction_receipt	list of valid transaction receipts included in block
block_extensions	extension_type	extends block fields to support additional features (NOT included in block ID calculation)
id	block_id_type	UUID of this block ID (a function of block header and block number); can be used to query block for validation/retrieval purposes
block_num	uint32_t	block number (sequential counter value since genesis block 0); can be used to query block for validation/retrieval purposes



Some of the block fields are known in advance when the block is created, so they are added during block initialization. Others are computed and added during block finalization, such as the merkle root hashes for transactions and actions, the block number and block ID, the signature of the producer that created and signed the block, etc. (see Network Peer Protocol: 3.1. Block ID)

4.7.22. Block Production

During each schedule round of block production, the producer on schedule must create $B_p=12$ contiguous blocks containing as many validated transactions as possible. Each block is currently produced within a span of $T_b=500$ ms (0.5 s). To guarantee sufficient time to produce each block and transmit to other nodes for validation, the block production time is further divided into two configurable parameters: - maximum processing interval: time window to push transactions into the block (currently set at 200 ms). - minimum propagation time: time window to propagate blocks to other nodes (currently set at 300 ms).

All loose transactions that have not expired yet or dropped as a result of a previous failed validation, are kept in a local queue for both block inclusion and syncing with other nodes. During block production, the scheduled transactions are applied and validated by the producer on schedule, and if valid, pushed to the pending block within the processing interval. If the transaction falls outside this window, it is unapplied and rescheduled for inclusion in the next block. If there are no more block slots available for the current producer, the transaction is picked up eventually by another producing node (via the peer-to-peer protocol) and pushed to another block.

The maximum processing interval is slightly less for the last block (from the producer round of B_p blocks) to compensate for network latencies during handoff to the next producer. By the end of the processing interval, no more transactions are allowed in the pending block, and the block goes through a finalization step before it gets broadcasted to other block producers for validation. Blocks go through various stages during production: apply, finalize, sign, and commit.

4.7.23. Apply Block

Apply block essentially pushes the transactions received and validated by the producing node into a block. Internally, this step involves the creation and initialization of the block header and the signed block instance. The signed block instance simply extends the block header with a signature field. This field eventually holds the signature of the producer that signs the block. Furthermore, recent changes in EOSIO allow multiple signatures to be included, which are stored in a header extensions field.

4.7.24. Finalize Block

Produced blocks need to be finalized before they can be signed, committed, relayed, and validated. During finalization, any field in the block header that is necessary for cryptographic validation is computed and stored in the block. This includes generating both merkle tree root hashes for the list of action receipts and the list of transaction receipts pushed to the block.

4.7.25. Sign Block

After the transactions have been pushed into the block and the block is finalized, the block is ready to be signed by the producer. This involves computing a signature digest from the serialized contents of the block header, which includes the transaction receipts included in the block. After the block is signed with the producer's private key, the signature digest is added to the signed block instance. This completes the block signing.



4.7.26. Commit Block

After the block is signed, it is committed to the local chain. This pushes the block to the reversible block database (see Network Peer Protocol: 2.2.3. Fork Database). This makes the block available for syncing with other nodes for validation (see the Network Peer Protocol for more information about block syncing).

4.7.27. Block Validation

Block validation is a fundamental operation necessary to reach consensus within an EOSIO blockchain. During block validation, producers receive incoming blocks from other peers and confirm the transactions included within each block. Block validation is about reaching enough quorum among active producers to agree upon: The integrity of the block and the transactions it contains.

The deterministic, chronological order of transactions within each block. The first step towards validating a block begins when a block is received by a node. At this point, some safety checks are performed on the block. If the block does not link to an already known block or it matches the block ID of any block already received and processed by the node, the block is discarded. If the block is new, it is pushed to the chain controller for processing.

4.7.28. Push Block

When the block is received by the chain controller, the software must determine where to add the block within the local chain. The fork database, or Fork DB for short, is used for this purpose. The fork database holds all the branches with reversible blocks that have been received but are not yet finalized. To that end, the following steps are performed: Add block to the fork database. If block is added to the main branch that contains the current head block, apply block;

or if block must be added to a different branch, then: if that branch now becomes the preferred branch compared to the current main branch: rewind all blocks up to the nearest common ancestor (and rollback the database state in the process), re-apply all blocks in the different branch, add the new block and apply it.

That branch now becomes the new main branch. otherwise: add the new block to that branch in the fork database but do nothing else. In order for the block to be added to fork database, some block validation must occur. Block header validation must always be done before adding a block to the fork database. And if the block must be applied, some validation of the transactions within the block must occur.

The degree to which transactions are validated depends on the validation mode that nodeos is configured with. Two block validation modes are supported: full validation (the default mode), and light validation.

4.7.29. Full Validation

In full validation mode, every transaction that is applied is fully validated. This includes verifying the signatures on the transaction and checking authorizations.

4.7.30. Light Validation

In light validation mode, blocks signed by trusted producers (which can be configured locally per node) can skip some of the transaction validation done during full validation. For example, signature verification is skipped, and all claimed authorizations on actions are assumed to be valid.

4.7.31. Block Finality

Block finality is the final outcome of EOSIO consensus. It is achieved after a supermajority of active producers have validated the block according to the consensus rules (see 3.1. Layer 1: Native Consensus (aBFT)). Blocks that reach finality are permanently recorded in the blockchain and cannot be undone. In this regard, the last irreversible block (LIB) in the chain refers to the most recent block that has become final. Therefore, from that point backwards the transactions that have been recorded on the blockchain cannot be reversed, tampered, or erased.



4.7.32. Goal of Finality

The main point of finality is to give users confidence that transactions that were applied prior and up to the LIB block cannot be modified, rolled back, or dropped. The LIB block can also be useful for active nodes to determine quickly and efficiently which branch to build off from, regardless of which is the longest one. This is because a given branch might be longer without containing the most recent LIB, in which case a shorter branch with the most recent LIB must be selected.

4.8. Transactions Protocol

4.8.1. Overview

Actions define atomic behaviors within a smart contract. At a higher level, transactions define groups of actions that execute atomically within a decentralized application. Analogously to a database transaction, the group of actions that form a blockchain transaction must all succeed, one by one, in a predefined order, or else the transaction will fail. To maintain transaction atomicity and integrity in case of a failed transaction, the blockchain state is restored to a state consistent with the state prior to processing the transaction. This guarantees that no side effects arise from any actions executed prior to the point of failure.

4.8.2. Actions

An action can be authorized by one or more actors previously created on the blockchain. Actions can be created explicitly within a smart contract or generated implicitly by application code. For any given actor: action pair there is at most one explicit associated minimum permission. If there are no explicit minimum permissions set, the implicit default is `actor@active`. Each actor can independently set their personal minimum permission for a given action. Also, a complex but flexible authorization structure is in place within the EOSIO software to allow actors to push actions on behalf of other accounts. Thus, further checks are enforced to authorize an actor to send an action (see Permission Check).

There are two types of actions involved in a transaction. They mainly differ in the way they are executed by the EOSIO software:

1. Explicit actions, which are present in a signed transaction (see 2. Transaction Instance).
2. Implicit (inline) actions, which are created as a side effect of processing a transaction.
4. Implicit (inline) actions are also defined in smart contract code, just like explicit actions. The key difference is that inline actions are not included in the actual transactions propagated through the network and eventually included in a block; they are implicit.

Explicit Actions Regular or explicit actions, as their name implies, are included in the actual list of actions that form a transaction. Explicit actions are encoded as action instances (see Action Instance) before being pushed into the transaction. Explicit actions also contain the actual payload data, if any, associated with the action to be executed as part of the transaction.



4.8.3. Implicit Actions

An implicit (inline) action is generated as a result of an explicit caller action within a transaction (or another inline action, if nested) that requires that implicit action to perform an operation for the caller action to continue. As such, inline actions work within the same scope and permissions of the caller action. Therefore, inline actions are guaranteed to execute within the same transaction.

4.8.4. Smart Contracts

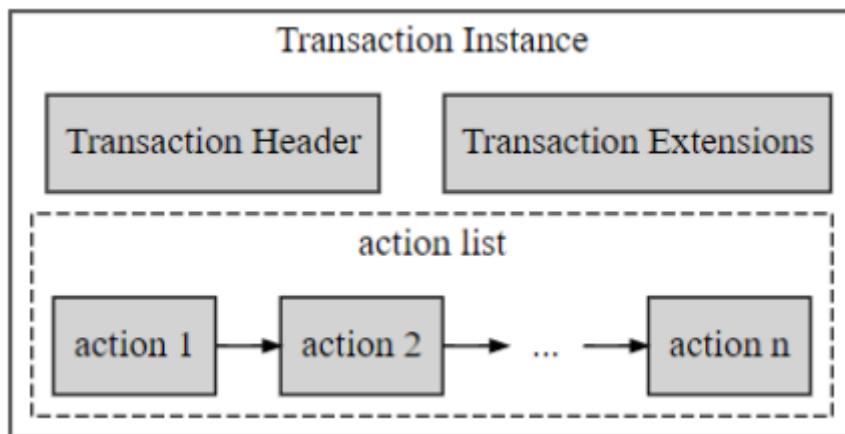
In EOSIO, smart contracts consist of a set of actions, usually grouped by functionality, and a set of type definitions which those actions depend on. Therefore, actions specify and define the actual behaviors of the contract. Several actions are implemented in the standard EOSIO contracts for account creation, producer voting, token operations, etc. Application developers can extend, replace, or disable this functionality altogether by creating custom actions within their own smart contracts and applications. Transactions, on the other hand, are typically created at the application level. Smart contracts are agnostic to them.

4.8.5. Implementation

An EOSIO smart contract is implemented as a C++ class that derives from `EOSio:contract`. Actions are implemented as C++ methods within the derived class. Transactions, on the other hand, are generated dynamically (as transaction instances) within an EOSIO application. The EOSIO software processes each transaction instance and keeps track of its state as it evolves from creation, signing, validation, and execution.

4.8.6. Transaction Instance

A transaction instance consists of a transaction header and the list of action instances and transaction extensions that make the actual transaction. The transaction header includes information necessary to assess the inclusion of the transaction in a block based on its expiration time, which is computed when the transaction is pushed for execution. Other fields include the block number that includes the transaction, a block ID prefix used to prevent "cross chain" or "cross fork" attacks, upper limits for CPU and network usage, and the number of seconds to delay the transaction, if applicable. The diagram below depicts a transaction instance.



The action instances may consist of regular actions or context free actions. Signatures are created and validated at the transaction level. Accounts and permissions are handled on a per action basis. Each action instance contains information to validate whether it is authorized to be executed based on the permission levels of the actors specified in the action and the actual authorizations defined in the smart contract for that action (see Permission Check).

4.8.7. Transaction ID

A transaction instance contains the minimum set of fields that distinguish one transaction from another. Consequently, a transaction ID consists of a cryptographic hash of the basic fields included in a transaction instance. Therefore, the transaction ID is solely determined by the list of actions encapsulated within the transaction, the transaction header, and any embedded transaction extensions, which are optional. The transaction instance can be further specialized into a signed transaction instance or a packed transaction instance.

4.8.8. Signed Transaction Instance

A signed transaction extends the basic contents of the transaction schema to include the signature(s) generated by the account(s) that signed the transaction. It also includes any data associated with the context free actions, if any, that were included in the transaction instance (see signed transaction schema below). A transaction is not ready for execution and validation unless it is signed by the applicable actors.

signed transaction schema

Name	Type	Description
expiration	time_point_sec	the time the transaction must be confirmed by before it expires
ref_block_num	uint16_t	lower 16 bits of a block number in the last 2^{16} blocks
ref_block_prefix	uint32_t	lower 32 bits of block id referred by 'ref_block_num'
max_net_usage_words	unsigned_int	upper limit on total network bandwidth billed (in 64-bit words)
max_cpu_usage_ms	uint8_t	upper limit on total CPU time billed (in milliseconds)
delay_sec	unsigned_int	number of seconds to delay transaction for
context_free_actions	array of action	list of context-free actions if any
actions	array of action	list of action instances
transaction_extensions	extensions_type	extends fields to support additional features
signatures	array of signature_type	digital signatures after transaction is signed
context_free_data	array of bytes	context-free action data to send if any

The unpacked field holds the cached unpacked trx transaction after the transaction instance is constructed. If the signed transaction was previously compressed, it is decompressed from the packed_trx field and cached to unpacked. If the signed transaction was stored uncompressed, it is simply copied verbatim to unpacked.trx. The signatures field allows a quick signature validation of the transaction without requiring a full decompression of the transaction.

4.8.9. Transaction Lifecycle

Transactions go through various stages during their lifespan. First, a transaction is created in an application or an EOSIO client such as cleos by pushing the associated actions into the transaction. Next, the transaction is sent to the locally connected node, which in turn relays it to the active producing nodes for validation and execution via the peer-to-peer network. Next, the validated transaction is pushed to a block by the active producer on schedule along with other transactions. Finally, the block that contains the transaction is pushed to all other nodes for validation. When a supermajority of producers has validated the block, and the block becomes irreversible, the transaction gets permanently recorded in the blockchain and it is considered immutable.

4.8.10. Create Transaction

Transactions are created within an application by instantiating a transaction object and pushing the related action instances into a list within the transaction instance. An action instance contains the actual details about the receiver account to whom the action is intended, the name of the action, the list of actors and permission levels that must authorize the transaction via signatures and delays, and the actual message to be sent, if any (see action schema below).

action schema

Name	Type	Description
account	name	encoded 13-char account name
action_name	name	encoded 13-char action name
authorization	array of permission_level	list of actor:permission authorizations
data	bytes	action data to send

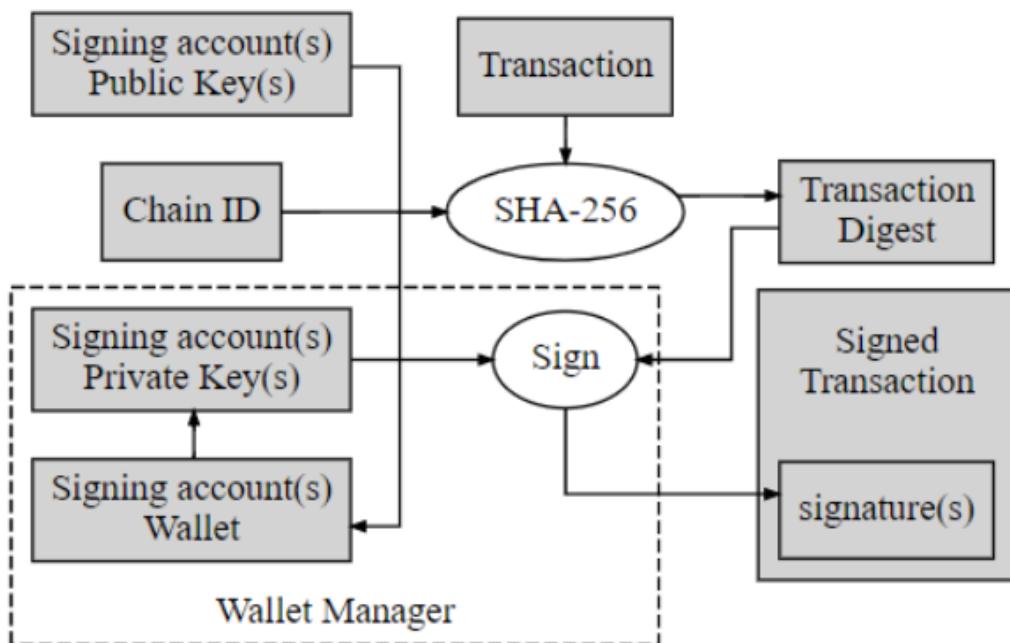
After the transaction instance is created at the application level, the transaction is arranged for processing. This involves two main steps: signing the transaction and pushing the signed transaction to the local node for actual propagation and execution of the transaction. These steps are typically performed within the EOSIO application.

4.8.11. Sign Transaction

The transaction must be signed by a set of keys sufficient to satisfy the accumulated set of explicit actors: permission pairs specified in all the actions enclosed within the transaction. This linkage is done through the authority table for the given permission (see Accounts and Permissions: Permissions).

The actual signing key is obtained by querying the wallet associated with the signing account on the client where the application is run. The transaction signing process takes three parameters: the transaction instance to sign, the set of public keys from which the associated private keys within the application wallet are retrieved, and the chain ID. The chain ID identifies the actual EOSIO blockchain and consists of a hash of its genesis state, which depends on the blockchain's initial configuration parameters.

Before signing the transaction, the EOSIO software first computes a digest of the transaction. The digest value is a SHA-256 hash of the chain ID, the transaction instance, and the context free data if the transaction has any context free actions. Any instance fields get serialized before computing any cryptographic hashes to avoid including reference fields (memory addresses) in the hash computation. The transaction digest computation and the signing process are depicted below.



After the transaction digest is computed, the digest is finally signed with the private key associated with the signing account's public key. The public-private key pair is usually stored within the local machine that connects to the local node. The signing process is performed within the wallet manager associated with the signing account, which is typically the same user that deploys the application.

The wallet manager provides a virtual secure enclave to perform the digital signing, so a message signature is generated without the private key ever leaving the wallet. After the signature is generated, it is finally added to the signed transaction instance.

4.8.12. Push Transaction

After the transaction is signed, a packed transaction instance is created from the signed transaction instance and pushed from the application to the local node, which in turn relays the transaction to the active producing nodes for signature verification, execution, and validation. Every producing node that receives a transaction will attempt to execute and validate it in their local context before relaying it to the next producing node. Hence, valid transactions are relayed while invalid ones are dropped.

The idea behind this is to prevent bad actors from spamming the network with bogus transactions. The expectation is for bad transactions to get filtered and dropped before reaching the active producer on schedule. When a transaction is received, no assumption is made on its validity. All transactions are validated again by the next producing node, regardless of whether it is producing blocks.

The only difference is that the producer on schedule attempts to produce blocks by pushing the transactions it validates into a pending block before pushing the finalized block to its own local chain and relaying it to other nodes.

4.8.13. Verify Transaction

The process to verify a transaction is twofold. First, the public keys associated with the accounts that signed the transaction are recovered from the set of signatures provided in the transaction. Such a recovery is cryptographically possible for ECDSA, the elliptic curve digital signature algorithm used in EOSIO.

Second, the public key of each actor specified in the list of action authorizations (actor: permission) from each action included in the transaction is checked against the set of recovered keys to see if it is satisfied.

Third, each satisfied actor: permission is checked against the associated minimum permission required for that actor: contract: action pair to see if it meets or exceeds that minimum. This last check is performed at the action level before any action is executed (see Permission Check).



4.8.14. Transaction Context

Once the public keys are recovered, a transaction context is created from the transaction instance. The transaction context keeps track of the trace of actions and the action receipt generated as each action is dispatched and executed. All state generated is kept within a transaction trace instance and a list of action receipts. The transaction trace consists of a list of action traces.

Each action trace contains information about the executed action, which includes the action receipt, the action instance, whether it is a context-free action, and the transaction ID that generated the action. The action receipt is generated later during transaction execution and finalization.

4.8.15. Permission Check

Since the sequence of actions contained in the transaction must be executed atomically as a whole, the EOSIO software first checks that the actors specified in each action have the minimum permission required to execute it. To that end, the software checks the following for each action: The named permission of each actor specified in each action instance.

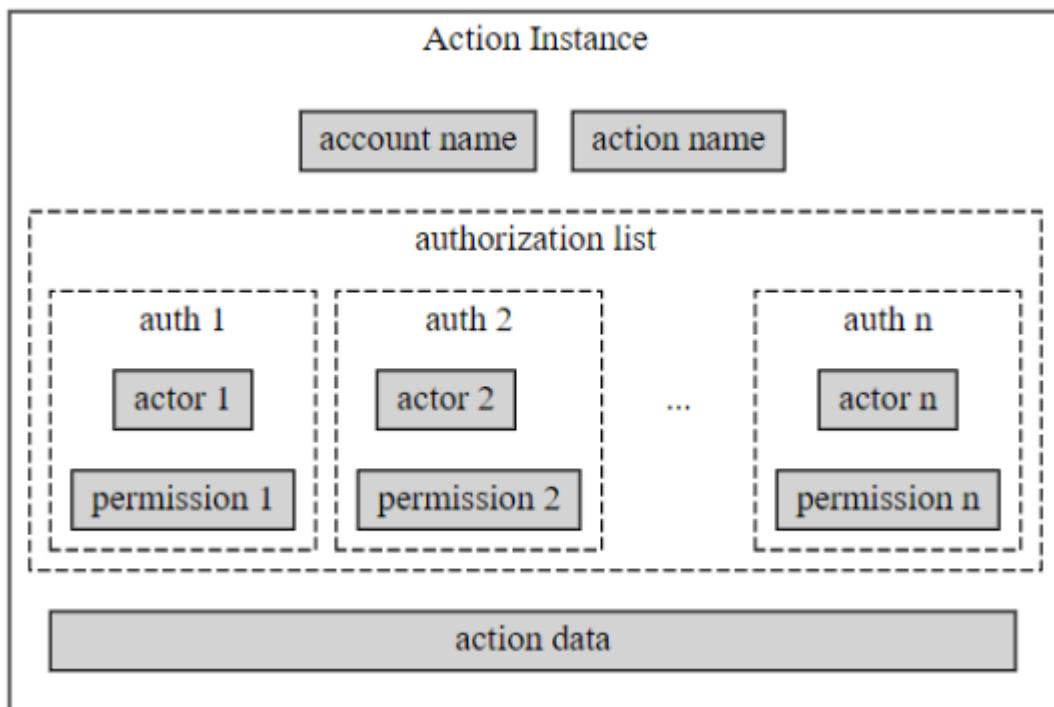
The named permission of the corresponding actor: contract: action pair specified in the smart contract. If there is at least one actor whose set of named permissions fail to meet the minimum permission level required by the corresponding actor: contract: action pair in the smart contract, the transaction fails.

The reason why action permissions are checked before any action is executed is due to performance. It is more efficient to cancel a transaction with all actions unexecuted, than doing so after a few actions executed, but later were rolled back as a result of a failed action or authorization.

Any state changes incurred during a failed action must be undone to preserve data integrity. Database sessions are expensive in terms of memory usage and computing resources. Therefore, undo operations must be minimized as possible.

4.8.16. Action Instance

The diagram below depicts an action instance. It consists of the receiver account, the action name, the list of actors and their permissions, and the action data containing the message to be sent, if any, to the receiver account.





4.8.17. Authority Check

After the minimum permission levels are checked, the authority table for the receiver account's permission that matches each actor's permission within the action instance is checked (see Accounts and Permissions: for more details).

4.8.18. Execute Transaction

To execute the transaction, a chain database session is started, and a snapshot is taken. This allows to roll back any changes made to the chain state in case any of the transaction actions fails. A corresponding transaction context keeps the transaction state during execution. To execute the transaction, each action associated with the corresponding transaction instance is dispatched for execution. Context free actions, if any, are dispatched first, followed by regular actions.

4.8.19. Apply Context

To prepare for action execution, an apply context instance is created locally for each action. The apply context, as its name implies, contains references to the necessary resources to apply the action, such as an instance to the chain controller (see Network Peer Protocol: Chain Controller), the chain database where state is kept, the transaction context where the transaction is running, the actual action instance, and the receiver account to whom the action is intended.

4.8.20. Action Trace

To prepare each action for execution, both action receipt and action trace instances are initialized. First, a hash of the action instance itself is computed and stored in the action receipt. Next, the action trace is initialized with statistics about the pending block where the transaction that includes the action will be pushed to.

Therefore, an action trace allows an action to be traced to the actual block and transaction that includes the action, including the actual node that produced the block. Finally, the action handler is located by matching the handler name, receiver account, and actor account with the list of action handlers maintained by the chain controller within the producing node.

These action handlers are applied in the controller when the system contracts and the client application are loaded. The handlers take the receiver account name, the contract name, the action name, and the action handler.

4.8.21. Action Execution

Once the proper action handler is located, the appropriate whitelists and blacklists are checked. If the node is currently producing blocks, the receiver account is checked against the account whitelist and blacklist, if any.

The action blacklist is checked next, if any. If the receiver account or the action name are in a blacklist, the action is aborted. If the receiver account is already on the whitelist, the blacklist check is skipped. If all checks pass, the action is finally executed by invoking the corresponding action handler, passing the actor account in the from parameter and the receiving account in the two parameters.

4.8.22. Finalize Transaction

After all actions included in the transaction are executed, the transaction enters the finalization stage. In this step, a corresponding action receipt is produced for each action. The action receipt contains a hash of the corresponding action instance, a few counters used for analytics, and the receiver account to which the action is intended to, if applicable

4.8.23. Transaction Receipt

After all action receipts are generated for the transaction, a transaction receipt is finally created and pushed into the signed block, along with other transaction receipts included in the block.

The transaction receipt summarizes the result of the transaction (executed, unexecuted, failed, deferred, expired, etc.), including the actual amount of CPU billed in microseconds, and the total NET storage used (see `transaction_receipt` schema below).

`transaction_receipt` schema

Name	Type	Description
<code>status</code>	<code>uint8_t</code>	result of transaction execution attempt
<code>cpu_usage_us</code>	<code>uint32_t</code>	total CPU used in microseconds
<code>net_usage_words</code>	<code>unsigned int</code>	total NET used in 64-bit words
<code>trx</code>	<code>variant</code>	holds transaction ID or packed transaction

The `status` field is an 8-bit enumeration type that can hold one of the following results: - executed - transaction succeeded, no error handler executed. - soft fail - transaction failed, error handler succeeded. - hard fail - transaction failed, error handler failed. - delayed - transaction delayed by user for future execution. - expired - transaction expired, CPU/NET refunded to user.

