Blockchain in Education

Merryl Ford, CSIR / SANBA

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Science and Innovation
REPUBLIC OF SOUTH AFRICA

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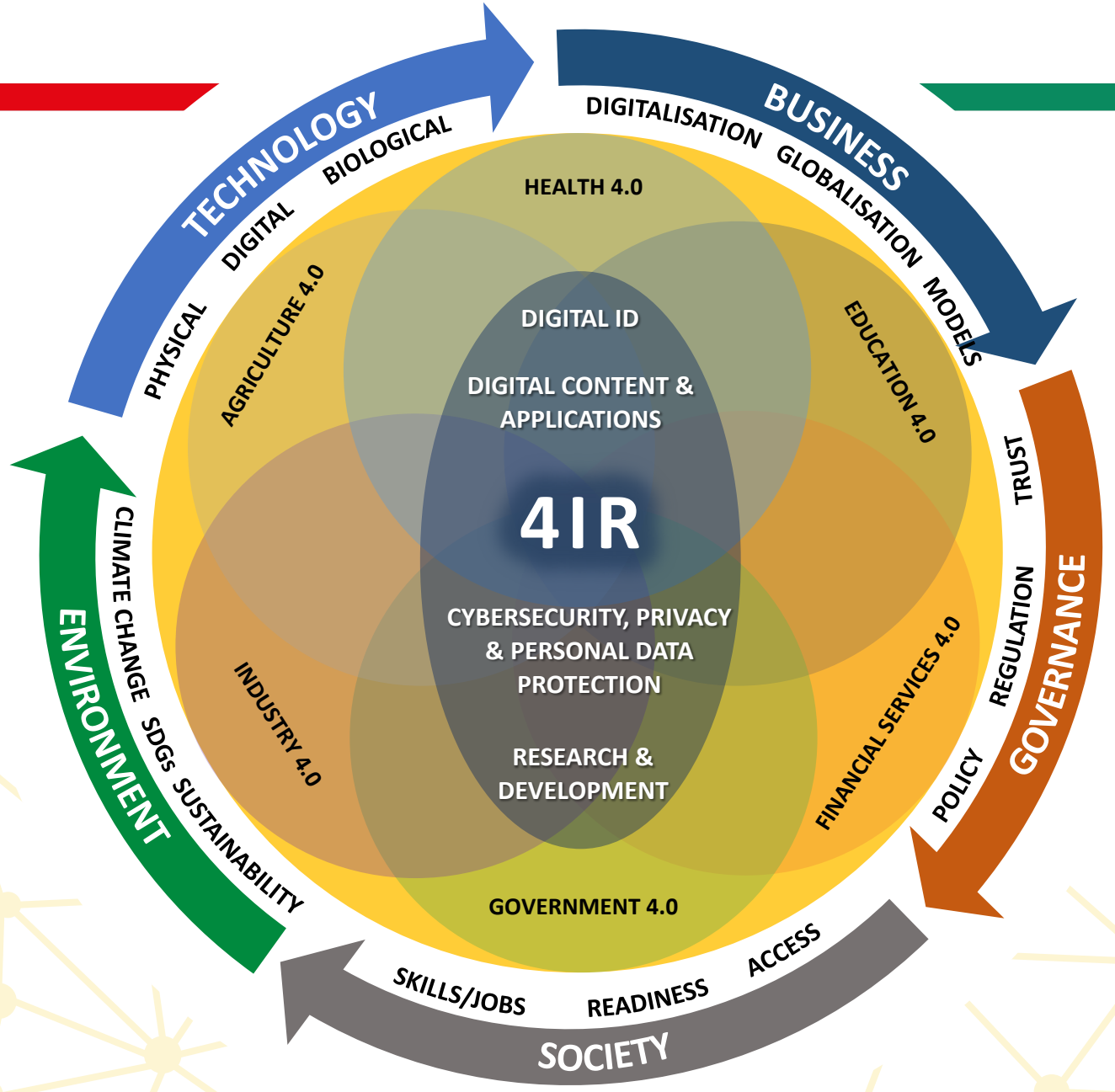
1 What is blockchain and why the hype?