The `trx` field holds the transaction ID or the packed transaction itself. The actual choice depends on the transaction type. Receipts generated from Deferred Transactions and Delayed User Transactions are stored by transaction ID; all other types are stored as packed transactions.

4.8.24. Deferred Transactions

Deferred transactions are generated as a side effect of processing the blockchain, so their state is stored in the chain database, not within a block. Therefore, there is no need to explicitly include their contents in the transaction receipt. All in-sync nodes should be aware of the form of a deferred transaction as a matter of consensus. Deferred transactions issued by a smart contract have no role or effect on the delayed status field of the transaction receipt.

4.8.25. Delayed User Transactions

Delayed user transactions contain the packed transactions when they are pushed to the network (at the start of the delay timer). However, unlike regular transactions, they bear a "delayed" status so their execution and validation can be postponed. Later on, when they execute/fail/expire (at the end of the delay timer), they only contain the transaction ID. This is because any in-sync node will have the transaction content from a previously broadcast block.

4.8.26. Validate Transaction

A transaction is verified and validated at various stages during its lifecycle: first when it propagates on the peer-to-peer network as a loose transaction (see 3.4. Verify Transaction), then during block validation as the block is confirmed among a supermajority of block producers, and optionally during a blockchain replay if nodeos is configured to fully re-validate transactions during replays. By default, recorded transactions are not completely re-validated during replays since it is assumed that the node operator has established trust in the local block log, either personally or through a side-channel so it is no longer considered a potential source of byzantine information.

4.8.27. Validation Process

When validating a transaction as part of a block, multiple validations occur at various levels. In full block validation, all transactions recorded in the block are replayed and the locally calculated merkle tree root hashes (generated from the transaction receipt data and the action receipt data, respectively) are compared against the *transaction_mroot* and *action_mroot* fields in the block header. Therefore, if a recorded transaction is tampered within a block, not only the merkle tree root hashes would cause a mismatch, but also the transaction signature(s) would fail to validate. If the tampering were not performed by a bona-fide block producer, the block signature would fail to validate as well (see Consensus Protocol: Block Validation).



4.9. Network Peer Protocol

4.9.1. Network overview

Nodes on an active EOSIO blockchain must be able to communicate with each other for relaying transactions, pushing blocks, and syncing state between peers. The peer-to-peer (p2p) protocol, part of the nodeos service that runs on every node, serves this purpose. The ability to sync state is crucial for each block to eventually reach finality within the global state of the blockchain and allow each node to advance the last irreversible block (LIB).

In this regard, the fundamental goal of the p2p protocol is to sync blocks and propagate transactions between nodes to reach consensus and advance the blockchain state.

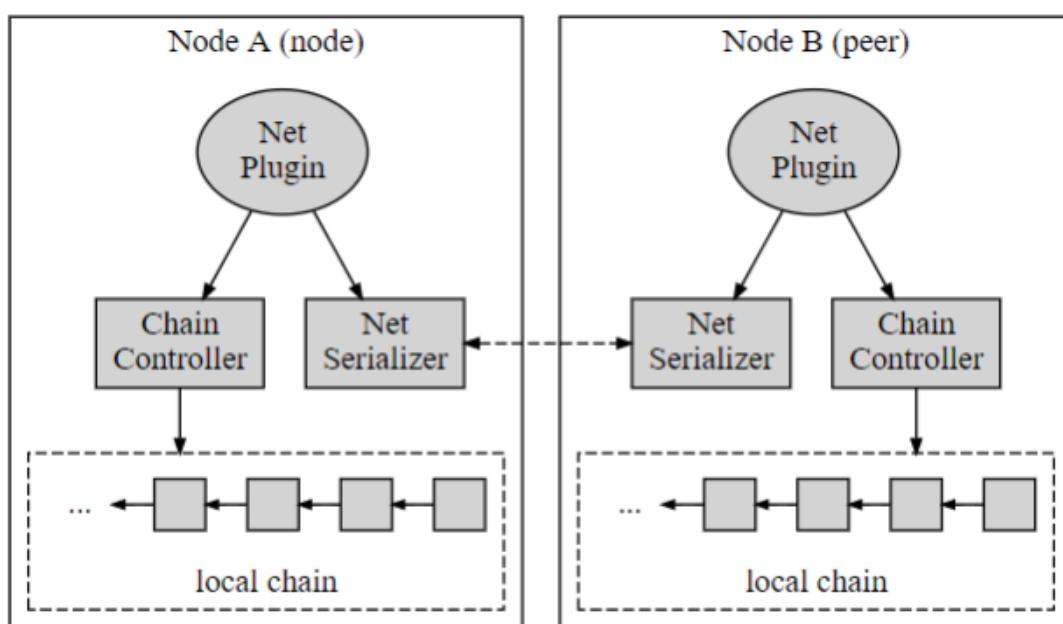
4.9.2. Goals

In order to add multiple transactions into a block and fit them within the specified production time of 0.5 seconds, the p2p protocol must be designed with speed and efficiency in mind. These two goals translate into maximizing transaction throughput within the effective bandwidth and reducing both network and operational latency. Some strategies to achieve this include Fit more transactions within a block for better economy of scale.

Minimize redundant information among blocks and transactions. Allow more efficient broadcasting and syncing of node states. Minimize payload footprint with data compression and binary encoding. Most of these strategies are fully or partially implemented in the EOSIO software.

Data compression, which is optional, is implemented at the transaction level. Binary encoding is implemented by the net serializer when sending object instances and protocol messages over the network.

2. Architecture The main goal of the p2p protocol is to synchronize nodes securely and efficiently. To achieve this overarching goal, the system delegates functionality into four main components: Net Plugin: defines the protocol to sync blocks and forward transactions between peers. Chain Controller: dispatches/manages blocks and transactions received, within the node. Net Serializer: serializes messages, blocks, and transactions for network transmission. Local Chain: holds the node's local copy of the blockchain, including reversible blocks. The interaction between the above components is depicted in the diagram below:



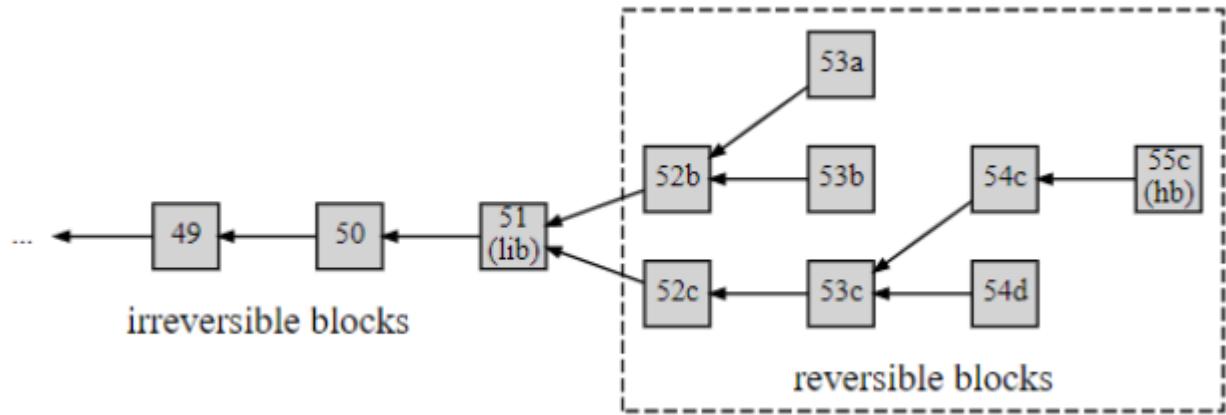


At the highest level sits the Net Plugin, which exchanges messages between the node and its peers to sync blocks and transactions. A typical message flow goes as follows: Node A sends a message to Node B through the Net Plugin (refer to diagram above).

Node A's Net Serializer packs the message and sends it to Node B. Node B's Net Serializer unpacks the message and relays it to its Net Plugin. The message is processed by Node B's Net Plugin, dispatching the proper actions. The Net Plugin accesses the local chain via the Chain Controller if necessary to push or retrieve blocks.

4.9.3. Local Chain

The local chain is the node's local copy of the blockchain. It consists of both irreversible and reversible blocks received by the node; each block being cryptographically linked to the previous one. The list of irreversible blocks contains the actual copy of the immutable blockchain. The list of reversible blocks is typically shorter in length, and it is managed by the Fork Database as the Chain Controller pushes blocks to it. The local chain is depicted below.



Each node constructs its own local copy of the blockchain as it receives blocks and transactions and syncs their state with other peers. The reversible blocks are those new blocks received that have not yet reached finality. As such, they are likely to form branches that stem from a main common ancestor, which is the LIB (last irreversible block). Other common ancestors different from the LIB are also possible for reversible blocks. In fact, any two sibling branches always have a nearest common ancestor. For instance, in the diagram above, block 52b is the nearest common ancestor for the branches starting at block 53a and 53b that is different from the LIB. Every active branch in the local chain has the potential to become part of the blockchain.

4.9.4. LIB Block

All irreversible blocks constructed in a node are expected to match those from other nodes up to the last irreversible block (LIB) of each node. This is the distributed nature of the blockchain. Eventually, as the blocks that follow the LIB block reach finality, the LIB block moves up the chain through one of the branches as it catches up with the head block (HB). When the LIB block advances, the immutable blockchain effectively grows. In this process, the head block might switch branches multiple times depending on the potential head block numbers received and their timestamps, which is ultimately used as tiebreaker.

4.9.5. Chain Controller

The Chain Controller manages the basic operations on blocks and transactions that change the local chain state, such as validating and executing transactions, pushing blocks, etc. The Chain Controller receives commands from the Net Plugin and dispatches the proper operation on a block or a transaction based on the network message received by the Net Plugin. The network messages are exchanged continuously between the EOSIO nodes as they communicate with each other to sync the state of blocks and transactions.

4.9.6. Signals' Producer and Consumer

The producer and consumer of the signals defined in the controller and their life cycle during normal operation, fork, and replay are as follows:

pre_accepted_block (carry signed_block_ptr)

- Produced by

Module	Function	Condition
controller	push_block	before the block is added to the fork db
	replay_push_block	before the replayed block is added to the fork db (only if the replayed block is not irreversible since irreversible block is not added to fork db during replay)

- Consumed by

Module	Usage
chain_plugin	checkpoint validation
	forward data to pre_accepted_block_channel

accepted_block_header (carry block_state_ptr)

- Produced by

Module	Function	Condition
controller	push_block	after the block is added to fork db
	commit_block	after the block is added to fork db (only if you are the one who produce the block, in other words, this is not applicable to the block received from others)
	replay_push_block	after the replayed block is added to fork db

- Consumed by

Module	Usage
chain_plugin	forward data to accepted_block_header_channel

accepted_block (carry block_state_ptr)

- Produced by

Module	Function	Condition
controller	commit_block	when the block is finalized

- Consumed by

Module	Usage
net_plugin	broadcast block to other peers

irreversible_block (carry block_state_ptr)

- Produced by

Module	Function	Condition
controller	log_irreversible	before it's appended to the block log and before the chainbase db is committed
	replay_push_block	when replaying an irreversible block

- Consumed by

Module	Usage
controller	setting the current lib of wasm_interface
chain_plugin	forward data to irreversible_block_channel
mongodb_plugin	forward the data to irreversible_block_state_queue

accepted_transaction (carry transaction_metadata_ptr)

- Produced by

Module	Function	Condition
controller	push_transaction	when the transaction executes successfully (only once, i.e. when it's unapplied and reapplied the signal won't be emitted)
	push_scheduled_transaction	when the scheduled transaction executes successfully
		when the scheduled transaction fails (subjective/ soft/ hard)
		when the scheduled transaction expires
		after applying onerror

- Consumed by

Module	Usage
chain_plugin	forward data to accepted_transaction_channel
mongodb_plugin	forward the data to transaction_metadata_queue

applied_transaction (carry std::tuple<const transaction_trace_ptr&, const signed_transaction&>)

- Produced by

Module	Function	Condition
controller	push_transaction	when the transaction executes successfully
	push_scheduled_transaction	when the scheduled transaction executes successfully
		when the scheduled transaction fails (subjective/ soft/ hard)
		when the scheduled transaction expires
		after applying onerror

- Consumed by

Module	Usage
chain_plugin	forward data to applied_transaction_channel
mongodb_plugin	forward the data to transaction_trace_queue

bad_alloc

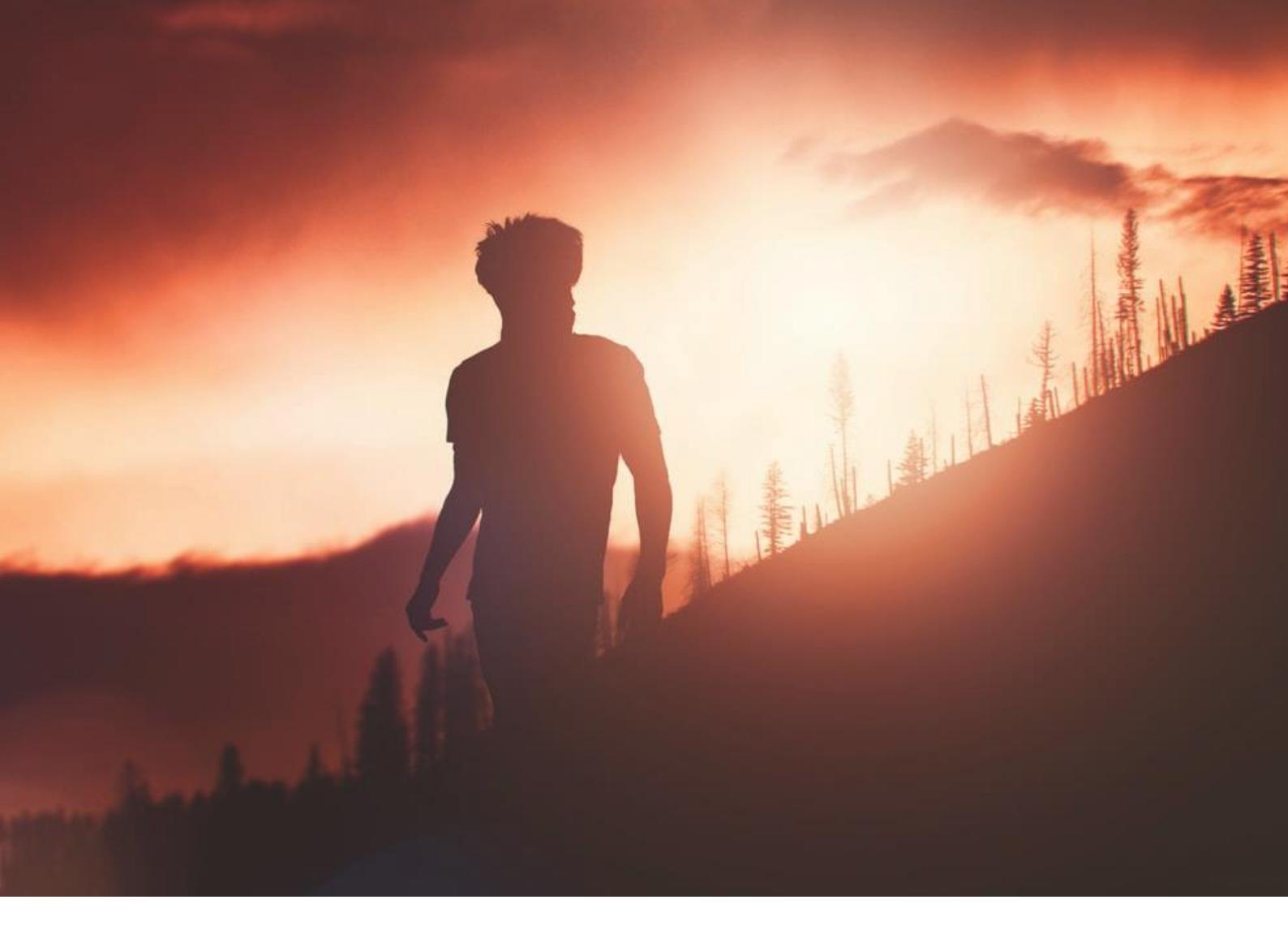
Not used.

4.9.7. Signals' Life Cycle

A normal operation where blocks and transactions are input When a transaction is pushed to the blockchain (through RPC or broadcasted by peer) Transaction is executed either successfully/ fail the validation -> *accepted_transaction* is emitted by the controller *chain_plugin* will react to the signal to forward the *transaction_metadata* to *accepted_transaction_channel* *mongodb_plugin* will react to the signal and add the *transaction_metadata* to its queue to be processed later on When a scheduled transaction is pushed to the blockchain Transaction is executed either successfully/ fail subjectively/ soft fail/ hard fail -> *accepted_transaction* is emitted by the controller *chain_plugin* will react to the signal to forward the *transaction_metadata* to *accepted_transaction_channel* *mongodb_plugin* will react to the signal and add the *transaction_metadata* to its queue to be processed later on When a block is pushed to the blockchain (through RPC or broadcasted by peer)

Before the block is added to fork *db* -> *pre_accepted_block* will be emitted by the controller *chain_plugin* will react to the signal to do validation of the block forward the *block_state* to *accepted_block_header_channel* and validate it with the checkpoint After the block is added to fork *db* -> *accepted_block_header* will be emitted by the controller *chain_plugin* will react to the signal to forward the *block_state* to *accepted_block_header_channel* Then the block will be applied, at this time all the transactions and *scheduled_transactions* inside the block will be pushed. All signals related to *push_transaction* and *push_scheduled_transaction* (see point A.1 and A.2) will be emitted.

When committing the block -> *accepted_block* will be emitted by the controller *net_plugin* will react to the signal and broadcast the block to the peers If a new block becomes irreversible, signals related to irreversible block will be emitted (see point A.5) When a block is produced For the block that is produced by you, the block will be added to the *fork_db* when it is committed -> *accepted_block_header* will be emitted by the controller *chain_plugin* will react to the signal to forward the *block_state* to *accepted_block_header_channel* and validate it with the checkpoint. Immediately after that (during committing the block) -> *accepted_block* will be emitted by the controller *net_plugin* will react to the signal and broadcast the block to the peers If a new block becomes irreversible, signals related to irreversible block will be emitted (see point A.5)



When a block becomes irreversible Once a block is deemed irreversible -> *irreversible_block* will be emitted by the controller before the block is appended to the block log and the chain base db is committed, *chain_plugin* will react to the signal to forward the *block_state* to *irreversible_block_channel* and also set the lib of *wasm_interface* *mongodb_plugin* will react to the signal and add the transaction_metadata to its queue to be processed later on B. operation where forks are presented and resolved When forks are presented, the blockchain will pop all existing blocks up to the forking point and then apply all new blocks in the fork. When applying the new block, all the transactions and *scheduled_transactions* inside the block will be pushed. All signals related to *push_transaction* and *push_scheduled_transaction* (see point A.1 and A.2) will be emitted. And then when committing the new block -> *accepted_block* will be emitted by the controller *net_plugin* will react to the signal and broadcast the block to the peers.

If a new block becomes irreversible, signals related to irreversible block will be emitted (see point A.5) C. normal replay (with or without replay optimization) When replaying irreversible block -> *irreversible_block* will be emitted by the controller Refer to A.5 to see how *irreversible_block* signal is responded

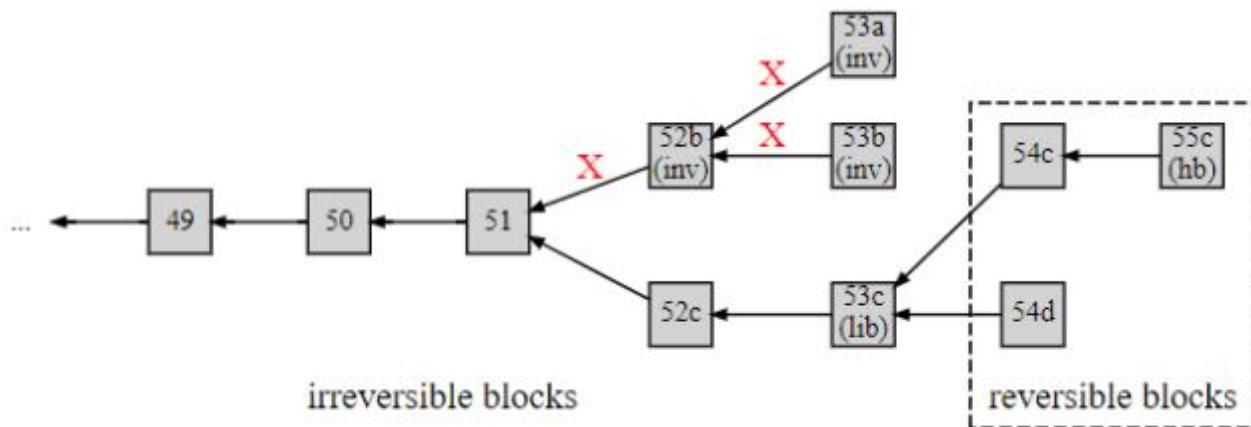
When replaying reversible *block*, before the block is added to `fork_db` -> `pre_accepted_block` will be emitted by the controller. When replaying reversible block, after the block is added to `fork db` -> `accepted_block_header` will be emitted by the controller. When replaying reversible block, when the block is committed -> `accepted_block` will be emitted by the controller Refer to A.3 to see how `pre_accepted_block`, `accepted_block_header` and `accepted_block` signal is responded.

4.9.8. Fork Database

The Fork Database (Fork DB) provides an internal interface for the Chain Controller to perform operations on the node's local chain. As new blocks are received from other peers, the Chain Controller pushes these blocks to the Fork DB. Each block is then cryptographically linked to a previous block. Since there might be more than one previous block, the process is likely to produce temporary branches called mini-forks. Thus, the Fork DB serves three main purposes: Resolve which branch the pushed block (new head block) will build off from.

Advance the head block, the root block, and the LIB block. Trim off invalid branches and purge orphaned blocks. In essence, the Fork DB contains all the candidate block branches within a node that may become the actual branch that continues to grow the blockchain. The root block always marks the beginning of the reversible block tree, and will match the LIB block, except when the LIB advances, in which case the root block must catch up.

The calculation of the LIB block as it advances through the new blocks within the Fork DB will ultimately decide which branch gets selected. As the LIB block advances, the root block catches up with the new LIB, and any candidate branch whose ancestor node is behind the LIB gets pruned. This is depicted below.





In the diagram above, the branch starting at block 52b gets pruned (blocks 52b, 53a, 53b are invalid) after the LIB advances from node 51 to block 52c then 53c. As the LIB moves through the reversible blocks, they are moved from the Fork DB to the local chain as they now become part of the immutable blockchain. Finally, block 54d is kept in the Fork DB since new blocks might still be built off from it.

4.9.9. Net Plugin

The Net Plugin defines the actual peer to peer communication messages between the EOSIO nodes. The main goal of the Net Plugin is to sync valid blocks upon request and to forward valid transactions invariably. To that end, the Net Plugin delegates functionality to the following components:

- Sync Manager: maintains the block syncing state of the node with respect to its peers.
- Dispatch Manager: maintains the list of blocks and transactions sent by the node.
- Connection List: list of active peers the node is currently connected to.
- Message Handler: dispatches protocol messages to the corresponding handler. (see 4.2. Protocol Messages).

4.9.10. Sync Manager

The Sync Manager implements the functionality for syncing block state between the node and its peers. It processes the messages sent by each peer and performs the actual syncing of the blocks based on the status of the node's LIB or head block with respect to that peer. At any point, the node can be in any of the following sync states: LIB Catch-Up: node is about to sync with another peer's LIB block. Head Catch-Up: node is about to sync with another peer's HEAD block.

In-Sync: both LIB and HEAD blocks are in sync with the other peers. If the node's LIB or head block is behind, the node will generate sync request messages to retrieve the missing blocks from the connected peer. Similarly, if a connected peer's LIB or head block is behind, the node will send notice messages to notify the node about which blocks it needs to sync with. For more information about sync modes see 3. Operation Modes.

4.9.11. Dispatch Manager

The Dispatch Manager maintains the state of blocks and loose transactions received by the node. The state contains basic information to identify a block, or a transaction and it is maintained within two indexed lists of block states and transaction states: Block State List: list of block states managed by node for all blocks received. Transaction State List: list of transaction states managed by node for all transactions received.

This makes it possible to locate very quickly which peer has a given block or transaction.

4.9.12. Block State

The block state identifies a block and the peer it came from. It is transient in nature, so it is only valid while the node is active. The block state contains the following fields:

The list of block states is indexed by block ID, block number, and connection ID for faster lookup. This allows to query the list for any blocks given one or more of the indexed attributes.

Block State Fields	Description
<code>id</code>	256-bit block identifier. A function of the block contents and the block number.
<code>block_num</code>	32-bit unsigned counter value that identifies the block sequentially since genesis.
<code>connection_id</code>	32-bit unsigned integer that identifies the connected peer the block came from.
<code>have_block</code>	boolean value indicating whether the actual block has been received by the node.

4.9.13. Transaction State

The transaction state identifies a loose transaction and the peer it came from. It is also transient in nature, so it is only valid while the node is active. The transaction state contains the following fields:

Transaction State Fields	Description
<code>id</code>	256-bit hash of the transaction instance, used as transaction identifier.
<code>expires</code>	expiration time since EOSIO block timestamp epoch (January 1, 2000).
<code>block_num</code>	current head block number. Transaction drops when LIB catches up to it.
<code>connection_id</code>	32-bit integer that identifies the connected peer the transaction came from.

The `block_num` stores the node's head block number when the transaction is received. It is used as a backup mechanism to drop the transaction when the LIB block number catches up with the head block number, regardless of expiration.

The list of transaction states is indexed by transaction ID, expiration time, block number, and connection ID for faster lookup. This allows to query the list for any transactions given one or more of the indexed attributes.

4.9.14. State Recycling

As the LIB block advances (see LIB Catch-Up Mode), all blocks prior to the new LIB block are considered finalized, so their state is removed from the local list of block states, including the list of block states owned by each peer in the list of connections maintained by the node.

Likewise, transaction states are removed from the list of transactions based on expiration time. Therefore, after a transaction expires, its state is removed from all lists of transaction states. The lists of block states and transaction states have a light footprint and feature high rotation, so they are maintained in memory for faster access. The actual contents of the blocks and transactions received by a node are stored temporarily in the fork database and the various incoming queues for applied and unapplied transactions, respectively.

4.9.15. Connection

List The Connection List contains the connection state of each peer. It keeps information about the p2p protocol version, the state of the blocks and transactions from the peer that the node knows about, whether it is currently syncing with that peer, the last handshake message sent and received, whether the peer has requested information from the node, the socket state, the node ID, etc.

The connection state includes the following relevant fields: Info requested: whether the peer has requested information from the node. Socket state: a pointer to the socket structure holding the TCP connection state. Node ID: the actual node ID that distinguishes the peer's node from the other peers. Last Handshake Received: last handshake message instance received from the peer. Last Handshake Sent: the last handshake message instance sent to the peer. Handshake Sent Count: the number of handshake messages sent to the peer. Syncing: whether or not the node is syncing with the peer.

Protocol Version: the internal protocol version implemented by the peer's Net Plugin. The block state consists of the following fields: Block ID: a hash of the serialized contents of the block. Block number: the actual block number since genesis. The transaction state consists of the following fields: Transaction ID: a hash of the serialized contents of the transaction.

Block number: the actual block number the transaction was included in. Expiration time: the time in seconds for the transaction to expire.



4.9.16. Net Serializer

The Net Serializer has two main roles: Serialize objects and messages that need to be transmitted over the network. Serialize objects and messages that need to be cryptographically hashed. In the first case, each serialized object or message needs to get deserialized at the other end upon receipt from the network for further processing. In the latter case, serialization of specific fields within an object instance is needed to generate cryptographic hashes of its contents.

Most IDs generated for a given object type (action, transaction, block, etc.) consist of a cryptographic hash of the relevant fields from the object instance. 3. Operation Modes From an operational standpoint, a node can be in either one of three states with respect to a connected peer: In-Sync mode: node is in sync with peer, so no blocks are required from that peer.

LIB Catch-Up mode: node requires blocks since LIB block is behind that peer's LIB. HEAD Catch-Up mode: node requires blocks since HEAD block is behind that peer's Head. The operation mode for each node is stored in a sync manager context within the Net Plugin of the nodeos service. Therefore, a node is always in either in-sync mode or some variant of catchup mode with respect to its connected peers.

This allows the node to switch back and forth between catchup mode and in-sync mode as the LIB and head blocks are updated and new fresh blocks are received from other peers.

4.9.17. Block ID

The EOSIO software checks whether two blocks match or hold the same content by comparing their block IDs. A block ID is a function that depends on the contents of the block header and the block number (see Consensus Protocol: Block Structure).

Checking whether two blocks are equal is crucial for syncing a node's local chain with that of its peers. To generate the block ID from the block contents, the block header is serialized, and a SHA-256 digest is created. The most significant 32 bits are assigned the block number while the least significant 224 bits of the hash are retained. Note that the block header includes the root hash of both the transaction merkle tree and the action merkle tree.

Therefore, the block ID depends on all transactions included in the block as well as all actions included in each transaction.

4.9.18. In-Sync Mode

During in-sync mode, the node's head block is caught up with the peer's head block, which means the node is in sync block-wise. When the node is in-sync mode, it does not request further blocks from peers, but continues to perform the other functions: Validate transactions, drop them if invalid; forward them to other peers if valid. Validate blocks, drop them if invalid; forward them to other peers upon request if valid. Therefore, this mode trades bandwidth in favor of latency, being particularly useful for validating transactions that rely on TaPoS (transaction as proof of stake) due to lower processing overhead.

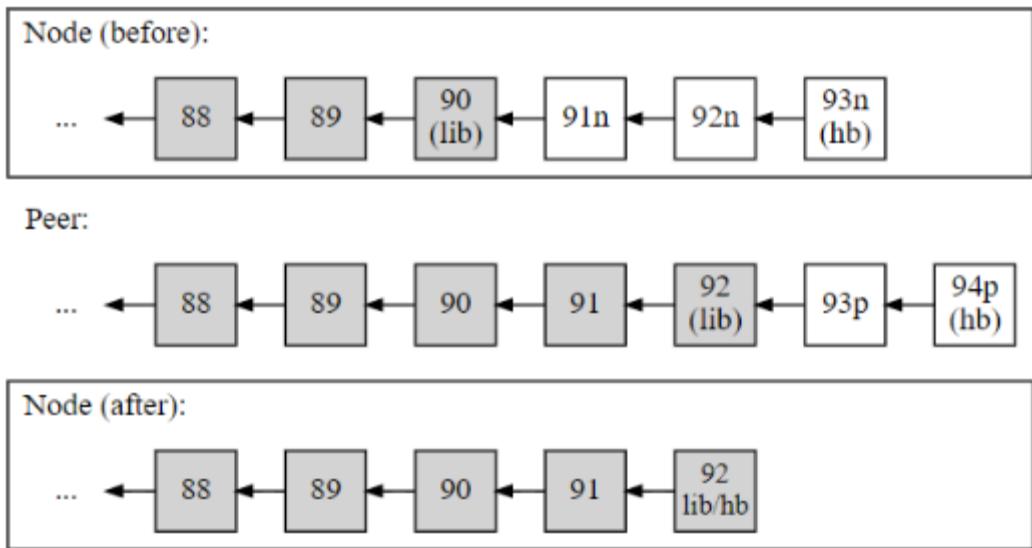
Note that loose transactions are always forwarded if valid and not expired. Blocks, on the other hand, are only forwarded if valid and if explicitly requested by a peer. This reduces network overhead.

4.9.19. Catch-Up Mode

A node is in catchup mode when its head block is behind the peer's LIB or the peer's head block. If syncing is needed, it is performed in two sequential steps: Sync the node's LIB from the nearest common ancestor + 1 up to the peer's LIB. Sync the node's head from the nearest common ancestor + 1 up to the peer's head. Therefore, the node's LIB block is updated first, followed by the node's head block.

4.9.20. LIB Catch-Up Mode

Case 1 above, where the node's LIB block needs to catch up with the peer's LIB block, is depicted in the below diagram, before and after the sync (Note: inapplicable branches have been removed for clarity):

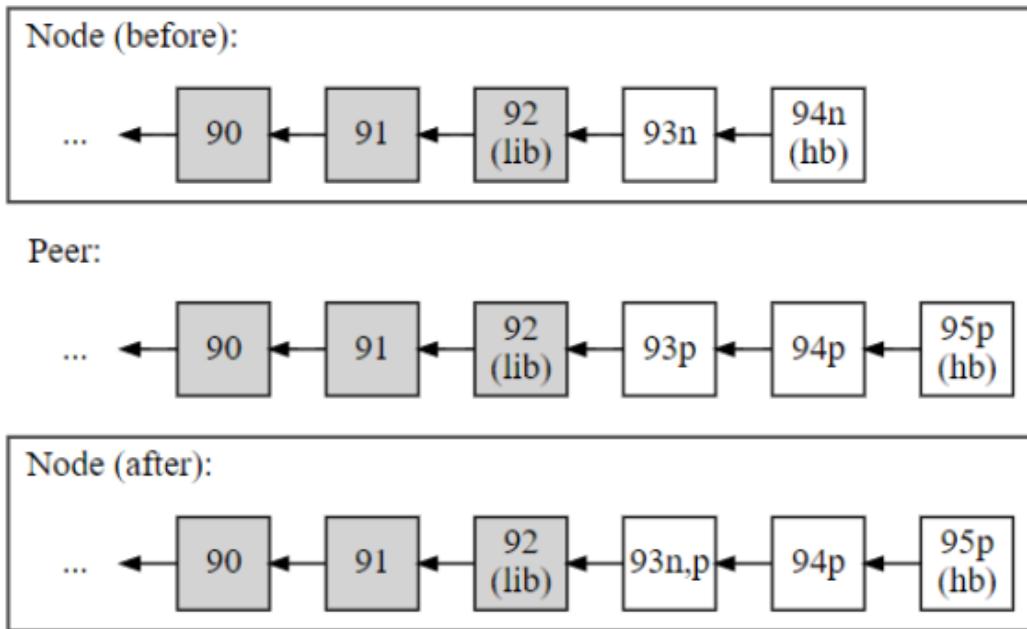


In the above diagram, the node's local chain syncs up with the peer's local chain by appending finalized blocks 91 and 92 (the peer's LIB) to the node's LIB (block 90). Note that this discards the temporary fork consisting of blocks 91n, 92n, 93n. Also note that these nodes have an "n" suffix (short for node) to indicate that they are not finalized, and therefore, might be different from the peer's.

The same applies to unfinalized blocks on the peer; they end in "p" (short for peer). After syncing, note that both the LIB (lib) and the head block (hb) have the same block number on the node.

4.9.21. Head Catch-Up Mode

After the node's LIB block is synced with the peer's, there will be new blocks pushed to either chain. Case 2 above covers the case where the peer's chain is longer than the node's chain. This is depicted in the following diagram, which shows the node and the peer's local chains before and after the sync:



In either case 1 or 2 above, the syncing process in the node involves locating the first common ancestor block starting from the node's head block, traversing the chains back, and ending in the LIB blocks, which are now in sync (see LIB Catch-Up Mode).

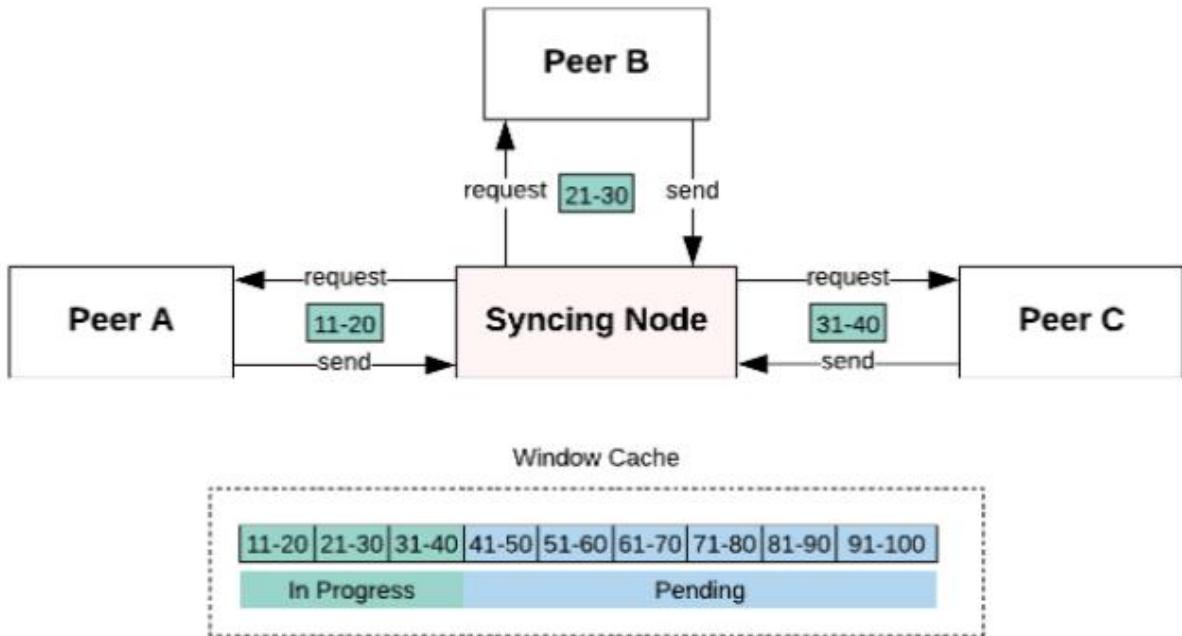
In the worst case scenario, the synced LIBs are the nearest common ancestor. In the above diagram, the node's chain is traversed from head block 94n, 93n, etc. trying to match blocks 94p, 93p, etc. in the peer's chain. The first block that matches is the nearest common ancestor (block 93n and 93p in the diagram). Therefore, the following blocks 94p and 95p are retrieved and appended to the node's chain right after the nearest common ancestor, now re-labeled 93n,p (see Block Retrieval process).

Finally, block 95p becomes the node's head block and, since the node is fully synced with the peer, the node switches to in-sync mode.

4.9.22. Block Retrieval

After the common ancestor is found, a sync request message is sent to retrieve the blocks needed by the node, starting from the next block after the nearest common ancestor and ending in the peer's head block. To make effective use of bandwidth, the required blocks are obtained from various peers, rather than just one, if necessary.

Depending on the number of blocks needed, the blocks are requested in chunks by specifying the start block number and the end block number to download from a given peer. The node uses the list of block states to keep track of which blocks each peer has, so this information is used to determine which connected peers to request block chunks from. This process is depicted in the diagram below:



When both LIB and head blocks are caught up with respect to the peer, the operation mode in the Sync Manager is switched from catch-up mode to in-sync mode. 3.4. Mode Switching Eventually, both the node and its peer receive new fresh blocks from other peers, which in turn push the blocks to their respective local chains. This causes the head blocks on each chain to advance.

Depending on which chain grows first, one of the following actions occur: The node sends a catch up request message to the peer with its head block info. The node sends a catch up notice message to inform the peer it needs to sync. In the first case, the node switches the mode from in-sync to head catchup mode. In the second case, the peer switches to head catchup mode after receiving the notice message from the node.

In practice, in-sync mode is short-lived. In a busy EOSIO blockchain, nodes spend most of their time in catchup mode validating transactions and syncing their chains after catchup messages are received.

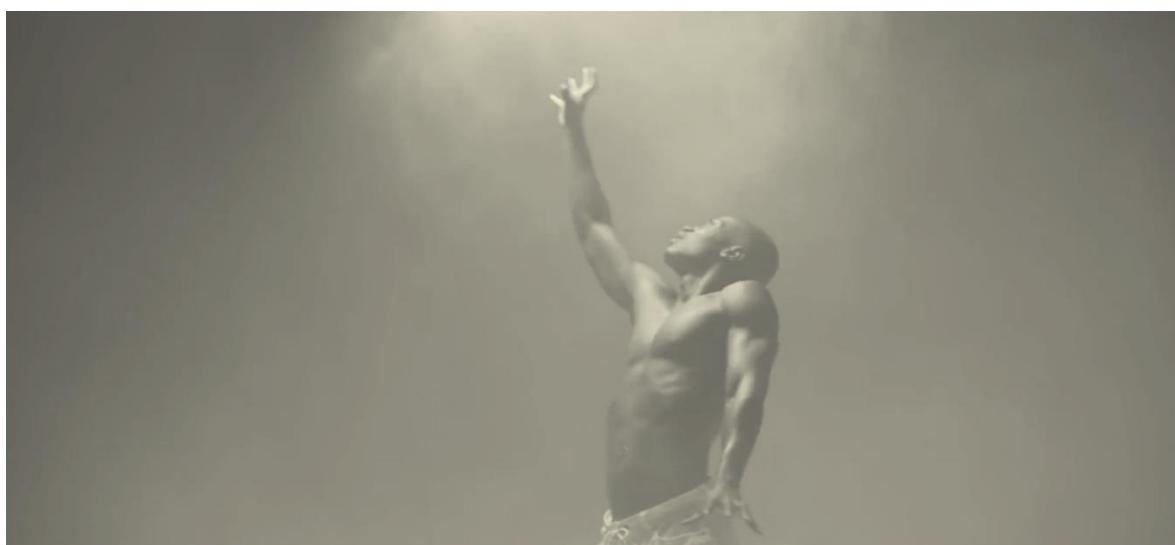
4.10. Protocol Algorithm

The p2p protocol algorithm runs on every node, forwarding validated transactions and validated blocks. Starting EOSIO v2.0, a node also forwards block IDs of unvalidated blocks it has received. In general, the simplified process is as follows: A node requests data or sends a control message to a peer. If the request can be fulfilled, the peer executes the request; repeat 1. The data messages contain the block contents or the transaction contents. The control messages make possible the syncing of blocks and transactions between the node and its peers (see [Protocol Messages](#)). In order to allow such synchronization, each node must be able to retrieve information about its own state of blocks and transactions as well as that of its peers.

4.10.1. Node/Peers Status

Before attempting to sync state, each node needs to know the current status of its own blocks and transactions. It must also be able to query other peers to obtain the same information. In particular, nodes must be able to obtain the following on demand: Each node can find out which blocks and transactions it currently has. All nodes can find out which blocks and transactions their peers have.

Each node can find out which blocks and transactions it has requested. All nodes can find out when each node has received a given transaction. To perform these queries, and thereafter when syncing state, the Net Plugin defines specific communication messages to be exchanged between the nodes. These messages are sent by the Net Plugin when transmitted and received over a TCP connection.



4.10.2. Protocol Messages

The p2p protocol defines the following control messages for peer to peer node communication:

Control Message	Description
handshake_message	initiates a connection to another peer and sends LIB/head status.
chain_size_message	requests LIB/head status from peer. Not currently implemented.
go_away_message	sends disconnection notification to a connecting or connected peer.
time_message	transmits timestamps for peer synchronization and error detection.
notice_message	informs peer which blocks and transactions node currently has.
request_message	informs peer which blocks and transaction node currently needs.
sync_request_message	requests peer a range of blocks given their start/end block numbers.

The protocol also defines the following data messages for exchanging the actual contents of a block or a loose transaction between peers on the p2p network:

Data Message	Description
signed_block_v0	serialized contents of a signed block v0 (no pruned CFD support).
packed_transaction_v0	serialized contents of a packed transaction v0 (no pruned CFD).
signed_block	serialized contents of a signed block v1 (with pruned context-free data support).
trx_message_v1	serialized contents of transaction ID and packed transaction v1 (supports pruned CFD).

4.10.3. Handshake Message

The handshake message is sent by a node when connecting to another peer. It is used by the connecting node to pass its chain state (LIB number/ID and head block number/ID) to the peer. It is also used by the peer to perform basic validation on the node the first time it connects, such as whether it belongs to the same blockchain, validating that fields are within range, detecting inconsistent block states on the node, such as whether its LIB is ahead of the head block, etc.

The handshake message consists of the following fields:

Message Field	Description
<code>network_version</code>	internal net plugin version to keep track of protocol updates.
<code>chain_id</code>	hash value of the genesis state and config options. Used to identify chain.
<code>node_id</code>	the actual node ID that distinguishes the peer's node from the other peers.
<code>key</code>	public key for peer to validate node; may be a producer or peer key, or empty.
<code>time</code>	timestamp the handshake message was created since epoch (Jan 1, 2000).
<code>token</code>	SHA-256 digest of timestamp to prove node owns private key of the key above.
<code>sig</code>	signature for the digest above after node signs it with private key of the key above.
<code>p2p_address</code>	IP address of node.
<code>last_irreversible_block_num</code>	the actual block count of the LIB block since genesis.
<code>last_irreversible_block_id</code>	a hash of the serialized contents of the LIB block.
<code>head_num</code>	the actual block count of the head block since genesis.
<code>head_id</code>	a hash of the serialized contents of the head block.
<code>os</code>	operating system where node runs. This is detected automatically.
<code>agent</code>	the name supplied by node to identify itself among its peers.
<code>generation</code>	counts <code>handshake_message</code> invocations; detects first call for validation.

If all checks succeed, the peer proceeds to authenticate the connecting node based on the `--allowed-connection` setting specified for that peer's net plugin when nodeos started:

- ❖ Any: connections are allowed without authentication.
- ❖ Producers: peer key is obtained via p2p protocol.
- ❖ Specified: peer key is provided via settings.
- ❖ None: the node does not allow connection requests.

The peer key corresponds to the public key of the node attempting to connect to the peer. If authentication succeeds, the receiving node acknowledges the connecting node by sending a handshake message back, which the connecting node validates in the same way as above.

Finally, the receiving node checks whether the peer's head block or its own needs syncing. This is done by checking the state of the head block and the LIB of the connecting node with respect to its own. From these checks, the receiving node determines which chain needs syncing.

4.10.4. Chain Size Message

The chain size message was defined for future use, but it is currently not implemented. The idea was to send ad-hoc status notifications of the node's chain state after a successful connection to another peer. The chain size message consists of the following fields:

Message Field	Description
<code>last_irreversible_block_num</code>	the actual block count of the LIB block since genesis.
<code>last_irreversible_block_id</code>	a hash of the serialized contents of the LIB block.
<code>head_num</code>	the actual block count of the head block since genesis.
<code>head_id</code>	a hash of the serialized contents of the head block.

The chain size message is superseded by the handshake message, which also sends the status of the LIB and head blocks but includes additional information, so it is preferred.

4.10.5. Go Away Message

The go away message is sent to a peer before closing the connection. It is usually the result of an error that prevents the node from continuing the p2p protocol further. The go away message consists of the following fields:

Message Field	Description
<code>reason</code>	an error code signifying the reason to disconnect from peer.
<code>node_id</code>	the node ID for the disconnecting node; used for duplicate notification.

The current reason codes are defined as follows:

- ❖ No reason: indicate no error actually; the default value.
- ❖ Self: node was attempting to self-connect.
- ❖ Duplicate: redundant connection detected from peer.
- ❖ Wrong chain: the peer's chain ID does not match.
- ❖ Wrong version: the peer's network version does not match.
- ❖ Forked: the peer's irreversible blocks are different
- ❖ Unlikable: the peer sent a block we couldn't use
- ❖ Bad transaction: the peer sent a transaction that failed verification.
- ❖ Validation: the peer sent a block that failed validation.
- ❖ Benign other: reasons such as a timeout. not fatal but warrant resetting.
- ❖ Fatal other: a catch all for fatal errors that have not been isolated yet.
- ❖ Authentication: peer failed authentication.

After the peer receives the go away message, the peer should also close the connection.

4.10.6. Time Message

The time message is used to synchronize events among peers, measure time intervals, and detect network anomalies such as duplicate messages, invalid timestamps, broken nodes, etc. The time message consists of the following fields:

Message Field	Description
org	origin timestamp; set when marking the beginning of a time interval.
rec	receive timestamp; set when a message arrives from the network.
xmt	transmit timestamp; set when a message is placed on the send queue.
dst	destination timestamp; set when marking the end of a time interval.

4.10.7. Notice Message

The notice message is sent to notify a peer which blocks and loose transactions the node currently has. The notice message consists of the following fields :

Message Field	Description
known_trx	sorted list of known transaction IDs node has available.
known_blocks	sorted list of known block IDs node has available.

Notice messages are lightweight since they only contain block IDs and transaction IDs, not the actual block or transaction.

4.10.8. Request Message

The request message is sent to notify a peer which blocks and loose transactions the node currently needs. The request message consists of the following fields:

Message Field	Description
req_trx	sorted list of requested transaction IDs required by node.
req_blocks	sorted list of requested block IDs required by node.

4.10.9. Sync Request Message

The sync request message requests a range of blocks from peer. The sync request message consists of the following fields:

Message Field	Description
start_block	start block number for the range of blocks to receive from peer.
end_block	end block number for the range of blocks to receive from peer.

Upon receipt of the sync request message, the peer sends back the actual blocks for the range of block numbers specified.

4.10.10. Message Handler

The p2p protocol uses an event-driven model to process messages, so no polling or looping is involved when a message is received. Internally, each message is placed in a queue and the next message in line is dispatched to the corresponding message handler for processing. At a high level, the message handler can be defined as follows:

```
receiver/read handler:  
    if handshake message:  
        verify that peer's network protocol is valid  
        if node's LIB < peer's LIB:  
            sync LIB with peer's; continue  
        if node's LIB > peer's LIB:  
            send LIB catchup notice message; continue  
    if notice message:  
        update list of blocks/transactions known by remote peer  
    if trx message:  
        insert into global state as unvalidated  
        validate transaction; drop if invalid, forward if valid  
    else  
        close the connection
```



4.10.11. Send Queue

Protocol messages are placed in a buffer queue and sent to the appropriate connected peer. At a higher level, a node performs the following operations with each connected peer in a round-robin fashion:

```
send/write loop:  
    if peer knows the LIB:  
        if peer does not know we have a block or transaction:  
            next iteration  
        if peer does not know about a block:  
            send transactions for block that peer does not know  
            next iteration  
        if peer does not know about transactions:  
            sends oldest transactions unknown to remote peer  
            next iteration  
        wait for new validated block, transaction, or peer signal  
    else:  
        assume peer is in catchup mode (operating on request/response)  
        wait for notice of sync from the read loop
```

4.10.12. Protocol Improvements

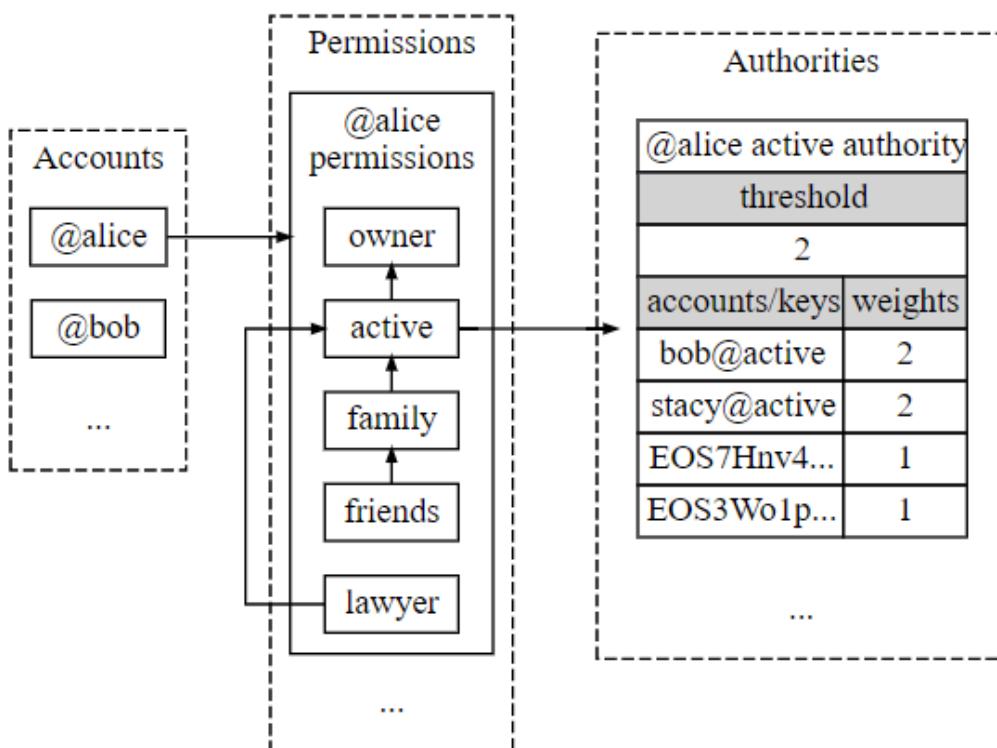
Any software updates to the p2p protocol must also scale progressively and consistently across all nodes. This translates into installing updates that reduce operation downtime and potentially minimize it altogether while deploying new functionality in a backward compatible manner, if possible.