THE 4IR – BEYOND THE TECHNOLOGY-ONLY FOCUS – New ways of BEING and DOING



Source: M.Ford,
CSIR (2019/20/21)

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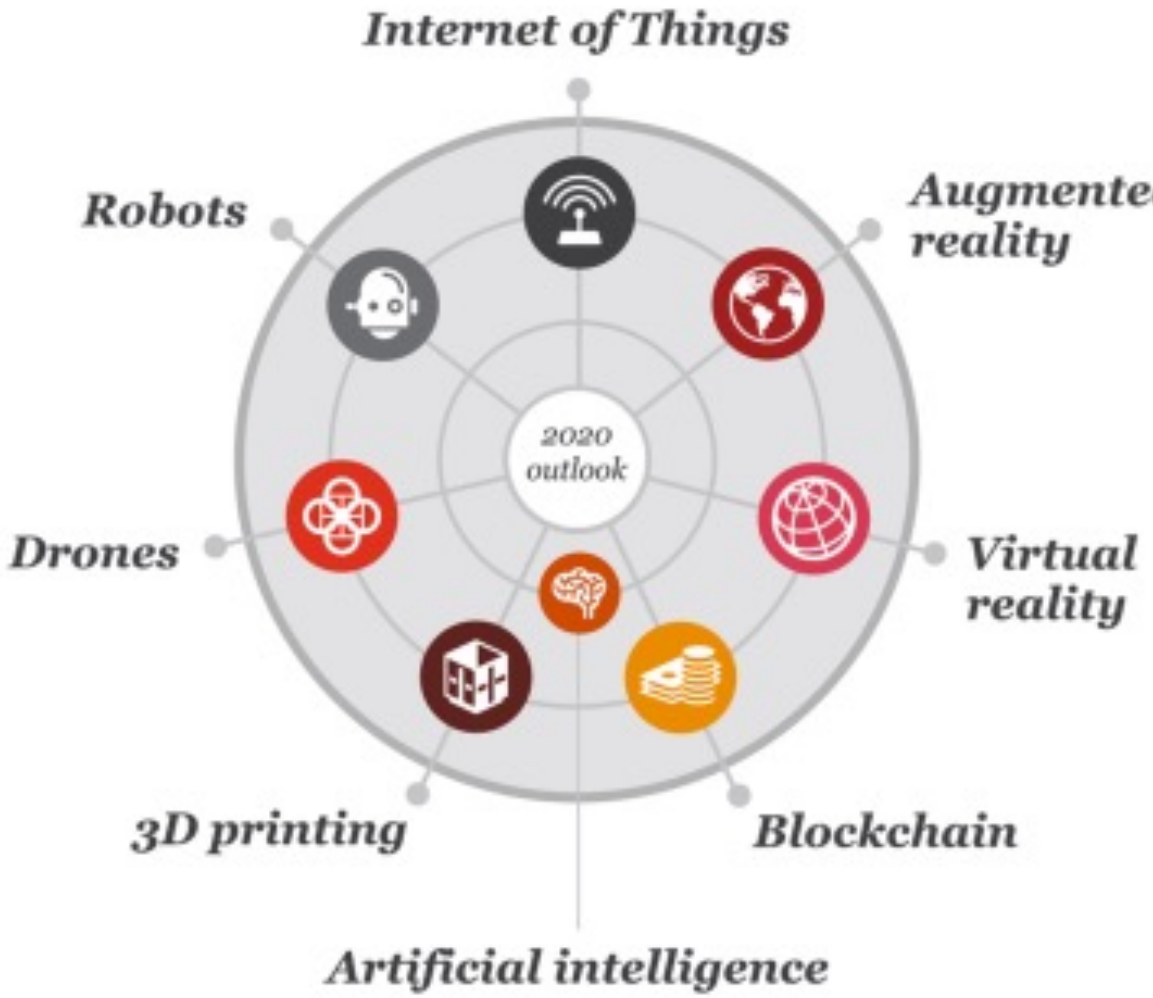
4IR technologies