On the other hand, data throughput can be increased by taking measures that minimize message footprint, such as using data compression and binary encoding of the protocol messages.

4.11. Accounts and Permissions

4.11.1. Accounts and Permissions overview

An account identifies a participant in an EOSIO blockchain. A participant can be an individual or a group depending on the assigned permissions within the account. Accounts also represent the smart contract actors that push and receive actions to and from other accounts in the blockchain. Actions are always contained within transactions. A transaction can be one or more atomic actions.



Permissions associated with an account are used to authorize actions and transactions to other accounts. Each permission is linked to an authority table which contains a threshold that must be reached in order to allow the action associated with the given permission to be authorized for execution. The following diagram illustrates the relationship between accounts, permissions, and authorities.

The example above depicts Alice's account, her named permissions along with their hierarchical dependencies, and her linked active authority table. It also shows that a weight threshold of two must be reached in Alice's active authority in order to allow an action associated with the active permission to be executed by or on behalf of Alice.

4.11.2. Accounts

Each account is identified by a human readable name between 1 and 12 characters in length. The characters can include a-z, 1-5, and optional dots (.) except the last character. This allows exactly one exa ($2^{60} - 1$) accounts minus one:

$$31^1 \cdot \sum_{n=0}^{n=11} 32^n = 2^{60} - 1 = 1,152,921,504,606,846,975$$

which is in the order of 1×10^{18} .

Ownership of each account on an EOSIO blockchain is solely determined by the account name. Therefore, an account can update its keys without having to redistribute them to other parties.

4.11.3. Account Schema

Besides the account name, the blockchain associates other fields with each account instance stored in the chain database, such as ram quota/usage, CPU/net limits/weights, voter info, etc. (see account schema below). More importantly, each account holds the list of named permissions assigned to it. This allows a flexible permission structure that makes single or multi-user authorizations possible (see Permissions).

account schema

Name	Type	Description
account_name	name	encoded 13-char account name
head_block_num	uint32_t	last block account was referenced
head_block_time	time_point	last time account was referenced
privileged	bool	True, if privileged account, False otherwise
last_code_update	time_point	time account code was set/updated
created	time_point	time account was created
core_liquid_balance	asset	current balance of token asset
ram_quota	int64_t	maximum RAM amount for account
net_weight	int64_t	weight for net limit percentage (weight/total)
cpu_weight	int64_t	weight for cpu limit percentage (weight/total)
net_limit	account_resource_limit	total net used, available, and max
cpu_limit	account_resource_limit	total cpu used, available, and max
ram_usage	int64_t	amount of RAM in bytes used by account
permissions	array of permission	list of named permissions
total_resources	variant	total cpu/net weights for all accounts
self_delegated_bandwidth	variant	cpu/net stake delegated from self
refund_request	variant	cpu/net refund amounts for token unstaking
voter_info	variant	name of voter, proxy or producers, vote stake
rex_info	variant	vote stake and rex balance if applicable

The name type consists of a 64-bit value that encodes alphanumeric characters into 5-bit chunks, except the last character, if any, which uses a 4-bit chunk. The name type is used to encode account names, action names, etc. The *time_point* type stores timestamps in microseconds. The asset type associates a currency or token symbol with a given amount.

The *account_resource_limit* type keeps track of the amount used, available, and maximum that can be used in a given window for the given resource (NET or CPU). The permission type holds the list of permission levels associated with the account (see Permissions).

4.11.4. Actions and Transactions

Besides identifying participants in an EOSIO blockchain, actions and transactions are the other reason for accounts to exist. An action requires one or more actors to push or send the action, and a receiver account to whom the action is directed. A receiver account is also needed when leaving proof, in an action receipt, that the action was pushed to the intended recipient.

In contrast, transactions are agnostic to accounts, although there is an indirect link to them through their associated keys. Transactions are signed using one or more signing keys belonging to the one or more actors involved in the actions that form the transaction. This can be the receiving account itself or other authorized actors specified on the authority table from the receiving account's permission.

4.11.5. Permissions

Permissions control what EOSIO accounts can do and how actions are authorized. This is accomplished through a flexible permission structure that links each account to a list of hierarchical named permissions, and each named permission to an authority table (see permission schema below).

permission schema

Name	Type	Description
perm_name	name	named permission
parent	name	parent's named permission
required_auth	authority	associated authority table

The parent field links the named permission level to its parent permission. This is what allows hierarchical permission levels in EOSIO.

4.11.6. Permission Levels

A named permission may be created under another permission, thereby allowing a hierarchical parent-children permission structure. This makes implicit action authorizations possible by allowing a given *actor: child-permission* authorization within an action to be implicitly satisfied if the *actor: parent-permission* is also satisfied. An authorization quorum or "threshold" must still be met for the action to be authorized for execution (see Authority Threshold).

4.11.7. Contract-level Permissions

It is also possible to create an implicit link between two accounts with the same named permission (for authorization satisfaction purposes). This can be achieved by associating an explicit named permission to the smart contract (different from the "minimum permission" for that contract[::action]).

However, defining explicit *actor:permission* authorizations within actions is preferred versus associating permissions to the whole contract.

Every account has two default named permissions when created owner and active. They have a parent-child relationship by default, although this can be customized by adding other permission levels and hierarchies.

4.11.8. Owner permission

The owner permission sits at the root of the permission hierarchy for every account. It is therefore the highest relative permission an account can have within its permission structure. Although the owner permission can do anything a lower level permission can, it is typically used for recovery purposes when a lower permission has been compromised.

As such, keys associated with the owner permission are typically kept in cold storage, not used for signing regular operations.

4.11.9. Active permission

In the current EOSIO implementation, the implicit default permission linked to all actions is active, which sits one level below the owner permission within the hierarchy structure.

As a result, the active permission can do anything the owner permission can, except changing the keys associated with the owner. The active permission is typically used for voting, transferring funds, and other account operations. For more specific actions, custom permissions are typically created below the active permission and mapped to specific contracts or actions. Refer to the Creating and Linking Custom Permissions for more details.

4.11.10. Custom Permissions

EOSIO allows to create custom hierarchical permissions that stem from the owner permission. This allows finer control over action authorizations. It also strengthens security in case the active permission gets compromised.

4.11.11. Authority Table

Each account's permission can be linked to an authority table used to determine whether a given action authorization can be satisfied. The authority table contains the applicable permission name and threshold, the "factors" and their weights, all of which are used in the evaluation to determine whether the authorization can be satisfied. The permission threshold is the target numerical value that must be reached to satisfy the action authorization (see authority schema below).

authority schema

Name	Type	Description
threshold	uint32_t	threshold value to satisfy authorization
keys	array of key_weight	list of public keys and weights
accounts	array of permission_level_weight	list of account@permission levels and weights
waits	array of wait_weight	list of time waits and weights

The *key_weight* type contains the actor's public key and associated weight. The *permission_level_weight* type consists of the actor's *account@permission* level and associated weight.

The *wait_weight* contains the time wait and associated weight (used to satisfy action authorizations in delayed user transactions (see Transactions Protocol: Delayed User Transactions)).

All of these types allow to define lists of authority factors that are used for satisfaction of action authorizations (see Authority factors below).

4.11.12. Authority Factors

Every authority table linked to a given permission lists potential "factors" explicitly used in the evaluation of the action authorization. A factor type can be one of the following:

- ❖ Actor's account name and permission level.
- ❖ Actor's public key
- ❖ Time wait

The potential actors who may execute the action are specified by either public key or account name in the authority table. Time waits are special factors which are satisfied by publishing a transaction with a delay in excess of the defined time. These carry weights as well that may contribute to satisfy the threshold.

4.11.13. Authority Threshold

Authorization over a given action is determined by satisfying all explicit authorizations specified in the action instance (see Transactions Protocol: Action Instance). Those are in turn individually satisfied by evaluating each "factor" (account, public key, wait) for satisfaction (potentially recursively) and summing the weights of those that are satisfied. If the sum equals or exceeds the weight threshold, the action is authorized.

4.11.14. Authority Example

The authority table for Alice's publish named permission is shown below. According to its contents, in order to authorize an action under that permission, a threshold of two must be reached. Since both *bob@active* and *stacy@active* factors have a weight of two, either one can satisfy the action authorization. This means that either Bob or Stacy with a permission level of active or higher can independently execute any action under Alice's publish permission.

Permission	Account / Public Key	Weight	Threshold
publish	bob@active	2	2
	stacy@active	2	
	EOS7Hnv4iBfcw2...	1	
	EOS3Wo1p9er7fh...	1	

Alternatively, it would require two accounts with public keys EOS7Hnv4iBfcw2... and EOS3Wo1p9er7fh... to satisfy the action authorization.

This is because each public key has a weight of 1 in the authority table.



4.11.15. Permission Mapping

Any given account can define a mapping between any of its named permissions and a smart contract or action within that contract. This sets the "minimum permission" required for that contract[::action]. It does not afford, however, any other account any access or authority to execute that contract[::action]. This is by design and the process is controlled by a permission evaluation mechanism, described next.

4.11.16. Permission Evaluation

When determining whether an action is authorized to be executed, the EOSIO software first checks whether the signatures provided in the transaction are valid (see Signature Validation).

Then it proceeds to check the authorization of all the actions included in the transaction. This is where permissions are evaluated. If there is at least one action that fails to be authorized (by not meeting the authority threshold (see Authority Threshold), the transaction fails.

4.11.17. Custom Permissions

By default, every account on the EOSIO blockchain is linked to the active permission. Again, this can be customized by creating children permissions under active or by creating alternate permissions under owner (see Permission Levels).

Creating custom permissions under owner (separate from active) is recommended. This is because if the keys associated with the active permission are compromised, the security of the account will not be compromised.

4.11.18. Use Case: social media

Say we have a publish permission created for message posting on a social media application. However, we do not want to associate that permission with sensitive actions, such as transferring or withdrawing funds. Under this scenario, it makes sense to link the social::post action to the publish permission.

This allows to define an authority structure which can authorize post but cannot satisfy the default active permission for all other actions. That authority structure could delegate itself to a different account at any named permission level. If it did so to another publish permission on another account, that would be purely coincidental.

4.11.19. Signature Validation

Satisfying authorities linked to permissions involves first and foremost the validation/recovery of the public keys that signed the transaction. After a signed transaction is received by a node, the set of signatures is extracted from the transaction instance. The set of public keys are then recovered from the signatures.

Then for all actions included in the transaction, the node checks that each actor:permission meets or exceeds the minimum permission as defined by the per-account permission links.

Once validated, the set of recovered keys are provided to the authorization manager instance along with the amount of time "waited". The authorization manager then proceeds to check whether the provided "factors" satisfy the authorities, potentially recursing into other linked permission levels/authorities (see Authority Table and Transactions Protocol: Verify Transaction for more information).

“In a gentle way,
you can shake the world”

– Mahatma Gandhi

4.12. User Experience (UX)

4.12.1. Main hypothesis:

We need to develop user friendly applications with a main strategy focused on providing a final product which sticks to these three characteristics: SIMPLE, INTUITIVE, VISUAL.

4.12.2. Brainstorming:

- ❖ Intuitive understanding: Once the user downloads the app we want them to spend their whole journey in a really intuitive way, they must understand instantly all the possibilities that our service offers.
- ❖ Intelligible and optimized registration data: The registration must be quickly, intuitive and direct. The user must feel that in a short period of time he will have access to his new account. Moreover, we will try to ask for the less information needed to join us, as it is proven that the more steps the user goes through before registration the more possibilities we have to lose him as a potential member.
- ❖ Effective resolutions: Our app should be designed in such a way that the user feels in every moment that possible problems could be easily solved, for this we must have a responsive resolution AI chat system linked to the app documentation, delivering simple, direct and fast answers from user's questions.
- ❖ Minimalist design: Less is more, consequently we want to create a minimalist design which fulfills the needed functions, providing a clean and serious sensation in the user's first eye contact.
- ❖ Universalized language: Icons and images are for excellence the best way of achieving an intuitive and universalized visual comprehension. Although we need to include text we are going to limit ourselves to the indispensable.

Furthermore, the app will count with icons and symbols to simplify in every moment the user journey. Besides, users will be able to personalize their app according to the theme they prefer (.i.e., Sahara theme, Niagara theme, Savanna theme, etc.)

- ❖ Fixed functionalities: We are going to have two main fixed functionalities in the app: on the upper part we have the fixed greeting and the help button (AI chatbot) and in the down part we have the main menu made with icons and titles as for people to understand the possible movements and backwards in an easy way.

4.13. Customer Experience (CX)

Customer experience, also known as CX, is your customers' holistic perception of their experience with our business or brand.

CX is the result of every interaction a customer has with your business, from navigating the website to talking to customer service and receiving the product/service they bought from you. Everything you do impacts your customers' perception and their decision to keep coming back or not—so a great customer experience is your key to success.

4.13.1. Why is CX important for your business?

Delivering a great customer experience is hugely important for any business. The better experience customers have, the more repeat custom and positive reviews you'll receive, while simultaneously reducing the friction of customer complaints.

The benefits of delivering a great CX include:

- ❖ Increased customer loyalty.
- ❖ Increased customer satisfaction.
- ❖ Better word-of-mouth marketing, positive reviews, and recommendations.
- ❖ Successful and strong emotional bonds.
- ❖ Increased reliability.
- ❖ Solid reputation.

4.13.2. Our strategy

We know that nowadays for any customer relationship it's essential to provide insights in regard to added value, experience, emotional bonds, transparency, two-way communication, etc.

Therefore, we are going to introduce an innovative structure for our project based on the whole concept of SION UNIVERSE.



Our project, your project, will take our users into a full technological experience that will definitely go beyond the screen.

More than an app or a cryptocurrency, we bring a definitive solution for the assertive development of a globalized economy by being a friendly option to benefit yourself and others. Through storytelling and transmedia strategies we are going to build constant interaction and solid loyalty.

4.13.3. The promise

Our promise is relevant and concrete: Sion provides you secure access to financial freedom through digitalization and holistic education. We want people to learn how to invest and make profit taking advantage of digital media and the decentralized power of technology.

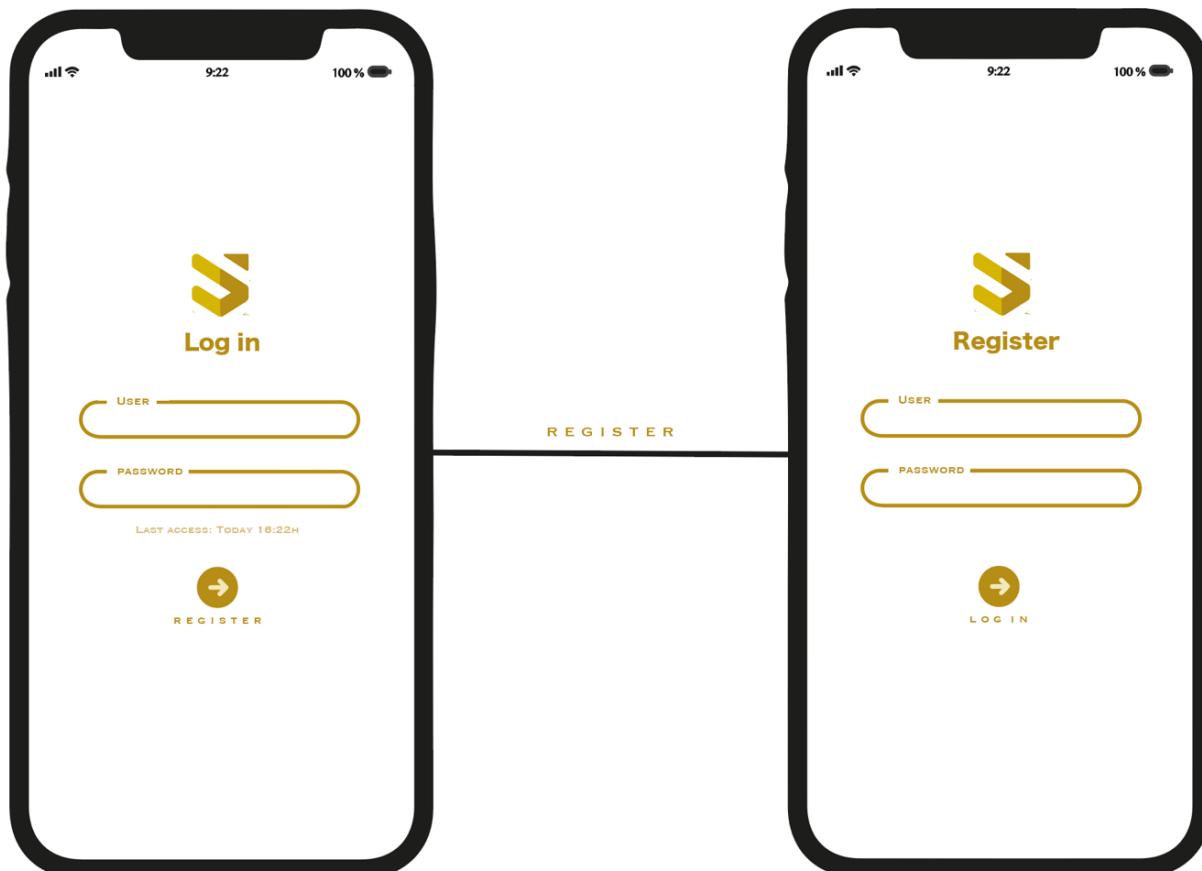
The success of individuals will drive the economic growth of the community. According to this, our business model could be understood as a WIN-WIN one: "If our client benefits, consequently the local economy as well".

4.14. First mobile UI wireframes

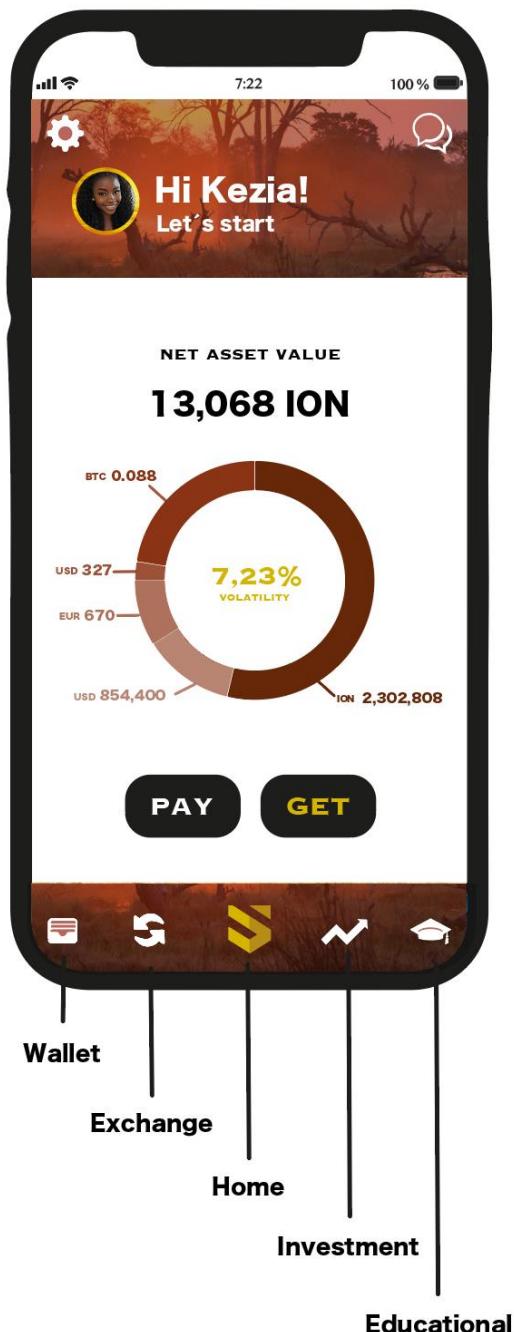
4.14.1. Log In & Register

Sion Dapps will have a common Sing Up, whether the user register from one Dapp or other, the user's database is shared between Sion Dapps, so only one register is needed.

The Dapp sing up requires a less data as possible but however, we need to identify every new registration as a human being and not a bot. Also, if we want to create a fair and clean financial system users must pass compliance and only one master account is deployed for every user. To achieve that, a picture of user's passport will be required to verify the Sion account.

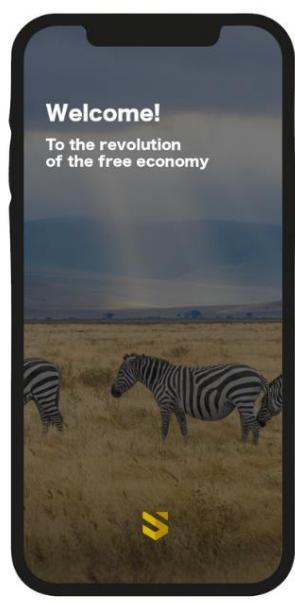
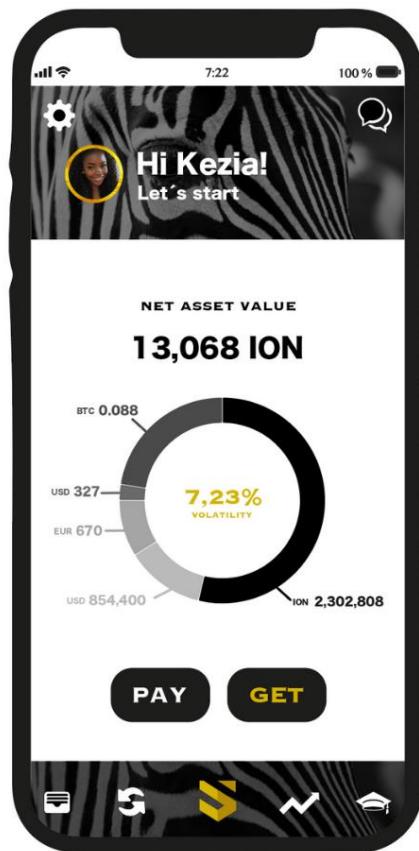


4.14.2. Mobile home screen

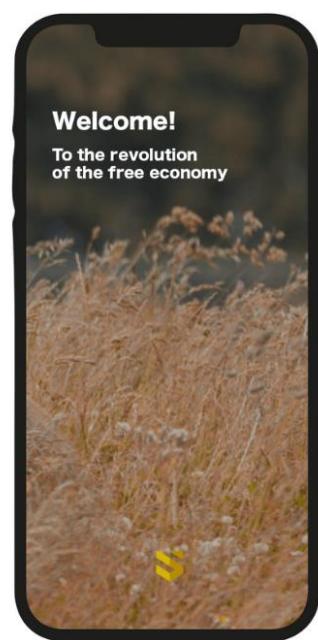
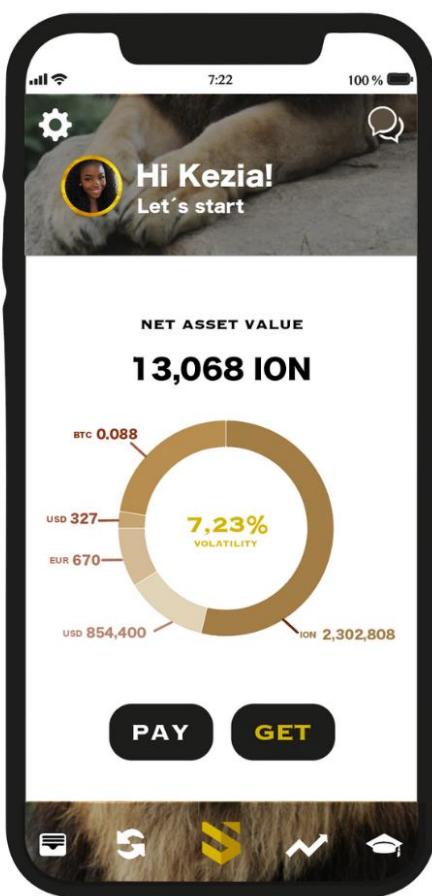
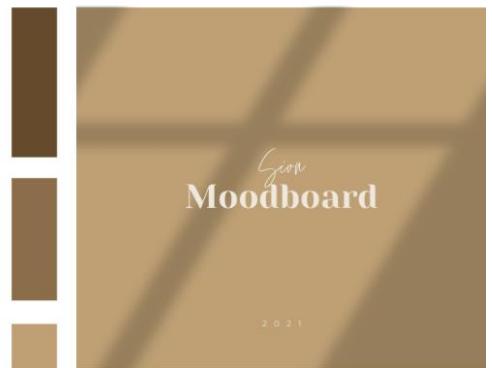


- ❖ **Wallet:** The user can manage his multicurrency accounts in the Sion blockchain and watch history of movements (transactions).
- ❖ **Exchange:** The user is able to trade multiple fiat and crypto currencies. The module is connected to live Sion exchange providing instant liquidity to the market.
- ❖ **Home:** In this part we find the initial dashboard together with the app main functions: settings, profile and chatbot (AI). Besides, the user will be able of paying (contactless, QR code, direct transfer) and getting money instantaneously.
- ❖ **Investment:** The user access to a digital investment universe that will give him the possibility of economic growth and development. One of the main features, as a decentralized financial system, is the peer-to-peer credit exchange that connects lenders and borrowers through smart contracts.
- ❖ **Educational:** Sion provides an educational platform to teach and instruct its community through short interactive videos. In this section we will employ gaming strategies as to create engagement, based on token rewards.