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#TechMegatrend

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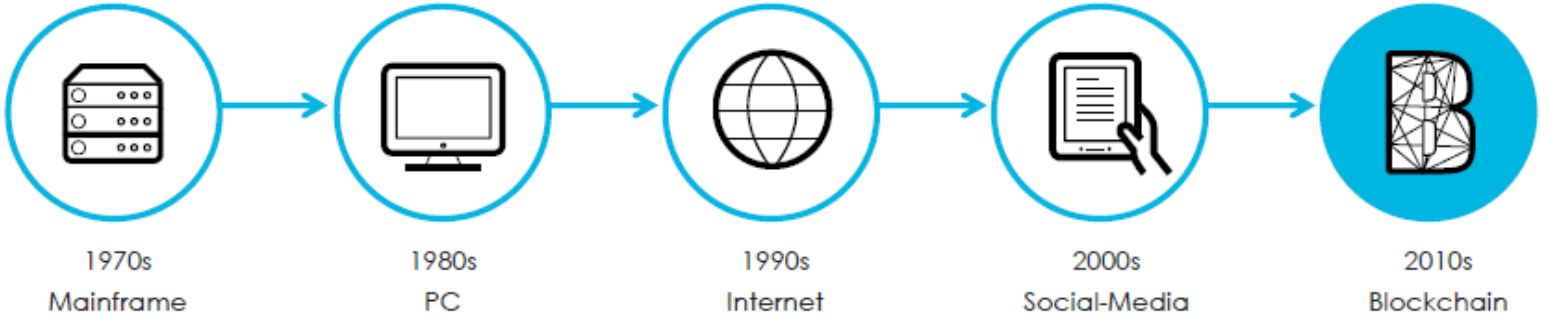

Figure 1: A new paradigm for computing

The blockchain is the most important technology since the Internet itself."

– Marc Andreessen

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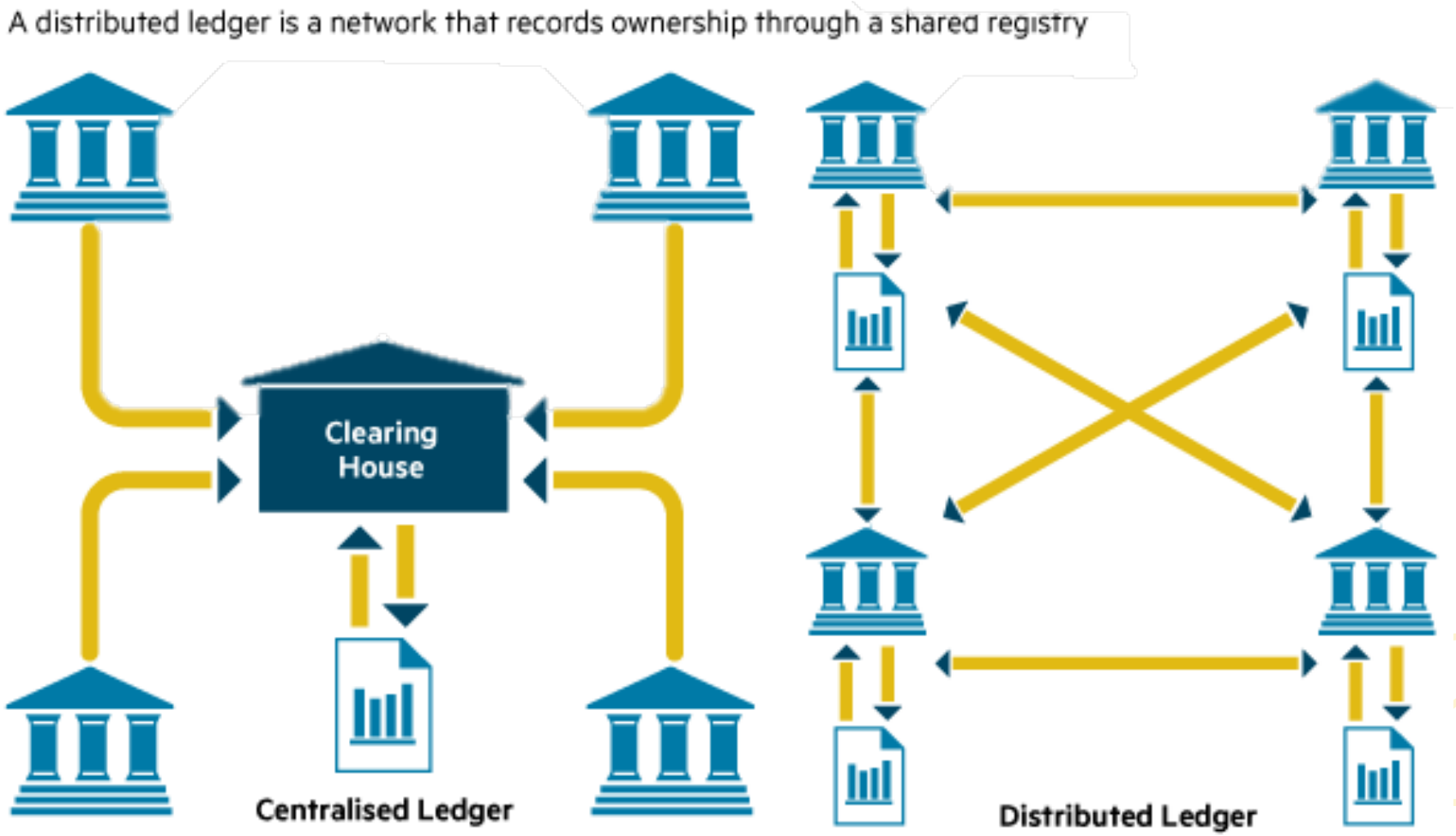
The concept of distributed ledgers