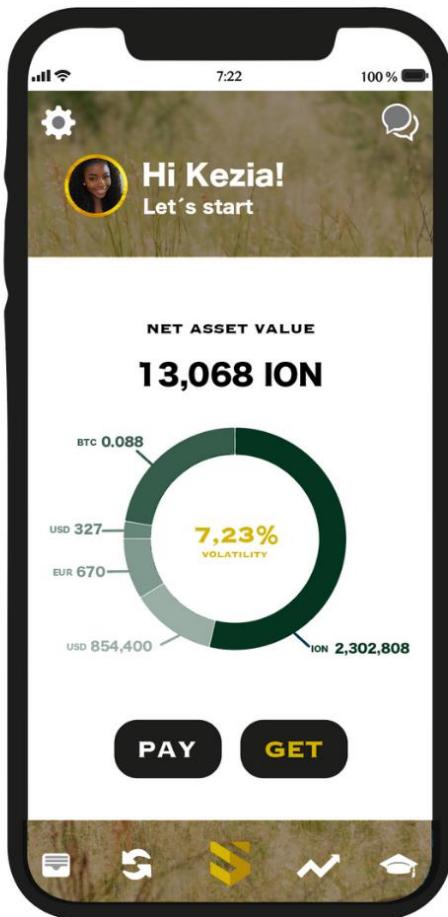
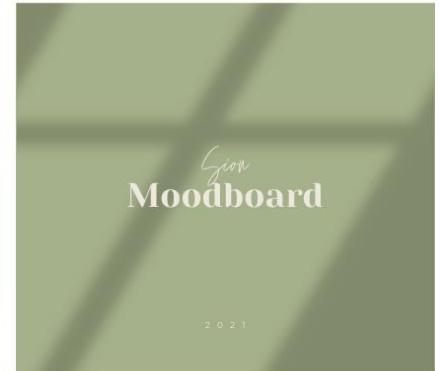
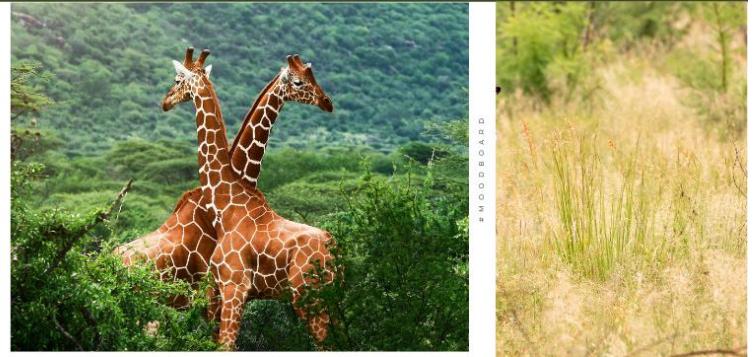
SION-SAVANNA THEME



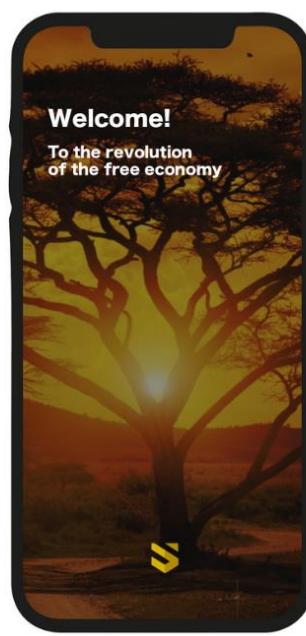
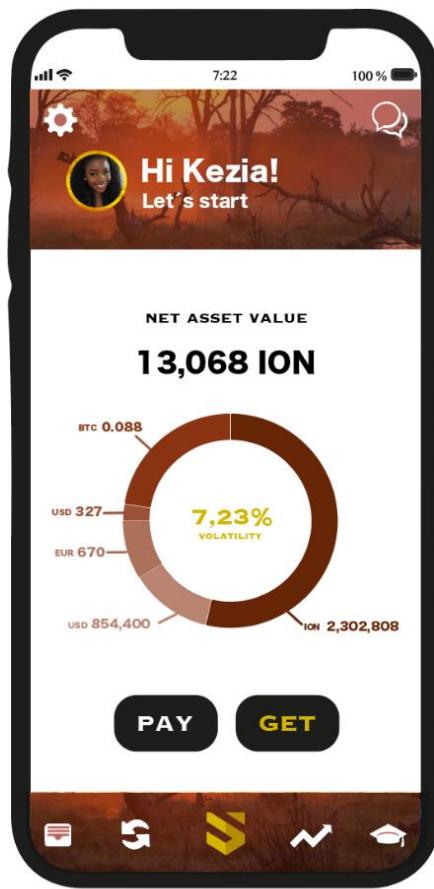
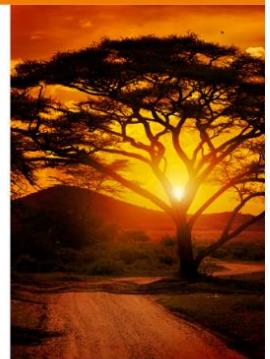
SION-LION THEME



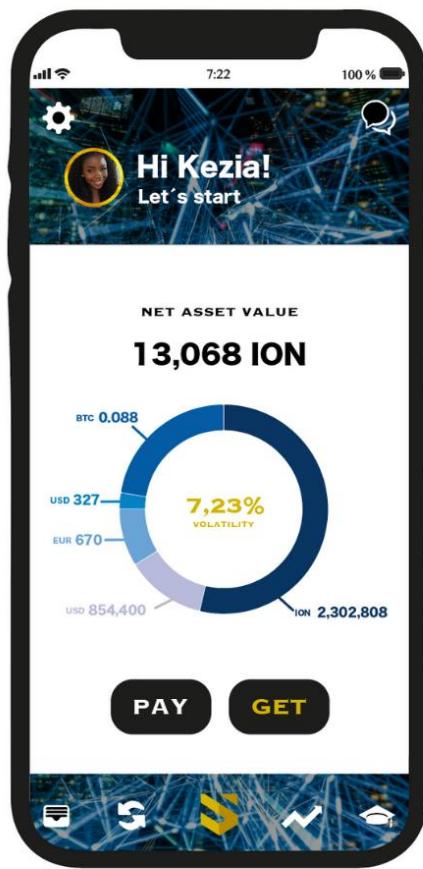
SION-NATURE THEME



SION-SUNSET THEME



SION-TECH THEME





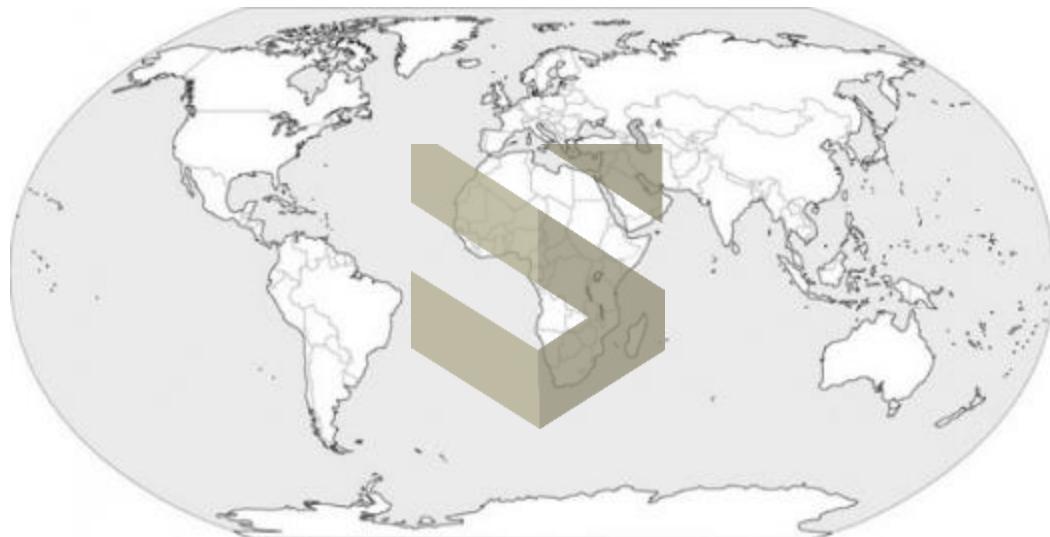
CHAPTER V

Sion Foundation

“Poverty does not come from the diminution of wealth, but from the multiplication of desires.”

- Plato

5. Sion Foundation



5.1. Preface

Sion Foundation is a private non-profitable organization (P-NPO) founded in Geneve (Switzerland) in 2021. It's governed by Swiss & European Laws, holded by International Companies and Managed by its Executive Team and Board of Directors. It's main function is to manage the ethical development of **SION COIN**, its blockchain, and the four (4) Sion official Dapps: **SION EXCHANGE**, **SION PEOPLE**, **SION BUSINESS** and **SION COMMUNITY**. Sion Coin Reserves will deploy the **SION BLOCKCHAIN**, creating the official African crypto-currency, **SION COIN**, with a maximum supply of twenty two (22) trillion ION coins.

The first task of the Sion Foundation is to build a structured wallet portfolio for each African Central Banks and for International Foreign Exchange, as well. After the first Initial Coin Offering (ICO) on December 2021, **SION COIN** will be delivered to the market in ±10% of the maximum supply.

In June 2023, the Second Coin Offering (2CO) will deliver another ±20% of the supply. In September 2026, the Third Coin Offering (3CO) will deliver another block of ±30% of the total coin offer. Finally, on February 2031, the Last Coin Offering (LCO) will be injected to the market, delivering another ±40%. At that point **SION COIN** will be ±99% distribute in the African economy and for foreign traders.

5.2. Functions & Obligations of the Sion Foundation

Sion Foundation main function is to deliver constant liquidity into the African economy and into international financial. Providing a fair market price model to maintain the competitiveness of Sion Coin. In order to be a stable coin, Sion Foundation algorithms will execute 24-7 a fair counterparty controlling the official offer and demand (bid-ask) on the national and international markets. Sion Exchange will provide to individuals, collectives, profitable organizations, non-profitable organizations, governmental institutions, investment banks, commercial banks and Central Banks a continuously market pricing by its market making systems between 41 African fiat-currencies, G16 fiat-currencies (USD, EUR, GBP, CHF, CNY, JPY, AUD, NZD, CAD, HKD, SGD, MXN, BRL) & 9 top cryptocurrencies (BTC, ETH, EOS, XRP, BCH, USDT, CAR, STE) versus Sion Coin (ION).

Another of the Sion Foundation obligation, consists in the maintenance of the Sion decentralized applications (Dapps), also keep investigating new technologies and protocols that can be of improvement in the Sion ecosystem.

- I. Sion Foundation will provide constantly support to African financial institutions (AFI) and non-profitable organizations (NPO). Support will start on technical documentation, IT management, innovative initiatives, liquidity providing (market making), distribution support and client attention.
- II. Sion Foundation must guarantee the well practice of the project, in any of its steps. The next 10 years are critical for introducing Sion to Africans daily life. Success or fail depends on the honest practice of the organizations, every individual and/or entity involved and the good development of the African telecommunications industry in the recent years.
- III. Sion Foundation will maintain the arches of Sion master wallet in a safety and cold safe environment. Official addresses, private and public keys, passwords and any sensible data will be storage in a safety and decentralized secret way.
- IV. The General Data Protection Regulation (GDPR) is a robust privacy law that was created by the European Union (EU) in 2016 and became effective in 2018. The purpose of the GDPR is to update digital security for the citizens of the EU by giving them a higher level of control on the personal information they share online. Sion Foundation data collection policy meets any of the acts sentenced by the GDPR laws.
- V. Sion Foundation will honor its agreements of Well Standing Practices, meeting always with the actual Swiss, European and African laws.
- VI. Sion Foundation guarantees that everything published by its official media channels, its hereby true.
- VII. Sion Foundation guarantees that the maximum supply of Sion Coin is of 22,000,000,000,000 ION tokens. (22 trillion Sion Coin).

5.3. Maintaining Sion Coin peg to the US Dollar

The main mission of Sion Foundation is to achieve the ±\$1.00 ION rate in order to be competitive against global markets. The next 3 years (2021-2024) will be easy as the main ION providing venues will be Sion Exchange and its market making algorithms. At that point, Sion Foundation will control ±75% of the Sion Coin supply, which makes it easy to 'control' the market price.

After the ICO, more than 60% of the supply will be delivered to the market with already ±5 years mature market with its own offer and demand. In the Last Coin Offering, Sion Foundation will already hold billions of currencies that will make easier for Sion Foundation to be a prime trading coin liquidity provider. The foundation will be able to provide competitive prices to financial markets worldwide.

Fiat-currency vs. Sion Coin rates: (July 2021)

INTERNATIONAL FIAT-CURRENCIES	Currency	1 ION = 1 USD (Official ICO rate)
		Block Discount
	United States Dollar (USD)	1.00
	Euro (EUR)	0.83
	Great British Pound (GBP)	0.71
	Switzerland Franc (CHF)	0.90
	Chinese Yuang (CNY)	6.25
	Japanese Yen (JPY)	110.29
	Australian Dollar (AUD)	1.31
	New Zealand Dollar (NZD)	1.40
	Canadian Dollar (CAD)	1.21
	Hong Kong Dollar (HKD)	7.76
	Singapore Dollar (SGD)	1.33
	Mexican Dollar (MXN)	20.14
	Brazilian Real (BRL)	5.08

Crypto-currency vs Sion Coin rates: (July 2021)

MAIN CRYPTO-CURRENCIES	
SION (ION)	1.00
Bitcoin (BTC)	0.000026
Ethereum (ETH)	0.000358
EOSio (EOS)	0.16
Ripple (XRP)	0.97
Bitcoin Cash (BCH)	0.0014
Tether (USDT)	1.00
Cardano (CAR)	0.55
Stellar (STE)	4,437.94

5.4. Sion Foundation banking & wallet structure

The integration of decentralized banking and traditional centralized banking is not an easy task. We will face many walls on the way, starting with compliance issues, old application programming interfaces (API), server connectivity problems, etc. However, our team is prepared to face every of the stones in the way to digitalize the African economy. The first step is to open an account for Sion Foundation in each of the 43 African Central Banks (ACB).

From there we will channel all African Coin Distribution (ACD) in every of the 4 blocks coin offering provided during the 10 years of the SION integration. If most ACB are computed in servers infrastructure we'll be able to connect via API to their databases in order to integrate their financial system into blockchain and be able to control the currency exchange accounting.

Sion wallet's master accounts will be created officially in EOS blockchain in December 2021. At that point, 43 wallets for African Central Banks, 16 more wallets for international currencies demand, and 6 more for crypto-currencies demand. A total of 53 wallets will be created after the Sion Master Account Wallet (SMAW) where the 20 trillion ION coins will be created once.

The first official distribution (or ICO) will be effectively in December 2021 and the correspondent number of coins will be transferred to the 53 master Sion wallets and the secret keys of each wallet will be securely send to each of the mandataries for each wallet distribution.

After the ICO is done, new secret keys and passwords will be generated for the SMAW and will be store in a cold device (disconnected from the Internet), until the next Coin Offering (CO) in 2023. Each CO block will be performed with the same protocol until LCO in January 2031.

5.5. Sion FX Fund

Sion FX Fund will be founded in Luxembourg in September 2021. Sion FX Fund will hold bank accounts in Luxembourg, Great Britain & Hong Kong. The main goal of Sion FX Fund is to control in a healthy way the needs of the international financial market, including commodities trade commerce and digital assets investments.

The SIF will be founded with a deposit of Eur 10M from private investment and ION 20T after Sion's blockchain is successfully deployed. From the SIF, and its global banking architecture, Sion Coins offer will be accessible against sixteen (16) global fiat-currencies and nine (9) crypto-currencies.

These venues of liquidity will cover the funding needs in this new modern African revolution. African international commerce will increase exponentially in the next decades, being, at one point, one of the main sources of commodities, including farm and metals, textiles, technology, plastic recycle, etc. of the world. But this time Africa will get 100% of the profits. Another function, it's to re-buy the global Sion Coin (ION) offer in order to maintain the price competitiveness, its market value and the worldwide ION liquidity.

5.5.1. European Banking Accounting

The main banking deposits in the European legislation from the international investors of the Sion FX Fund will be holded in:

- ❖ HSBC London (UK)
- ❖ Barclays London (UK),
- ❖ Royal Bank of Scotland (RBS-UK)
- ❖ Santander London (UK)
- ❖ Deutsche Bank (Luxembourg)
- ❖ BGL BNP Paribas (Luxembourg)
- ❖ Andbank (Luxembourg)
- ❖ Credit Suisse (Switzerland)
- ❖ UBS (Switzerland)

Asian Banking Accounting Meanwhile, the Asian currency deposits will be holded in the following banks:

- ❖ HSBC Hong Kong (HKD, CNY, SGD, AUD)
- ❖ DBS Bank (CNY, HKD, AUD).

5.5.2. Crypto-currency accounting

The crypto-currency main accounts will be holded half in warm storage and half in cold storage. Wallet Addresses (WA), Account Codes (AC), Passwords (Pw), Secret Keys (SK) and other sensible information will be saved securely, and a keys control protocol will be executed every new Coin Offering Block (COB).

The following table and chart (Figure 1) represents a model simulation, based on historical Imports and Exports data of every African country, to predict a potential market demand in the next years for each of the twenty five (25) fiat and crypto currencies allowed in the fund.

5.5.3. Legality & Jurisdiction

The constitution of the Sion FX Fund will be ruled by Luxembourg and European laws. The fund object will be a "Société d'Investissement Libre" (or SIL).

The hedge fund will act accordantly and strictly by the fund rules written in this document.

Sion FX Fund will have an ISIN number and will be accessible through bank transfers, digital deposits and credit/debit deposits worldwide, an exception for American citizen. Also, will be listed in Bloomberg, Inversis and other fund platforms.

An Exchange Traded Fund (ETF) may be issued on the 2ICO in 2023.

5.5.4. Fund Management

The official Fund Manager (FM) of the hedge fund will be Sion Foundation (Switzerland). The Asset Manager (AM) will be Black Rock Asset Management London or HSBC Asset Management Luxembourg. The administrator and the auditor of the hedge fund will be KMPG and EY.

As mentioned above, half of the crypto-currencies will be stored in cold wallets and the other half, will be deposited and used in Sion Exchange (see IV. SION DAPPS) as collateral to market make the books of the exchange.

On the other hand, fiat deposits will be store as coin value guarantee and counterparty, and one half of the fiat volume will be used in Sion Exchange traded by Sion's market making algorithms in order to offer constant liquidity in the sixteen (16) fiat-currencies books.

5.5.5. Risk Management

Sion Foundation Management Strategy (SFMS) from the Sion FX Fund SIL will be focus on control big tickets in the Sion Exchange, to provide to traders and bots good and tight spreads.

Sion's Market Making (SMM) algorithms will avoid big trades (aggressive side) providing a passive execution liquid prices on the Bids and Asks of each fiat and crypto currency.

The rest of the funds will be employed for African Development Projects (ADP) as mentioned in the last chapters. Every investment will be published in the official Sion FX Fund website and investors around the world will be able to participate thanks to this investment vehicle.

5.5.6. Expected Sion FX Fund AUM table for the next decade

		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
1	ION	22,000	17,000	15,000	14,500	14,000	10,000	9,000	8,000	7,000	5,000	500	250	100
2	USD	0	1.00	2.00	4.00	8.00	32.00	64.00	128	256	512	4,096	8,192	16,384
3	EUR	0.01	0.50	1.00	2.00	4.00	16.00	32.00	64	128	256	2,048	4,096	8,192
4	GBP	0	0.10	0.20	0.40	0.80	3.20	6.40	13	26	51	410	819	1,638
5	CHF	0	0.05	0.10	0.20	0.40	1.60	3.20	6	13	26	205	410	819
6	CNY	0	10.00	20.00	40.00	80.00	320.00	640.00	1,280	2,560	5,120	40,960	81,920	163,840
7	HKD	0	0.50	1.00	2.00	4.00	16.00	32.00	64	128	256	2,048	4,096	8,192
8	SGD	0	0.40	0.80	1.60	3.20	12.80	25.60	51	102	205	1,638	3,277	6,554
9	AUD	0	0.15	0.30	0.60	1.20	4.80	9.60	19	38	77	614	1,229	2,458
10	BTC	0	1,000	2,000	4,000	8,000	32,000	64,000	128,000	256,000	512,000	4,096,000	8,192,000	16,384,000
11	ETH	0	3,000	6,000	12,000	24,000	96,000	192,000	384,000	768,000	1,536,000	12,288,000	24,576,000	49,152,000
12	EOS	0	10,000	20,000	40,000	80,000	320,000	640,000	1,280,000	2,560,000	5,120,000	40,960,000	81,920,000	163,840,000
13	BCH	0	3,000	6,000	12,000	24,000	96,000	192,000	384,000	768,000	1,536,000	12,288,000	24,576,000	49,152,000
14	XRP	0	100,000	200,000	400,000	800,000	3,200,000	6,400,000	12,800,000	25,600,000	51,200,000	409,600,000	819,200,000	1,638,400,000
15	LTC	0	50,000	100,000	200,000	400,000	1,600,000	3,200,000	6,400,000	12,800,000	25,600,000	504,800,000	1,009,600,000	2,019,200,000
16	STE	0	50,000	100,000	200,000	400,000	1,600,000	3,200,000	6,400,000	12,800,000	25,600,000	504,800,000	1,009,600,000	2,019,200,000

[1] AUM corresponds to Assets Under Management



5.5.7. Expected Sion FX Fund AUM in logarithmic scale

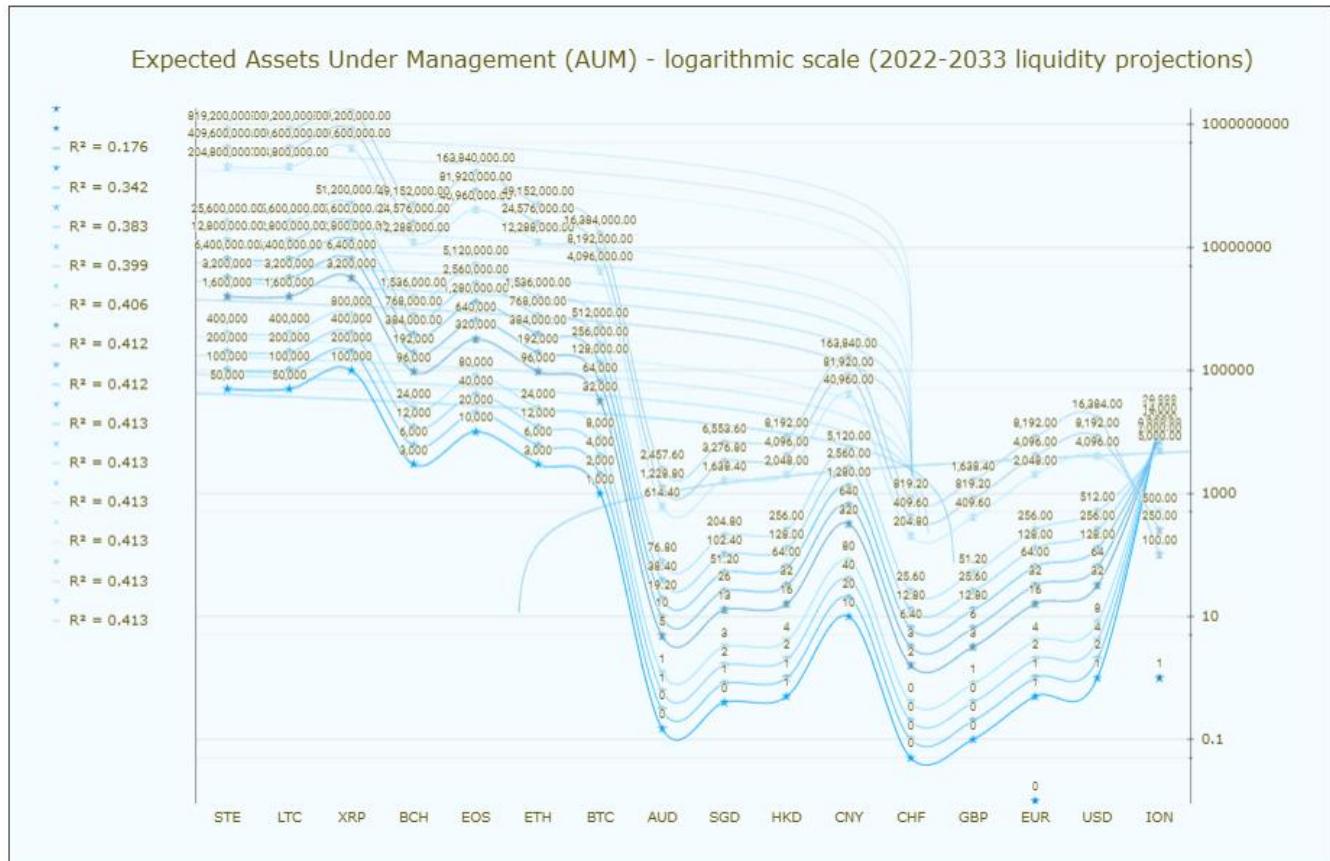


Figure 1. SIMCFF cash flow based on expected regression model from African international trading historical records. Data source worldbank.org

5.6. Insurance of ethical practices

Nowadays, the word has been broken. Politicians, businessman/woman, financial institutions, private banks and many other, have corrupted the economy and the game of power. Before 2008 only ±5% of the world's population were richer than the ±95% rest. Meanwhile, after the 2008 Global Financial Crisis (GFC-08) the reaction of the main Central Banks, including the FED and the BCE, was to start a massive cash injection in their economy, which they called it Quantitative Easing (QE).

The QE plus a low interest rates policy have driven the global economy into a historical credit bubble never saw before. Private Bankers have abused client's trust, being responsible of the Mortgage Bubble that resulted in the failing of the "too big to fall" Lehman Brothers in September 2008, which caused the decline of the global economy specially in the developed countries.

Affecting worst, the countries that their production is based in services. Countries with a high volume of financial operations have benefit a lot in the last decade, levering their position in long and short markets. Volatility has increased the recent years in two forms: 1. Higher Price Volatility (HPV) and 2. More-often Prices Spikes (MPS) which make global financial market every time more complex for individual and corporate traders. The technology sector has well-performed in the last years; however, technology titans, like Google, Facebook, Amazon, etc. have affected the employment market in the developed countries.

Automation faces a conflict of interests between workers and employers. The last decades main Central Banks have fight Inflation (caused by QA), financing government and tier-1 banks to stimulate the economy (with no great results...) and helping credit to flow lowering the interest rates, even in negative - like the Swiss Franc (CHF) big crash of 15th January 2015, which caused the currency to drop ±40% against other currencies counterparties. It was caused by the Bank of Switzerland (BOS) when announced that they dropped their interest rates to -0.75% with the intention to provoke banks to withdraw their CHF holded accounts and use the money in corporate borrowing and mortgages, in order to reactivate their economy.

Sion Foundation guarantees the good standing practices in every step of our work. The goal of our foundation was to help millions of people in Africa that needs help urgently. Europe, the States, Israel, China, Japan, Australia, and a long etcetera, have watched Africa's deteriorated over the years without doing anything or worth, making Africa's development harder. We are not heroes, neither the financial elite nor any corrupted government, we an international team from different disciplines that collaborate to create a better world for our children.

After everything that we saw, or listened, or made; for all the promises made by our governors and broken thousands of times, for the indifference of the middle class, for the hunger of the low-class, to break classes, to break borders, to break monopoly and finally, to achieve financial freedom, we created Sion Coin. Welcome to the bright future of Africa.

“Forgiveness liberates the soul. It removes fear. That is why it is such a powerful weapon. You can shake the world.”

– Nelson Mandela

5.7. Humanitarian projects in Africa

In Africa, hunger is increasing at an alarming rate. The COVID-19 pandemic, conflict, drought, economic woes, and extreme weather are reversing years of progress. As of 2019, 234 million sub-Saharan Africans were chronically undernourished, more than in any other region. In the whole of Africa, 250 million people were experiencing hunger, which is nearly 20% of the population. Conditions are deteriorating across six countries in East Africa, where 7 million people are at risk of starvation and another 33.8 million face acute food insecurity.

At least 12.8 million children are acutely malnourished in the region. “It’s heartbreaking that the lives of millions of children in East Africa are at risk due to a perfect storm of conflict, changing or unpredictable weather patterns, and the aftershocks of COVID-19,” said Edgar Sandoval Sr., president and CEO of World Vision U.S. “The long-term harm of malnutrition on children’s development hinders their ability to achieve their God-given potential.

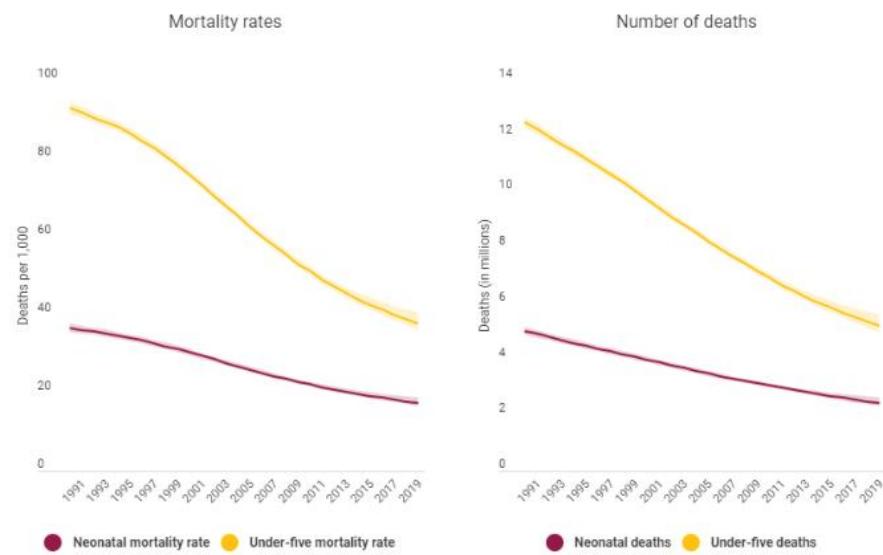
World Vision has launched an emergency response for Ethiopia, Somalia, Sudan, South Sudan, Kenya, and Uganda to help feed 3.2 million people, including 1.2 million children. We’re supplying families with nutritional care and screening children and pregnant mothers for acute malnutrition. “We are marshaling resources to support vulnerable communities across East Africa to avert the catastrophic effects of hunger, starvation, and loss of livelihoods. We are particularly concerned about the impact on children,” said Joseph Kamara, regional humanitarian and emergency affairs director for World Vision in East Africa. “It is not too late to avert the crisis, but it will be soon, if we don’t act quickly and decisively.”

Further south, successive crop failures and poor harvests in Zambia, Zimbabwe, Mozambique, and Angola are taking a toll on agriculture production, and food prices are soaring. In the past four growing seasons, parts of Southern Africa experienced their lowest rainfall since 1981.

Other areas suffered widespread destruction from Cyclones Idai and Kenneth in March and April 2019, near the time for harvesting.

Both the under-five mortality rate and the number of under-five deaths have fallen by more than half since 1990

Global mortality rates and number of deaths by age, 1990–2019



Note: All figures are based on unrounded numbers. The solid line represents the median estimate and the shaded area represents the 90 per cent uncertainty bound around the median value.

Source: United Nations Inter-agency Group for Child Mortality Estimation (UN IGME) 2020.

Whilst overall, poverty has been on the decline in Africa, the number of poor has continued to rise as a result of a growing population. According to a U.N. report, poverty decreased from 54% in 1990 to 41% in 2015, despite the increasing number of poor.

This trend has continued until today and, as the current numbers show, African countries continue to have the highest poverty rates in the world. Accurately tracking poverty-related data in Africa is made difficult by the lack of reporting from many countries with the quality of reports often being questionable.

However, the statistics below represent the closest current estimates thanks to data from World Data Lab.

5.7.1. How is poverty defined?

The current international poverty line is set at \$1.9 a day by the World Bank which is based on the average value of goods needed to sustain one adult per day. In other words, people who earn less than that which is considered necessary to sustain a single adult are considered poor. This translates to roughly US\$635 a year, significantly less than the poverty threshold in relatively wealthy countries such as the U.S (US\$12,140 per adult). This figure also does not consider non-essential factors such as sanitation, water, electricity, and quality of life.

5.7.2. Poverty in Africa

A fast-growing population is one of the factors that counter poverty eradication efforts across Africa. However, a burgeoning middle class in many countries has seen the overall poverty rate decline. In 2021, there are 490 million people in Africa living in extreme poverty, or 36% of the total population. This number is up from 481 million in 2019. Although this is an increase of just over 9 million, it represents an overall decrease as the population increased by roughly 30 million. As a whole, Africa is not on target to meet its Sustainable Development Goal 1 – Eradicate Poverty by 2030. At the current rate, 2.6 people escape poverty every minute whereas the required rate is 1.6 people/second.

5.7.3. Poverty by region and country

Poverty is significantly worse in sub-Saharan Africa as opposed to North Africa. Only two of Africa's 46 sub-Saharan countries are on track to meet their SDG 1 targets – Mauritania and Gabon. The region is also home to some of the poorest countries in the world, e.g., Burundi, DR Congo, Malawi, and Mozambique. In South Africa, the continent's second-largest economy, 16 million people live in extreme poverty – 26% of the population.

This is down 1% from its poverty rate in 2020. Nigeria, Africa's largest economy, currently has a 46% poverty rate with 90 million of its 210 million-strong population living in extreme poverty. Burundi, often regarded as the world's poorest country, has the highest poverty rate in Africa at 80%. It is closely followed by the Central African Republic (79%), Madagascar (78%), the Republic of the Congo (75%), and the Democratic Republic of the Congo (74%).

5.7.4. Poverty by demographics

Poverty in Africa seems to largely be independent of gender with most countries having similar poverty rates between males and females. Age also follows global trends with poverty worse among younger and older individuals.

5.7.5. Poverty by sex

In Africa, 35%, or 241 million, of males in Africa, live below the poverty line which is down 1% from 2020. 36%, or 249 million, of females in Africa live below the poverty line. Rwanda has one of the most skewed distributions with 50% of females and 40% of males living in poverty. This means roughly 750,000 more women live in poverty than men.

The kingdom of Eswatini's poverty level is also gender-skewed with 37% of women falling under the poverty line but only 28% of men.

5.7.6. Poverty by age:

As in many other regions, poverty disproportionately affects children with 41% of children aged 14 and below falling below the poverty line. The most affluent age group seems to be those aged 25 to 34 with only 31% of individuals falling below the poverty line.

It's imperative we react now. No more excuses.

Sion Foundation billing will be investment in Humanitarian Project (HP) around Africa. Every project will be presented in Sion Foundation official website and every transaction invested in the project will be saved in Sion blockchain and accessible to everybody.

Basically, Sion's projects will be audited by the own Sion blockchain transparently. Every HP will be published to Sion Community Dapp and every user will have access to invest with Sion Coin and receive variable profits and/or fix interests of the HP securely through Sion Smart Contracts Engine (SSCE).



5.8. Educational projects in Africa

The hypocrisies of the modern society, where democracy is the tyranny of incompetents.

Information is divided by elites and classes. Education has become a business in the world. Online platforms like YouTube, Vevo, Coursera, Google Learning, among many others, have provided access to educational free & payment resources. For example, today a young teenager can learn coding skills online from anywhere in the world with an Internet connection.

This trend will be seen in the next decades, the democratization of the education and freedom of information is in its way. Which will provide an equal world for future generations. At the dawn of independence, incoming African leaders were quick to prioritize education on their development agendas. Attaining universal primary education, they maintained, would help post-independence Africa lift itself out of abject poverty.

As governments began to build schools and post teachers even to the farthest corners of the continent, with help from religious organizations and other partners, children began to fill the classrooms and basic education was under way.

Africa's current primary school enrolment rate is above 80% on average, with the continent recording some of the biggest increases in elementary school enrolment globally in the last few decades, according to the United Nations Educational, Scientific and Cultural Organization (UNESCO), which is tasked with coordinating international cooperation in education, science, culture and communication. More children in Africa are going to school than ever before. Yet despite the successes in primary school enrolment, inequalities and inefficiencies remain in this critical sector.

According to the African Union (AU), the recent expansion in enrolments "masks huge disparities and system dysfunctionalities and inefficiencies" in education subsectors such as preprimary, technical, vocational and informal education, which are severely underdeveloped. It is widely accepted that most of Africa's education and training programs suffer from low-quality teaching and learning, as well as inequalities and exclusion at all levels. Even with a substantial increase in the number of children with access to basic education, a large number still remain out of school. A newly released report by the United Nations Development Programme (UNDP), *Income Inequality Trends in sub-Saharan Africa: Divergence, Determinants and Consequences*, identifies the unequal distribution of essential facilities, such as schools, as one the drivers of wide income disparities. Ayodele Odusola, the lead editor of the report and UNDP's chief economist, makes the following point:

Quality education is key to social mobility, and can thus help reduce poverty, although it may not necessarily reduce [income] inequality." To address education inequality, he says, governments must invest heavily in child and youth development through appropriate education and health policies and programmes. Higher-quality education, he says, improves the distribution of skilled workers, and state authorities can use this increased supply to build a fairer society in which all people, rich or poor, have equal opportunities. As it is now, only the elites benefit from quality education.

Wealthy leaders in Africa send their children to study in the best universities abroad, such as Harvard. After studies, they come back to rule their countries, while those from poor families who went to public schools would be lucky to get a job even in the public sector," notes Mr. Odusola. Another challenge facing policy makers and pedagogues is low secondary and tertiary enrolment.

Angela Lusigi, one of the authors of the UNDP report, says that while Africa has made significant advances in closing the gap in primary-level enrolments, both secondary and tertiary enrolments lag behind. Only four out of every 100 children in Africa is expected to enter a graduate and postgraduate institution, compared to 36 out of 100 in Latin America and 14 out of 100 in South and West Asia. "In fact, only 30 to 50% of secondary-school-aged children are attending school, while only 7 to 23% of tertiary-school-aged youth are enrolled. This varies by subregion, with the lowest levels being in Central and Eastern Africa and the highest enrolment levels in Southern and North Africa," Ms. Lusigi, who is also the strategic advisor for UNDP Africa, told Africa Renewal. According to Ms. Lusigi, many factors account for the low transition from primary to secondary and tertiary education. The first is limited household incomes, which limit children's access to education.

A lack of government investment to create equal access to education also plays a part. "The big push that led to much higher primary enrolment in Africa was subsidized schooling financed by both public resources and development assistance," she said. "This has not yet transitioned to providing free access to secondary- and tertiary-level education."



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Another barrier to advancing from primary to secondary education is the inability of national institutions in Africa to ensure equity across geographical and gender boundaries. Disabled children are particularly disadvantaged. "Often in Africa, decisions to educate children are made within the context of discriminatory social institutions and cultural norms that may prevent young girls or boys from attending school," says Ms. Lusigi.

Regarding gender equality in education, large gaps exist in access, learning achievement and advanced studies, most often at the expense of girls, although in some regions boys may be the ones at a disadvantage. UNESCO's Institute for Statistics reports that more girls than boys remain out of school in sub-Saharan Africa, where a girl can expect to receive only about nine years of schooling while boys can expect 10 years (including some time spent repeating classes). More girls than boys drop out of school before completing secondary or tertiary education in Africa.

Globally, women account for two-thirds of the 750 million adults without basic literacy skills. Then there is the additional challenge of Africa's poorly resourced education systems, the difficulties ranging from the lack of basic school infrastructure to poor-quality instruction.

According to the Learning Barometer of the Brookings Institution, a US-based think tank, up to 50% of the students in some countries are not learning effectively. Results from regional assessments by the UN indicate "poor learning outcomes in sub-Saharan Africa, despite upward trend in average learning achievements."

Many children who are currently in school will not learn enough to acquire the basic skills needed to lead successful and productive lives. Some will leave school without a basic grasp of reading and mathematics.

5.8.1. African education overcoming

The drivers of inequality in education are many and complex, yet the response to these challenges revolves around simple and sound policies for inclusive growth, the eradication of poverty and exclusion, increased investment in education and human development, and good governance to ensure a fairer distribution of assets. With an estimated 364 million Africans between the ages of 15 and 35, the continent has the world's youngest population, which offers an immense opportunity for investing in the next generation of African leaders and entrepreneurs.

Countries can start to build and upgrade education facilities and provide safe, non-violent, inclusive and effective learning environments for all. The AU, keeping in mind that the continent's population will double in the next 25 years, is seeking through its Continental Education Strategy for Africa 2016–2025 to expand access not just to quality education, but also to education that is relevant to the needs of the continent.

The AU Commission deputy chairperson, Thomas Kwesi Quartey, says governments must address the need for good education and appropriate skills training to stem rising unemployment. Institutions of higher learning in Africa, he says, need to review and diversify their systems of education and expand the level of skills to make themselves relevant to the demands of the labor market.

"Our institutions are churning out thousands of graduates each year, but these graduates cannot find jobs because the education systems are traditionally focused on preparing graduates for white-collar jobs, with little regard to the demands of the private sector, for innovation or entrepreneurship," said Mr. Quartey during the opening of the European Union–Africa Business Forum in Brussels, Belgium, in June 2017. He noted that if African youths are not adequately prepared for the job market, "Growth in technical fields that support industrialization, manufacturing and development in the value chains will remain stunted."

Inequality's inclusion among the Sustainable Development Goals (SDG 10: Reduced Inequalities) serves as an important reminder to leaders in Africa to take the issue seriously. For a start, access to early childhood development programmes, especially for children from disadvantaged backgrounds, can help reduce inequality by ensuring that all children begin formal schooling with strong foundations.

The UNDP, through its new strategic plan (for 2018 through 2021), will work to deliver development solutions for diverse contexts and a range of development priorities, including poverty eradication, jobs and livelihoods, governance and institutional capacity and disaster preparedness and management. SCR will support economically any educational project in Africa's region, supporting African entrepreneurs in developing online & potential educational projects in multiple languages.

Sion Foundation will issue in 2022 a free online educational program focused mainly in economic, financial, business, technology, marketing and coaching. The program will be available in different languages in the Sion Community platform.

Our team will work to get public and private collaboration in order to get corporate certifications from the courses in order to add value to our African and International students to their resumes.

Making a good work on the educational contents of our platform and getting collaborations from private corporations, governments and Universities worldwide will help the next African generations building a more equal, culturized and strong society.

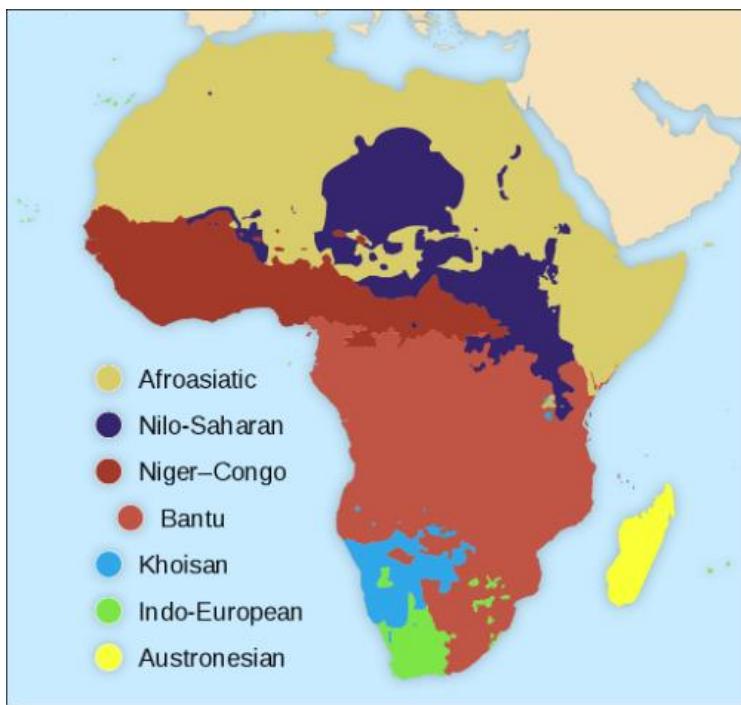
5.8.2. Spoken languages of Africa

The languages of Africa are divided into several major language families:

- ❖ Niger-Congo or perhaps Atlantic-Congo languages (includes Bantu and non-Bantu, and possibly Mande and others) are spoken in West, Central, Southeast and Southern Africa.
- ❖ Afroasiatic languages are spread throughout Western Asia, North Africa, the Horn of Africa and parts of the Sahel.
- ❖ Indo-European languages are spoken in South Africa and Namibia (Afrikaans, English, German) and are used as lingua francas in the former colonies of Britain and Liberia that was part of American Colonization Society (English), former colonies of France and of Belgium (French), former colonies of Portugal (Portuguese), former colonies of Italy (Italian), former colonies of Spain (Spanish) and the current Spanish territories of Ceuta, Melilla and the Canary Islands (Spanish).
- ❖ Various families of Nilo-Saharan languages (unity debated) are spoken from Tanzania to Eritrea and Sudan and from Chad to Mali.
- ❖ Austronesian languages are spoken in Madagascar.¹
- ❖ Khoe-Kwadi languages are spoken principally in Namibia and Botswana. There are several other small families and language isolates, as well as creoles and languages that have yet to be classified. In addition, Africa has a wide variety of sign languages, many of which are language isolates (see below).

The total number of languages natively spoken in Africa is variously estimated (depending on the delineation of language vs. dialect) at between 1,250 and 2,100, and by some counts at "over 3,000".

Nigeria alone has over 500 languages (according to SIL Ethnologue), one of the greatest concentrations of linguistic diversity in the world. However, "One of the notable differences between Africa and most other linguistic areas is its relative uniformity. With few exceptions, all of Africa's languages have been gathered into four major phyla."



Around a hundred languages are widely used for inter-ethnic communication. Arabic, Somali, Berber, Amharic, Oromo, Igbo, Swahili, Hausa, Manding, Fulani and Yoruba are spoken by tens of millions of people. Twelve dialect clusters (which may group up to a hundred linguistic varieties) are spoken by 75 percent, and fifteen by 85 percent, of Africans as a first or additional language.

Although many mid-sized languages are used on the radio, in newspapers and in primary-school education, and some of the larger ones are considered national languages, only a few

are official at the national level. The African Union declared 2006 the "Year of African Languages".

Most languages spoken in Africa belong to one of three large language families:

- ❖ Afroasiatic
- ❖ Nilo-Saharan
- ❖ Niger-Congo

Another hundred belong to smaller families such as Ubangian (sometimes grouped within Niger-Congo) and the various families called Khoisan, or the Indo-European and Austronesian language families mainly spoken outside Africa; the presence of the latter two dates to 2,600 and 1,500 years ago, respectively. In addition, the languages of Africa include several unclassified languages and sign languages.



The earliest Afroasiatic languages are associated with the Capsian culture, the Nilo-Saharan languages are linked with the Khartoum Mesolithic/Neolithic, the Niger-Congo languages are correlated with the west and central African hoe-based farming traditions and the Khoisan languages are matched with the south and southeastern Wilton industries.

More broadly, the Afroasiatic family is tentatively grouped within the Nostratic superfamily, and the Nilo-Saharan and Niger-Congo phyla form the Niger-Saharan macrophylum.

5.8.3. Afroasiatic languages

Afroasiatic languages are spoken throughout North Africa, the Horn of Africa, Western Asia and parts of the Sahel. There are approximately 375 Afroasiatic languages spoken by over 400 million people. The main subfamilies of Afroasiatic are Berber, Chadic, Cushitic, Omotic, Egyptian and Semitic.

The Afroasiatic Urheimat is uncertain. The family's most extensive branch, the Semitic languages (including Arabic, Amharic and Hebrew among others), is the only branch of Afroasiatic that is spoken outside Africa.

Some of the most widely spoken Afroasiatic languages include Arabic (a Semitic language, and a recent arrival from West Asia), Somali (Cushitic), Berber (Berber), Hausa (Chadic), Amharic (Semitic) and Oromo (Cushitic). Of the world's surviving language families, Afroasiatic has the longest written history, as both the Akkadian language of Mesopotamia and Ancient Egyptian are members.

5.8.4. Nilo-Saharan languages

Nilo-Saharan languages consist of a hundred diverse languages. The proposed family has a speech area that stretches from the Nile Valley to northern Tanzania and into Nigeria and DR Congo, with the Songhay languages along the middle reaches of the Niger River as a geographic outlier. Genetic linkage between these languages has not been conclusively demonstrated, and among linguists, support for the proposal is sparse.

The languages share some unusual morphology, but if they are related, most of the branches must have undergone major restructuring since diverging from their common ancestor. The inclusion of the Songhay languages is questionable, and doubts have been raised over the Koman, Gumuz and Kadu branches.

Some of the better known Nilo-Saharan languages are Kanuri, Fur, Songhay, Nobiin and the widespread Nilotc family, which includes the Luo, Dinka and Maasai. The Nilo-Saharan languages are tonal.

5.8.5. Niger-Congo languages

The Niger-Congo languages constitute the largest language family spoken in West Africa and perhaps the world in terms of the number of languages. One of its salient features is an elaborate noun class system with grammatical concord. A large majority of languages of this family are tonal such as Yoruba and Igbo, Akan and Ewe language. A major branch of Niger-Congo languages is the Bantu phylum, which has a wider speech area than the rest of the family (see Niger-Congo B (Bantu) in the map above).

The Niger-Kordofanian language family, joining Niger-Congo with the Kordofanian languages of south-central Sudan, was proposed in the 1950s by Joseph Greenberg. Today, linguists often use "Niger-Congo" to refer to this entire family, including Kordofanian as a subfamily. One reason for this is that it is not clear whether Kordofanian was the first branch to diverge from rest of Niger-Congo. Mande has been claimed to be equally or more divergent. Niger-Congo is generally accepted by linguists, though a few questions the inclusion of Mande and Dogon, and there is no conclusive evidence for the inclusion of Ubangian.

5.8.6. Other language families

Several languages spoken in Africa belong to language families concentrated or originating outside the African continent.



5.8.7. Austronesian

Malagasy belongs to the Austronesian languages and is the westernmost branch of the family. It is the national and co-official language of Madagascar and one of Malagasy dialects called Bushi is also spoken in Mayotte.