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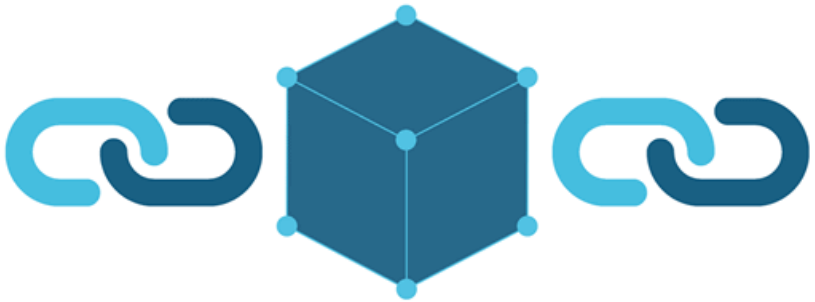
What’s blockchain in layman’s terms?

A **blockchain** can be thought of as a kind of “database” (ledger) where information can only be added and no information can be removed. A copy of this “database” is kept on hundreds of thousands of computers (“nodes”) around the world.



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History

Bitcoin: A Peer-to-Peer Electronic Cash Syst

Satoshi Nakamoto
satoshin@gmx.com
www.bitcoin.org

Abstract. A purely peer-to-peer version of electronic cash would allo
payments to be sent directly from one party to another without going
financial institution. Digital signatures provide part of the solution, bu
benefits are lost if a trusted third party is still required to prevent doub
We propose a solution to the double-spending problem using a peer-to-p
The network timestamps transactions by hashing them into an ongo
hash-based proof-of-work, forming a record that cannot be changed w
the proof-of-work. The longest chain not only serves as proof of t
events witnessed, but proof that it came from the largest pool of CPU powe
long as a majority of CPU power is controlled by nodes that are not cooperating to
attack the network, they'll generate the longest chain and outpace attackers. The
network itself requires minimal structure. Messages are broadcast on a best effort
basis, and nodes can leave and rejoin the network at will, accepting the longest
[illegible] what happened while they were gone.