The ancestors of the Malagasy people migrated to Madagascar around 1,500 years ago from Southeast Asia, more specifically the island of Borneo. The origins of how they arrived at Madagascar remains a mystery, however the Austronesians are known for their seafaring culture.

Despite the geographical isolation, Malagasy still has strong resemblance to Barito languages especially the Ma'anyan language of southern Borneo. With more than 20 million speakers, Malagasy is one of the most widely spoken of the Austronesian languages.

5.8.8. Indo-European

Afrikaans is Indo-European, as is most of the vocabulary of most African creole languages. Afrikaans evolved from the Dutch vernacular of South Holland (Hollandic dialect) spoken by the mainly Dutch settlers of what is now South Africa, where it gradually began to develop distinguishing characteristics in the course of the 18th century, including the loss of verbal conjugation (save for 5 modal verbs), as well as grammatical case and gender.

Most Afrikaans speakers live in South Africa. In Namibia it is the lingua franca. Overall, 15 to 20 million people are estimated to speak Afrikaans. Since the colonial era, Indo-European languages such as Afrikaans, English, French, Italian, Portuguese and Spanish have held official status in many countries, and are widely spoken, generally as lingua francas. (See African French and African Portuguese.)

German was once used in Germany's colonies there from the late 1800s until World War I, when Britain and France took over and revoked German's official status. Despite this, German is still spoken in Namibia, mostly among the white population. Although it lost its official status in the 1990s, it has been redesignated as a national language. Indian languages such as Gujarati are spoken by South Asian expatriates exclusively. In earlier historical times, other Indo-European languages could be found in various parts of the continent, such as Old Persian and Greek in Egypt, Latin and Vandalic in North Africa and Modern Persian in the Horn of Africa.

5.8.9. Small families

The three small Khoisan families of southern Africa have not been shown to be closely related to any other major language family. In addition, there are various other families that have not been demonstrated to belong to one of these families. (The questionable branches of Nilo-Saharan were covered above and are not repeated here.) Khoisan is a term of convenience covering some 30 languages spoken by around 300,000–400,000 people.

There are five Khoisan families that have not been shown to be related to each other: Khoe, Tuu and Kx'a, which are found mainly in Namibia and Botswana, as well as Sandawe and Hadza of Tanzania, which are language isolates. A striking feature of Khoisan languages, and the reason they are often grouped together, is their use of click consonants. Some neighboring Bantu languages (notably Xhosa and Zulu) have clicks as well, but these were adopted from Khoisan languages. The Khoisan languages are also tonal.



5.8.10. Creole languages

Due partly to its multilingualism and its colonial past, a substantial proportion of the world's creole languages are to be found in Africa. Some are based on Indo-European languages (e.g. Krio from English in Sierra Leone and the very similar Pidgin in Nigeria, Ghana and parts of Cameroon; Cape Verdean Creole in Cape Verde and Guinea-Bissau Creole in Guinea-Bissau and Senegal, all from Portuguese; Seychellois Creole in the Seychelles and Mauritian Creole in Mauritius, both from French); some are based on Arabic (e.g. Juba Arabic in the southern Sudan, or Nubi in parts of Uganda and Kenya); some are based on local languages (e.g. Sango, the main language of the Central African Republic); while in Cameroon a creole based on French, English and local African languages known as Camfranglais has started to become popular.

5.8.11. Unclassified languages

Further information: Category: Unclassified languages of Africa A fair number of unclassified languages are reported in Africa.

Many remain unclassified simply for lack of data; among the better-investigated ones that continue to resist easy classification are: - possibly Afroasiatic: Ongota, Gomba - possibly Nilo-Saharan: Shabo - possibly Niger-Congo: Jalaa, Mbre, Bayot - possibly Khoe: Kwadi - unknown: Laal, more of these, Jalaa is perhaps the most likely to be an isolate. Less-well investigated languages include Irimba, Luo, Mawa, Rer Bare (possibly Bantu), Bete (evidently Jukunoid), Bung (unclear), Kujarge (evidently Chadic), Lufu (Jukunoid), Meroitic (possibly Afroasiatic), Oropom (possibly spurious) and Weyto (evidently Cushitic).

Several of these are extinct, and adequate comparative data is thus unlikely to be forthcoming. Hombert & Philippson (2009) list a number of African languages that have been classified as language isolates at one point or another.

Many of these are simply unclassified, but Hombert & Philippson believe Africa has about twenty language families, including isolates. Beside the possibilities listed above, there are:

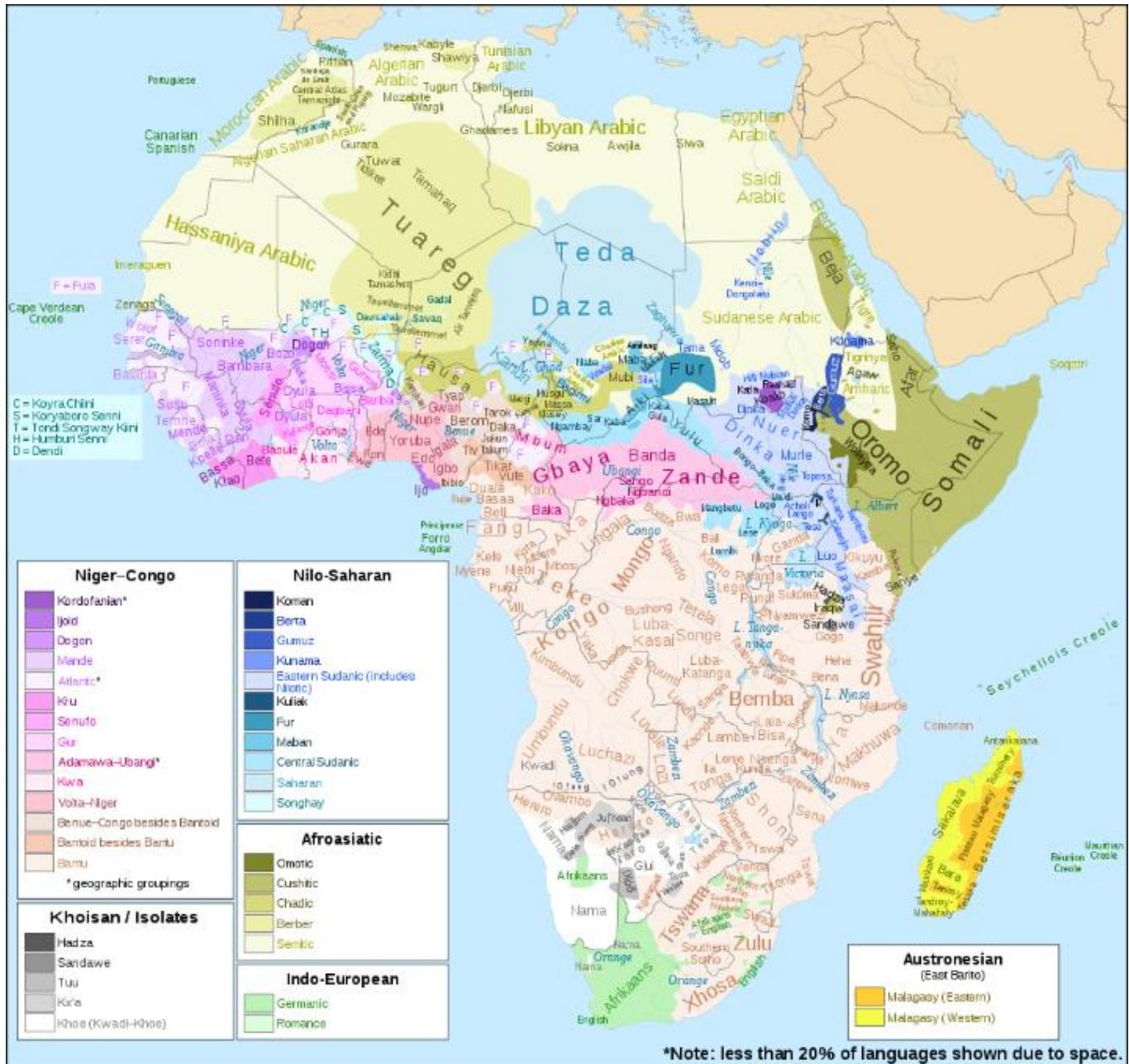
- Aasax or Aramanik (Tanzania) (South Cushitic contains non-Cushitic lexicon)
- Imeraguen (Mauritania)
- Hassaniyya Arabic restructured on an Azér (Soninke) base
- Kara (Fer?) (Central African Republic)
- Oblo (Cameroon) (Adamawa? Extinct?)
- Roger Blench notes a couple additional possibilities:
 - Defaka (Nigeria)
 - Dompo (Ghana) Below is a list of language isolates and otherwise unclassified languages in Africa, from Vossen & Dimmendaal (2020:434):

	Language	Country
1	Bangi Me	Mali
2	Bayot	Senegal
3	Dompo	Ghana
4	Ega	Ivory Coast
5	Gomba	Ethiopia
6	Gumuz	Ethiopia, Sudan
7	Hadza	Tanzania
8	Irimba	Gabon
9	Jalaa	Nigeria
10	Kujarge	Chad
11	Laal	Chad
12	Lufu	Nigeria
13	Luo	Cameroon

	Language	Country
14	Mawa	Nigeria
15	Meyobe	Benin, Togo
16	Mimi of Decorse; Mimi of Nachtigal	Chad
17	Mpra	Ghana
18	Oblo	Cameroon
19	Ongota	Ethiopia
20	Oropom	Kenya, Uganda
21	Rer Bare	Ethiopia
22	Shabo	Ethiopia
23	Weyto	Ethiopia
24	Wutana	Nigeria
25	Yeni	Cameroon

Table 1. Languages in Africa, from Vossen & Dimmendaal.
Source en.wikipedia.org/wiki/Languages_of_Africa

5.8.12. Traditional languages families, subfamilies and major spoken



5.8.13. African Ethnolinguistic Groups





5.9. Agricultural projects in Africa

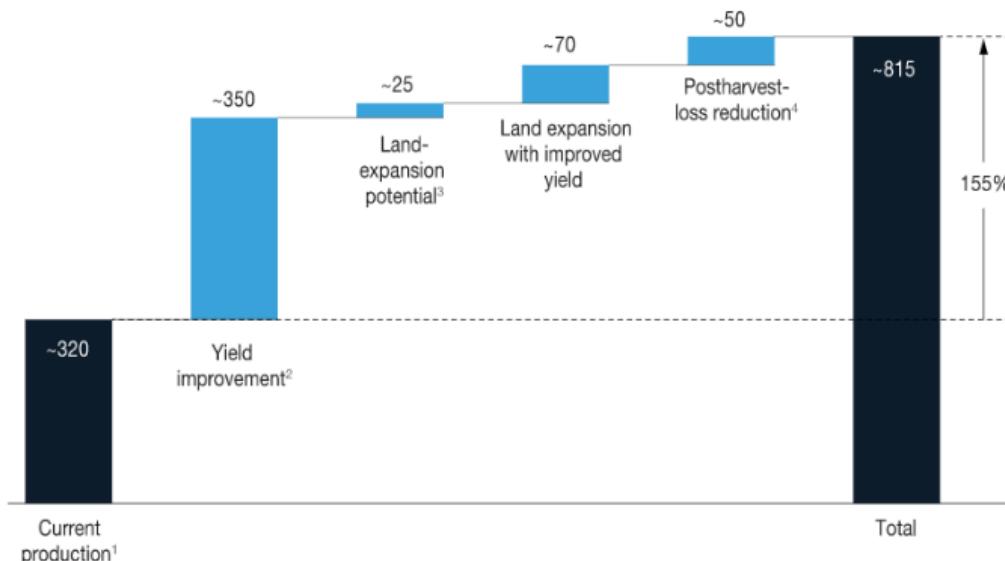
Agriculture in Africa has a massive social and economic footprint. More than 60 percent of the population of sub-Saharan Africa is smallholder farmers, and about 23 percent of sub-Saharan Africa's GDP comes from agriculture. Yet, Africa's full agricultural potential remains untapped. In a recent analysis, we determined that Africa could produce two to three times more cereals and grains (Exhibit 1), which would add 20 percent more cereals and grains to the current worldwide 2.6 billion tons of output. Similar increases could be seen in the production of horticulture crops and livestock.

Building on three years of analysis and on-the-ground experience with agriculture in sub-Saharan Africa (see sidebar, "Methodology"), this article offers insights in two areas. First, we address findings from our analysis on where the opportunity for growth lies in African agriculture, looking closely at growth in different countries, land expansion, cost competitiveness, and farmer productivity. Second, we describe practical recommendations on the supply and demand sides for companies—both local and multinational—looking to grow in this high-potential but challenging market. Governments, investors, and development partners can also follow this guidance to support the private sector.

Exhibit 1

Africa could be two to three times more productive if it intensified its agricultural productivity.

Cereal and coarse-grain production potential, Africa, millions of tons¹



¹Cereal and coarse-grain production in 2014, from FAOSTAT (latest year available).

²Economic-yield improvements without irrigation for main cereal crops for sub-Saharan Africa only, excluding South Africa; some discounts made for less “commercializable” crops, such as sorghum and millet; based on Global Yield Gap Atlas.

³Assumes 20-million-hectare land-expansion growth, based on McKinsey analysis.

⁴Based on sub-Saharan Africa moving from 14% agricultural and postharvest loss to 10% (Latin America benchmark).

McKinsey&Company | Source: FAO; Global Yield Gap Atlas; McKinsey analysis

5.9.1. Where will agricultural growth in Africa come from?

Realizing Africa's full agricultural potential will require significant investment. Sub-Saharan Africa will need eight times more fertilizer, six times more improved seed, at least \$8 billion of investment in basic storage (not including cold-chain investments for horticulture or animal products), and as much as \$65 billion in irrigation to fulfill its agricultural promise.

Much investment will also be needed in basic infrastructure, such as roads, ports, and electricity, plus improvements in policies and regional trade flows (Exhibit 2). For the purposes of this article, we define sub-Saharan Africa as including all African countries except Algeria, Egypt, Libya, Morocco, and Tunisia. Unless otherwise specified, South Africa is not included in sub-Saharan Africa.

Exhibit 2

Delivering on Africa's agricultural potential will require a significant investment.

Example investment requirements

Inputs		Infrastructure			Markets
Fertilizer	Hybrid seed	Irrigation	Storage	Other	Trade
					
8x increase in application required on average for main nutrients ¹	6x increase in hybridization rate, based on maize hectarage ²	Up to \$65 billion investment in irrigation in suitable areas in sub-Saharan Africa (from 5% to ~15% total cultivate area) ³	≥\$8 billion investment to ensure ~70% of grain production has access to local warehouse ⁴	Plus investments in roads, electricity, ports, and other infrastructure	Plus improvements in regional trade flows and policies, plus development of different off-take markets within value chains ⁵

¹Based on current application rates in sub-Saharan Africa and projected required application rate (based on removal rate of macronutrients) to achieve potential yield. ²Based on estimated current maize-hybridization rates and gap needed to get to 80% hybridization rate. ³Liangzhi You et al., *What is the irrigation potential of Africa?*, International Food Policy Research Institute, June 2010, ifpri.org. ⁴Based on analysis done in select countries (Ethiopia, Ghana, Mali, and Tanzania) on grain-storage costs, extrapolated to major grain-growing areas. ⁵Such as development of animal-feed market to off-take portion of grains currently almost completely grown for human consumption.

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When we talked to companies considering investing in African agriculture, we encountered questions about what would spur growth in the sector, particularly regarding which countries to pursue, the role of land expansion, the potential for larger-scale farming, and overall cost competitiveness. We found that addressing these topics helped companies focus on the solutions that are mostly likely to propel growth in agriculture in Africa. We discuss these topics below.

5.9.2. Few countries will account for a significant potential portion

Analyzing productivity potential across 44 countries in sub-Saharan Africa showed that nine countries make up 60 percent of the total potential, with three countries—Ethiopia, Nigeria, and Tanzania—comprising half of that. While this potential is highly concentrated, the significant variation in agricultural development and policy on the continent means differentiated approaches are required for each market. The three highest-potential countries illustrate this variation well with respect to government involvement in agriculture, enabling environment, and factors such as improved input adoption (Exhibit 3).

Exhibit 3

The three highest-potential countries highlight the diversity in starting points for agricultural growth.

Performance by region and metric

	Ethiopia	Nigeria	Tanzania
Level of government involvement in the agricultural system ¹	High	Moderate	Moderate
Fertilizer application rate, ² kilograms per hectare	58	14	10
Maize hybridization, ³ %	~40	<3	~20
Average distance-to-frontier score, ⁴ score out of 100	43.8	50.6	60.4

¹Qualitative assessment of government intervention in the sector (eg, land and farm ownership, tender systems for inputs, subsidy policies, managing maize prices and exports, extension services). ²Calculation based on metric ton (1 metric ton = 2,205 lbs) nutrient of nitrogen, phosphate (P2O5), and potash (K2O) consumed per country compared with world average of 120 kilograms per hectare; 2015 data (latest available). ³Percent of maize hectares using hybrid seed, 2018 data. ⁴World Bank; indicator of regulatory good practice; score shows absolute distance to best performance on each indicator (0 = worst performance and 100 = best); average is cross-indicator in seed, fertilizer, machinery, finance, markets, transport, water, and IT and communications technology; 2017 data.

Source: Agronomist interviews; *Enabling the business of agriculture 2017*, World Bank, 2017, eba.worldbank.org; FAOSTAT; International Fertilizer Association; McKinsey analysis



Overall cost competitiveness, not just yield, must improve. Rising urbanization and the growth of urban middle-class consumers in Africa could lead to \$645 billion in growth in consumer spending between 2015 and 2025. Of that growth, \$167 billion could be in food and beverages; a majority of that would come from sub-Saharan African countries. Urban consumers are expected to consume more fresh produce, dairy, meat, and processed food relative to their rural counterparts. This presents an opportunity and a challenge for African agriculture.

Currently, sub-Saharan Africa imports \$15 billion in food crops (grains, edible oils, and sugar), primarily from regions in Asia and South America. Imports are not necessarily a bad thing and, in fact, can play an important role in food security and sustainability, particularly when countries face constraints to production, such as land and water availability. However, if African agriculture is to play a greater role in supplying local food demand (and even global food demand), it will be important to improve cost competitiveness for food crops compared with major trading partners. Sub-Saharan Africa has already demonstrated a competitive advantage in select cash crops, such as cashews, coffee, processed horticulture, and tea in East Africa and cocoa in West Africa.

For some of these crops, such as cocoa, Africa has the lowest cost of production in the world. The same is not necessarily true for food crops, for which yield improvements alone are often not enough to improve cost competitiveness. Rice is an excellent example of this challenge.

5.9.3. How companies can pursue African agricultural opportunity

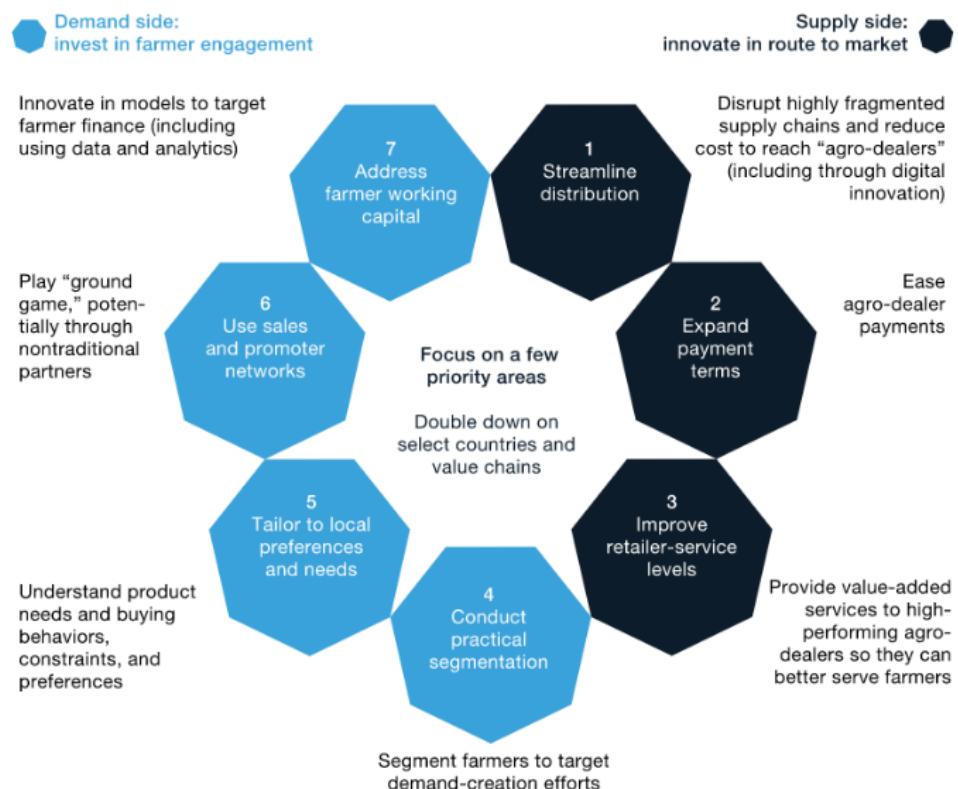
While Africa's agricultural potential is significant, unlocking it requires practical, on-the-ground effort and innovation. Given the continent's diversity, a winning strategy for any company must first prioritize a few countries and value chains in which to place most resources, including personnel, investment dollars, and partnerships.

Companies can pick these areas by disaggregating the growth potential and the enabling conditions across countries, value chains, and farmer types and then effectively prioritizing those areas based on the company's own product or service offering and competitive advantage.

Choosing these few priorities well is particularly important, as we have found that it is difficult to replicate approaches across countries fully; therefore, the need for purpose-built strategies can quickly fragment resources if too many areas are pursued. We typically find that a handful of prioritized areas will provide most of the growth for any company on the continent. Besides choosing priority areas, companies looking to invest in and expand their efforts in sub-Saharan African agriculture can follow seven lessons that touch on both supply and demand (Exhibit 4).

Exhibit 4

Seven lessons can help unlock Africa's agriculture potential.



These recommendations are most applicable to input players, but commodity traders and processors could adapt them for their use. For example, farmer engagement is still critical for traders and processors, but its importance is more in promoting quality and traceability in production rather than in creating demand for inputs.

5.9.4. Supply side: Innovate in route to market

Supply chains for agriculture in sub-Saharan Africa are fragmented. In analyzing major agricultural-input chains in eight countries, we found that inputs changed hands at least three times before they reached the farmer, moving from national importers to regional distributors to “agro-dealers” (which are typically small, rural shops). Of nearly 1,000 agro-dealers surveyed, 68 percent purchased from local distributors, and only 23 percent purchased directly from manufacturers.

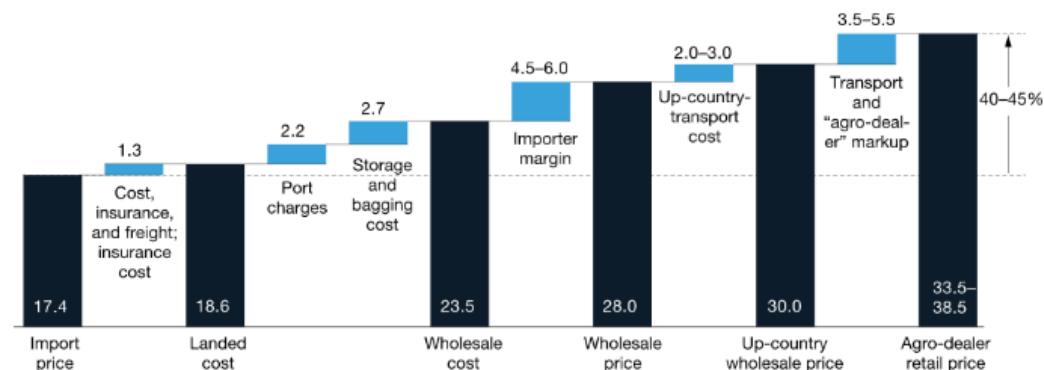
On average, this fragmented supply chain led to a 20 to 50 percent markup over import price across major agricultural inputs, with about one-third to one-half of that captured as margin by the distributors and retailers in the chain (see Exhibit 5 for a Tanzania fertilizer example).

National and regional distributors are a source of value-added services, such as demand creation and credit extension. Interviews and survey analysis of distributors and agro-dealers suggest that, with some exceptions, these distributors rarely provide such services to the smallholder-farmer value chain, though they often do so to that of large-scale farmers.

Exhibit 5

Import and distribution markups can add nearly 40 to 45 percent to the fertilizer price.

Cost buildup in Tanzania, 2015, \$ per 50-kilogram bag of urea



McKinsey&Company | Source: IFDC; interviews with local fertilizer importers and distributors

The question is not deciding whether these intermediaries are good or bad. Very often, some of them (particularly those at the “last mile”) play an important role in extending access to rural areas. Instead, when looking at the supply side, companies should find ways to improve efficiencies to reduce costs to farmers and to provide value-added services through these channels. We explore three ways companies could move to overcome these supply-side challenges.

Streamline and expand distribution Given fragmented supply chains, companies have an opportunity to reduce costs and increase value by streamlining and expanding distribution. For input companies, this can mean gaining greater control of the distribution chain and holding more of the working-capital burden by maintaining ownership of inventory in rural aggregation points.

In Tanzania, if fertilizer manufacturers were to invest in direct distribution to clusters of agro-dealers, that could yield a 10 to 15 percent cost reduction through savings on working capital and the decreased number of steps in the chain.

Presuming this savings would be passed on to the farmer, this would improve the ROI for about 800,000 additional farmers, nearly twice the number of farmers estimated to be using fertilizer in the regions studied. Such a change could equate to more farmers buying fertilizer. Improved distribution could also come through stronger partnerships with other input companies to share the costs of distribution and warehousing across the value chain, again relieving the burden on agro-dealers.