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Bitcoin Genesis Block

THE TIMES

£1.50

Eat Out from £5

More than 900 great restaurants, including four Gordon Ramsay favourites from £15

Start collecting tokens today. Pullout inside

Israel prepares to send tanks and troops into Gaza

Chancellor on brink of second bailout for banks

Billions may be needed as lending squeeze tightens

99p

Michael Sheen: Frost, Nixon and me

Working mums: So that's how she does it

Detox in style: The best spas on the planet

Salman Rushdie: I won't marry again

Giant killing? Guide to the FA Cup third round

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000000C0 6F 72 20 62 61 or banksÿÿÿÿ..ò.
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The world's most expensive pizza!

laszlo
Full Member

Activity: 199

Trust: **0**: -0 / +0(0)
Ignore

Re: Pizza for bitcoins?
May 22, 2010, 07:17:26 PM

quote #11

I just want to report that I successfully traded 10,000 bitcoins for pizza.

Pictures: http://heliacal.net/~solar/bitcoin/pizza/

Thanks jercos!

Report to moderator

BC: 157fRrqAKrDyGHr1Bx3yDxeMv8Rh45aUet

#bitcoinpizzaday

In 2010 a programmer, Laszlo Hanyecz, traded 10 000 bitcoin for 2 pizzas. Those pizzas are worth $550 million today!

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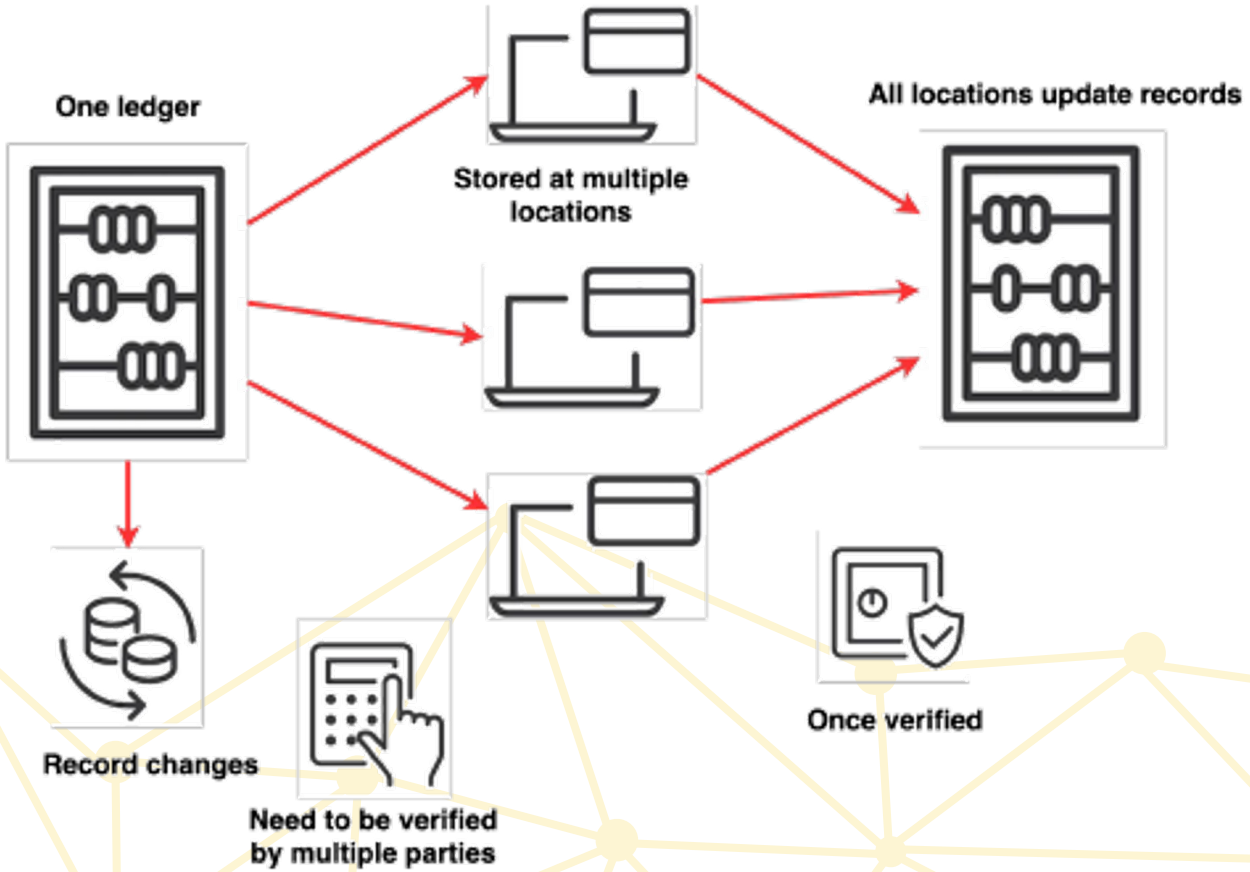
How it works - 1