The Last Mile Alliance in Tanzania, a partnership of Bayer, NMB Bank, Seed Co, Syngenta, and Yara, worked to establish agro-dealers in remote areas, using shipping containers as storage and building resources through training and demonstration plots. Another approach could be incentivizing the existing distribution chain differently.

In interviews with distributors and agro-dealers, we found that about 60 percent of them receive incentives in the form of volume-based discounts. But a look at the experience in consumer-goods businesses suggests that moving incentives from volume-based discounts toward those based on cross-selling with other products or expanding into underpenetrated areas could change behavior within the distribution chain to focus on expanding access and selling a more optimal product mix.

Some innovators are using digital solutions to provide streamlined and more reliable distribution for inputs and produce. For example, iProcure is a business-intelligence and data-driven stock-management company that uses data to support retailer fulfillment (with cost savings to current distributors).

Another company, Twiga Foods, uses a mobile-based B2B platform to connect farmers directly to buyers of horticulture produce. It uses a network of collection points and delivery vehicles to distribute this produce efficiently. These shifts in the distribution chain do come with challenges, though, including managing more complex logistics and payment collections from agro-dealers as well as taking on the risk of bad debts further down the distribution chain.

Moreover, cost savings may be limited, given the infrastructure constraints in more rural areas. Therefore, this approach should be tailored to the structure of the local distribution chain. For example, direct distribution may make sense in some parts of a country or to some types of farmers, while having local distributors (with improved incentives) may be a better approach in others.



5.9.5. Explore more flexible payment terms

Nominal interest rates in sub-Saharan African countries are commonly above 20 percent—among the highest in the world—making access to working capital for small agro-dealers challenging and limiting their ability to purchase sufficient volumes of inputs. Longer payment terms are a cheaper mode of finance; migrating dealers to longer terms based on payment history can facilitate growth. In some cases, partnerships can be developed to mitigate the risk of default. For example, AFAP Partnership provided a first-loss guarantee to fertilizer suppliers to extend payment terms to agro-dealers in Tanzania, contributing to an approximately 35 percent increase in fertilizer sales.

5.9.6. Improve service to agro-dealers.

Agro-dealers play a critical role as the last mile in the chain, often due to their knowledge of local farmers and the trust they engender in the community. In a survey of nearly 1,000 agro-dealers across four countries, we found that 30 percent of them provide some level of agronomic advice to farmers; 73 percent extended credit to at least some farmers (with one-third providing credit to 10 to 50 percent of their farmers). Improving service to agro-dealers is therefore a key lever for agriculture-input companies to explore—and they can learn from other institutions in the agriculture value chain that are doing this well. Several banks in Kenya support high-performing agro-dealers to improve their farmer-service levels.

Equity Bank Kenya and KCB Bank Kenya identify high-performing agro-dealers to serve as agents that offer financial services to farmers in their networks. While the average agro-dealer in Kenya reaches 600 to 1,000 farmers, Equity Bank Kenya works with high-performing dealers that are connected to up to 10,000 farmers, offering them preferential loan terms and access to accelerator programs with financial training and other incentives. Demand side: Invest in farmer engagement through traditional and nontraditional methods We found that most farmers in regions where companies had invested in demand-creation efforts were largely aware of the value of using improved inputs.

For example, hybrid-seed-adoption rates in southern Tanzania—where effort had been made by private companies to build demand—were greater than 60 percent, versus a 20 percent average national hybridization rate. We also learned that farmers were well aware of the qualities of different brands in these areas. Nine of ten farmers we interviewed in southern Tanzania were able to explain the merits of different brands across inputs. In Kenya, our agro-dealer survey found that 43 percent of farmers name a specific brand when they come to purchase inputs. This suggests that farmer engagement is critical. Yet, given the fragmentation of the farmer base in most of sub-Saharan Africa, it can be a daunting task. Private-sector companies could benefit from four demand-side approaches.

5.9.7. Better understand farmer segmentation

Farmers are not all the same. As mentioned, the ROI for inputs can vary significantly within a country, depending on market access, agronomic conditions, and other dimensions. However, we have observed that poor data often mean that companies use anecdotal information to make decisions about which farmers to target for demand creation as well as where to deploy their sales forces. This often engenders an overreliance on local distributors or traders. With relatively simple methods such as SMS-based surveys, field visits, and interviews, companies can typically assemble a practical farmer segmentation that allows for better targeting of demand-creation efforts.

In East Africa, we found that understanding whether a maize farmer was a “monocopper” (growing only maize) or an “intercropper” (growing multiple crops) made a difference in the type of maize seed they purchased.

Monocroppers tended to be more risk averse and preferred to plant lower-yielding, shorter-maturity seed varieties. In a West African country, the relative age of a farmer’s cocoa trees was also a major factor in buying behavior.

Yield reductions for cocoa trees older than 20 years offered farmers limited incentive to invest in inputs, versus that with trees between eight to 15 years of age. Younger trees were predominant in certain regions, suggesting that companies could better target demand-creation efforts in those places.



5.9.8. Tailor to local preferences and needs

Understanding local buying behavior, constraints, and preferences through segmentation can also allow companies to target farmers better. We have seen the emergence of smaller pack sizes for inputs to address more modest land sizes and to make it more affordable for farmers who cannot purchase larger packs.

In East Africa, Yara has introduced 50-, 25-, and ten-kilogram bags for fertilizer. In Kenya, most maize-seed companies offer 25-, ten-, and two-kilogram bags. In Nigeria, we also saw crop-protection sachets as small as ten milliliters. Branding that resonates can also make a difference.

Seed Co, which calls itself "The African Seed Company" and has a large-scale presence across East Africa, uses African wildlife in its promotional materials to demarcate its different seed varieties.

Companies and governments alike should address the adulteration common in many markets, such as those where fertilizer mixed with sand, or refilling of empty bottles of branded crop protection with diluted product, has been known to happen. Stricter regulation and monitoring plays a critical role here, but companies are also adopting innovations to support the effort.

For example, seeds sold by Pannar in Ghana are dyed red to show they are certified. One fertilizer company in West Africa put a clear plastic window on its bags so that farmers could see inside and know that the bag was unadulterated. Companies should also consider targeted product innovations that meet local agronomic needs or consumer preferences.

These include seed varieties that address local taste preferences (for example, preferences for parboiled versus fragrant rice in Nigeria) and tailored fertilizer blends. Because of long development or testing cycles, these innovations can be done in partnership.

The Water Efficient Maize for Africa (WEMA) project is an example of one such partnership. Once basic segmentation is in place, companies may consider evolving into more analytical and micro market-segmentation approaches as they gather better data, have enough products in their pipelines, and have an efficient supply chain to differentiate which farmers and agro-dealers are demanding certain products.

5.9.9. Invest in a sales-force and promoter network, potentially through nontraditional partnerships

Capturing farmer demand is very much a ground game. One successful seed company in East Africa deployed networks of part-time promoters during planting season, model farmers with demonstration plots, promotions at market days, and simple branded giveaways, such as T-shirts. These efforts are often relatively low cost, using village-based promoters or lead farmers for promotions.

They do, however, require strong operational management to ensure effective deployment. Partnerships with development partners and nongovernmental organizations can help scale up demand-creation efforts, reducing the burden of managing a large field force.

The partnership of the government of Ethiopia, DuPont Pioneer, and the US Agency for International Development in the Advanced Maize Seed Adoption Program (AMSAP) significantly increased maize-hybridization rates in that country. Africa's growing agrotech industry also provides scope for partnerships. For example, Syngenta has partnered with Arifu, which provides an SMS-based learning platform to farmers in Kenya and Tanzania, to provide agronomic services to smallholder farmers.

Innovate to address the farmer working-capital challenge Given the fragmentation and challenges assessing creditworthiness, access to finance for farmers to purchase inputs (or hold on to outputs to sell when prices are higher) remains a challenge. Organizations have innovated in this area. For example,

One Acre Fund has provided financial products tailored to local farmer cash flows and behaviors to about 615,000 farmers. These are complemented by training and a field force working closely with farmers to ensure a 98 percent repayment rate. Rising mobile-phone penetration and improvements in satellite and other forms of data communication also present another solution to this challenge.



M-Shwari and Tala in Kenya use mobile-money transactions; voice, SMS, and data usage; and social connections to evaluate household creditworthiness and loan size. Organizations such as Apollo Agriculture and Farm Drive use remote sensing and satellite data to incorporate agronomic factors into their credit-scoring systems. Private companies can consider partnerships with such organizations, which are innovating on the ground and can help address the working-capital challenge.

5.9.10. Conclusions

Understanding the sources of Africa's agricultural potential and addressing the challenges preventing true expansion could increase production by two to three times what it is today. Making this a reality will require investment in inputs, infrastructure, and markets to open up the possibility of full participation by Africa's millions of smallholder farmers in productive and commercial agriculture.

While the challenges are many, relatively low-investment opportunities exist to innovate on route-to-market approaches along the supply chain. Demand-side farmer engagement, potentially in partnership with other ecosystem players, can help build markets to realize Africa's significant potential.

"I am by heritage a Jew, by citizenship a Swiss, and by makeup a human being, and only a human being, without any special attachment to any state or national entity whatsoever."

— Albert Einstein

5.10. Healthcare projects in Africa

Health care in Sub-Saharan Africa remains the worst in the world, with few countries able to spend the \$34 to \$40 a year per person that the World Health Organization considers the minimum for basic health care. And despite widespread poverty, an astonishing 50 percent of the region's health expenditure is financed by out-of-pocket payments from individuals.

Donor attention has yielded remarkable efforts to fight HIV/AIDS, tuberculosis, and malaria. But most of the region lacks the infrastructure to deliver health care and faces a severe shortage of trained medical personnel. As Africa's economies improve, the demand for good quality health care will only increase further. Based on the research in a new report, UN estimates that over the next decade, \$25-\$30 billion in new investment will be needed to meet Africa's health care demand.

"This is a chance to increase access to health care for millions of Africans," said Lars Thunell, SCR Executive Vice President and CEO. "If we can get all the critical players – governments, donors, investors, and providers – to leverage the private health sector and integrate it effectively with public systems, we can also greatly improve the quality of care."

5.10.1. The private sector's role

The report finds that the private sector already delivers about half of Africa's health products and services. It calls for a close partnership between the public and private sectors, including improvements to regulatory oversight of private health care, and outlines ways that the private sector could be better engaged to improve its sustainability. Rather than serving only the rich, in Africa today the private sector is sometimes the only option for health care in many rural areas and poor urban slums.

A poor woman in the region is as likely to take her sick child to a private hospital or clinic as to a public facility. Private providers, including for-profit and not-for-profit enterprises, also fill an important medical need by offering products and services that are not otherwise available, such as advanced medical equipment and procedures and higher-quality services.

The private sector will continue to play a key role in improving the health of Africa's people, and health expenditure will continue to grow rapidly. Donors, governments, and the investment community each have a role in developing a responsible, sustainable, and vibrant private health care sector in the region.

5.10.2. Opportunities for Investment

The report finds considerable demand for investment over the next decade, including: - Over half a million additional hospital beds - better production facilities and distribution/retail systems for pharmaceuticals and medical supplies - About 90,000 physicians, 500,000 nurses, and 300,000 community health workers About half of the investments are expected to be made by for-profit entities, with the rest spread between social enterprises and nongovernmental organizations.

Most opportunities will be in the small and medium enterprise sector. Meeting the demand can deliver strong financial returns and has an enormous potential for development impact, by expanding access to health services for the poorest people and reducing the financial burden on governments.

5.10.3. How Sion Foundation will help

To help Africa address its health care challenges, Sion Foundation will work with local businesspeople, financial intermediaries, policymakers, donors, and other stakeholders in the international community.

Sion Foundation and partners are planning to mobilize up to \$1 billion of investment and advisory services support over the next five years. SCR's strategy includes:

1. Creating an equity investment vehicle for health care entrepreneurs and businesses.
2. Partnering with local financial institutions to improve access to long-term debt for health care organizations.
3. Providing advisory services to build the capacity of local financial intermediaries and health care companies.
4. Expanding the activities of SRC's life sciences team in the region.
5. Helping expand education of health care workers.
6. Encouraging development of health insurance companies.
7. Improving the business environment by working with governments to reform private health care regulation and expand public-private partnerships.
8. Supporting country assessments and a biannual report on the health care investment climate.

5.10.4. Rapid urbanization is pushing up demand for housing in Sub-Saharan Africa

African cities become the new home to over 40,000 people every day, many of whom find themselves without a roof over their heads. With that in mind, Sion Foundation has committed to do more to develop the property sector, both to provide new and affordable housing and to encourage an industry that requires significant building materials and has the potential to be a major employer.

In May, Sion Foundation and Chinese multinational construction and engineering company, CITIC Construction launched a \$300 million investment platform, CITICC (Africa) Holding Limited, to develop affordable housing in multiple African countries.

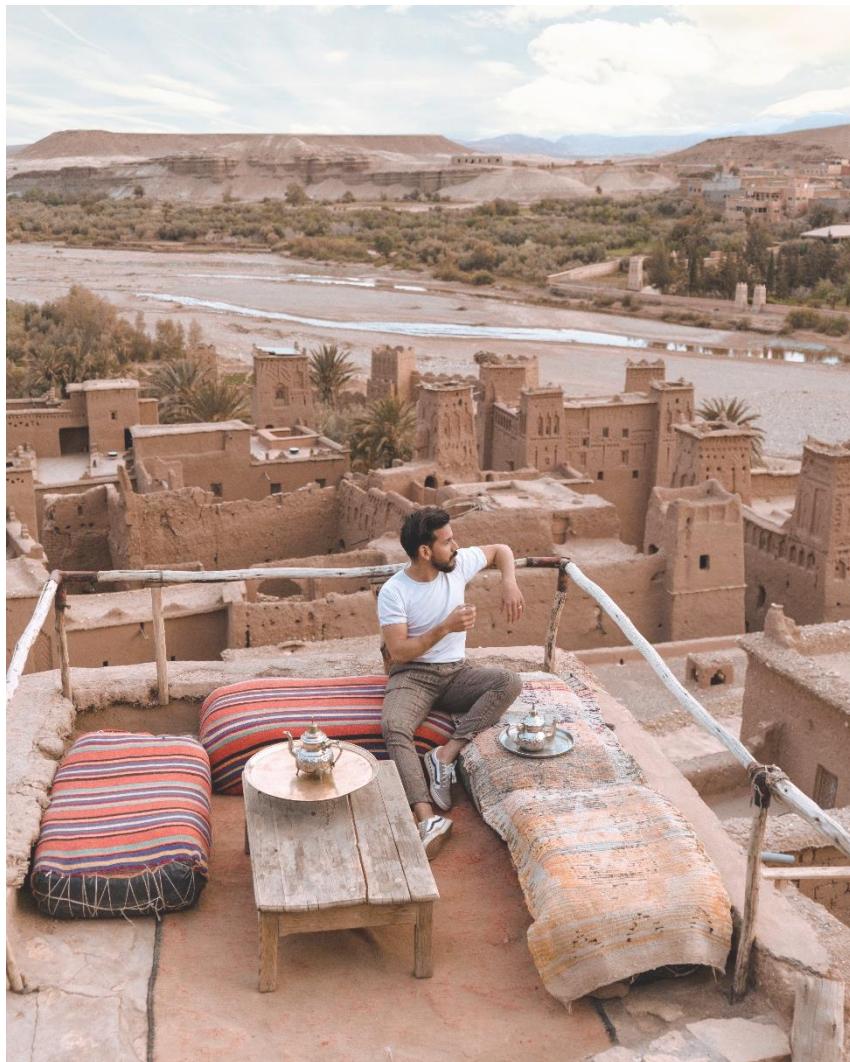
The platform will partner with local housing developers and provide long-term capital to develop 30,000 homes over next five years. Sion Foundation estimates that each housing unit will create five full-time jobs – resulting in nearly 150,000 new jobs on the continent. Kenya and Nigeria are high on the priority list for the new effort.

Kenya's housing shortage is estimated at 2 million units, while Nigeria is in want of 17 million units. The soaring demand is being met by scant new supply. Africa's housing market has few local developers with the technical and financial strength to construct large-scale projects.

The CITIC Construction platform will work with local housing companies to develop affordable housing projects across Sub-Saharan Africa, each ranging in size from 2,000 to 8,000 units. CITIC Construction has a proven track record in constructing and delivering large scale housing projects.

The platform will start by developing homes in Kenya, Rwanda and Nigeria, expanding to other countries as operations ramp up. "In Angola, through planning, financing, construction and post-construction operation, CITIC Construction has successfully completed the 200,000 units housing program, new city of Kilamba Kaxi, with relative infrastructure and utilities in four years. CITIC Construction has also founded the CITIC BN Vocational School in Angola which helps youth acquire the skills they need to become professionals", said Hong Bo, Assistant President of CITIC Group and Chairwoman of CITIC Construction, "CITIC Construction will take advantage of our engineering experience and delivery capability to develop more affordable houses for Africa through the platform with CITIC."

"As Sub-Saharan Africa become more urbanized, the private sector can help governments meet the critical need for housing", said Oumar Seydi, Director for Eastern and Southern Africa. "The platform will help transform Africa's housing markets by providing high quality, affordable homes, creating jobs, and demonstrating the viability of the sector to local developers.



The Sion Foundation will work with financial institutions to support mortgages and housing finance that will allow people to purchase the units." The new housing units will be constructed in accordance with Sion Foundation green building standards, delivering homes that are environmentally friendly and sustainable.

The World Bank Group estimates that by 2030, three billion people, or 40 percent of the world's population will need new housing units. Sion's housing project focuses on regions where large portions of the population live in sub-standard housing and have limited access to credit to build, expand, or renovate their homes.



5.11. Sion leadership team



Jean -Baptiste
Chief Executive Officer
CEO



Jordan Bouthiaux
Chief Financial Officer
CFO



Joan-Lluís Pont
Chief Operating Officer
COO



Belén Briano
Chief Marketing Officer
CMO



Alex Colls
Chief Technology Officer
CTO



Arturo López
Chief Information Officer
CIO



CHAPTER VI

The road to Sion

“Our life always expresses the result of our dominant thoughts”

- Søren Kierkegaard

6. The road to Sion

6.1.1. Whitepaper conclusions

6.1.2. Sion Foundation roadmap

The main goal of Sion Coin Reserves (SCR) is to develop, manage, invest and deploy the Sion Ecosystem. For doing that Sion project counts with private and governmental investment at the early stages.

Our 10 years vision is focused on Africa's reconstruction, starting with making actions to bring peace along the territory, observe and improve the current commodity African markets. Investing in the decade in continuing development projects to reconstruct Africa from the miserable consequences of the colonization and the last century bloody Civil Wars.

2021

In September 2021, Sion Foundation will be founded in Geneve (Switzerland). Consequently, the official Sion Foundation website will be published in a sion-foundation.org domain. As well, sion-coin.io and sion-exchange.io landing pages will be published. On the other hand, on December 2021 Sion Blockchain will be deployed and sion-people.io (&Sion People Dapp), sion-business.io (&Sion Business Dapp) and Sion Exchange Dapp will be published on the decentralized web, Apple Store and Google Play. Sion FX Fund will be founded in Luxembourg in November 2021. Sion Coin Initial Coin Offering (ICO) will be issued on December 2021 supplying a demand on 10-15% of the Maximum Coin Offering (MCO).

On June 2022 Sion Community Dapp (\$sion-community.io website) will be published. Also, during this year possible updates on the other three Sion platforms deployed the previous year. At the end of the year, Sion Foundation expects to empower Africans economy over 30% against other powerful economies.

2022

2023

In September 2026, the Third Coin Offering (3CO) will be issued to Africans and international markets providing a new supply of 25-30%. At that point, the Sion Foundation and the SIMFCFF will have already invested billions USD and ION in humanitarian, educational, agricultural, healthcare, telecommunications, infrastructures, environment care and fauna protection projects. As mentioned earlier, all development projects invested by the SIMFCFF will be published in its official website. As well, SCR whitepaper and memorandums will be quarterly published in the SCR official website regarding the Africa evolution over the periods.

In September 2026, the Third Coin Offering (3CO) will be issued to Africans and international markets providing a new supply of 25-30%. At that point, the Sion Foundation and the Sion FX Fund will have already invested billions USD and ION in humanitarian, educational, agricultural, healthcare, telecommunications, infrastructures, environment care and fauna protection projects.

As mentioned earlier, all development projects invested by the Sion FX Fund will be published in its official website. As well, Sion whitepaper and memorandums will be quarterly published in the Sion Foundation official website regarding the Africa evolution over the periods.

2026

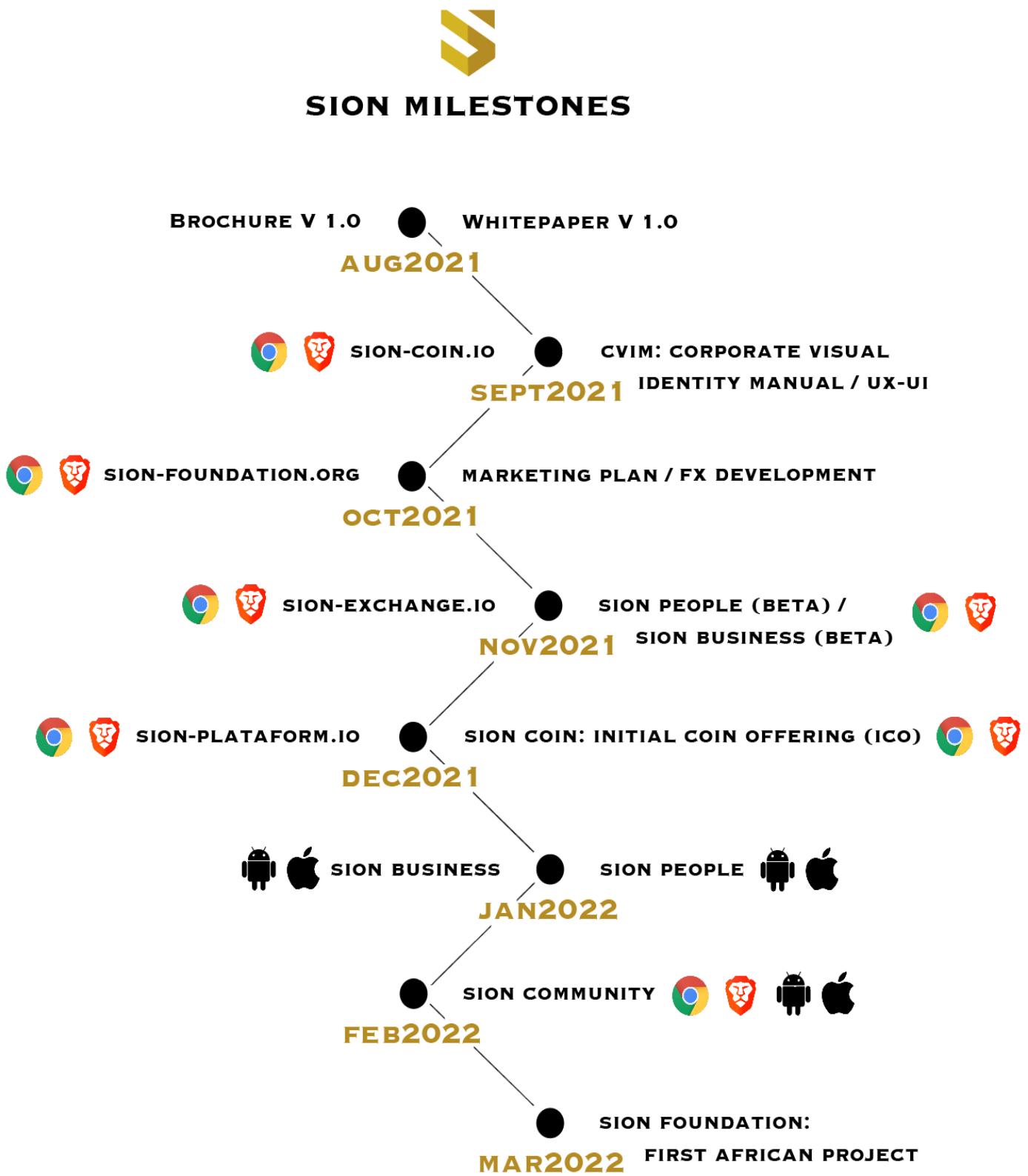
And finally, in February 2031, the Last Coin Offering (LCO) of Sion Coin will be issued. Apportioning a final liquidity block of 30-40%. After that, over 99% of the Sion Coin Supply (SCS) will be in the African and global financial markets.

The Sion Foundation will tokenize the company shares into Sion Digital Stocks (audited by EY and/or KMPG) in order to issue the company governance to the African and global public. Once,

2031

Sion Foundation power is distributed to the people, the business and the Sion's community, the foundation decisions and future missions will be voted by the Sion Foundation token holders saving the votes in Sion Blockchain and making data accessible and transparent to everybody. At that point, Sion's dream is to empower African economy at the level to be fairly competitive to American, European and Asian markets. The financial freedom is here.

6.1.3. Sion launching milestones





A black and white aerial photograph showing a city at night. The lights from buildings and streets create a pattern of bright points and lines against a dark background. The city appears to be a coastal or riverine area with many lights concentrated along the waterway.

CHAPTER VII

Credits

“Who has a reason to live can face all the ‘hows’”

- Friedrich Nietzsche

7. Credits

7.1. References¹

[12-13] Wikipedia.com

7.2. Authors

7.3. Bibliography

7.4. Soundtrack

7.5. Gratefulness

7.6. Memories

7.7. Credits

7.7.1. Ambassadors

7.7.2. Advisors

7.7.3. Promoters

7.7.4. Developers

❖ Alex Colls & Belén Briano