Blockchain is like a ledger or spreadsheet that keeps track of records.

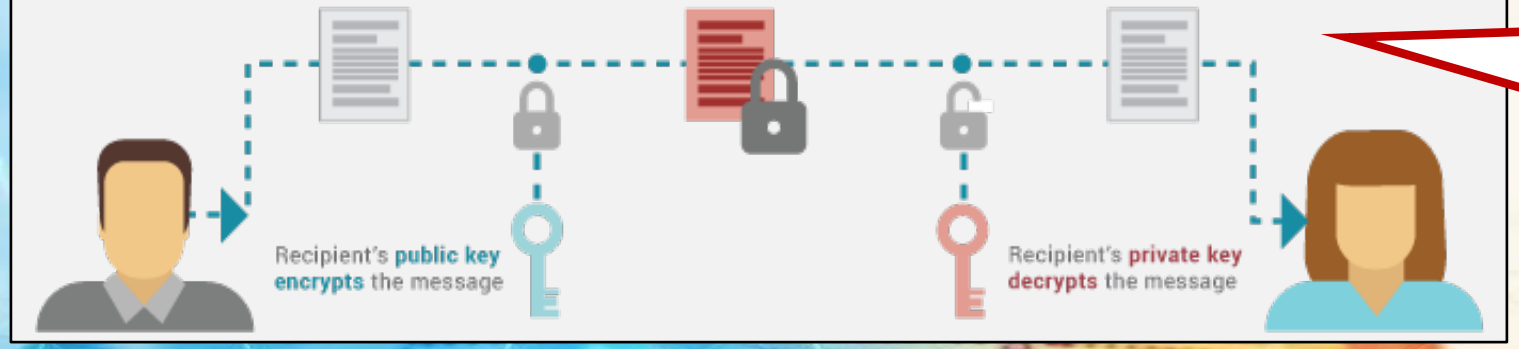
- There is only ONE version of this blockchain, and it is kept on multiple computers around the world.
- If anyone wants to change the records, they need to submit their change as a transaction.
- The transaction then needs to be verified as true by multiple parties.
- Once it has been verified, all the copies of the records update with the new records



The genius of blockchain – incentivising nodes to stay honest:

cryptography + mathematics + psychology + game theory

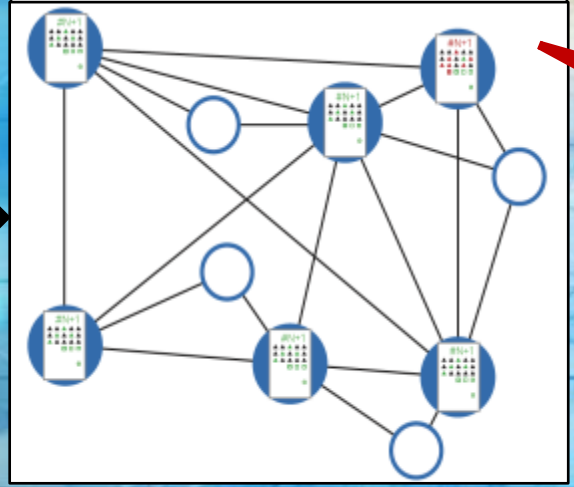
Asymmetric-key cryptography



cryptography

An incentive to service the network's transactions, record-keeping and security

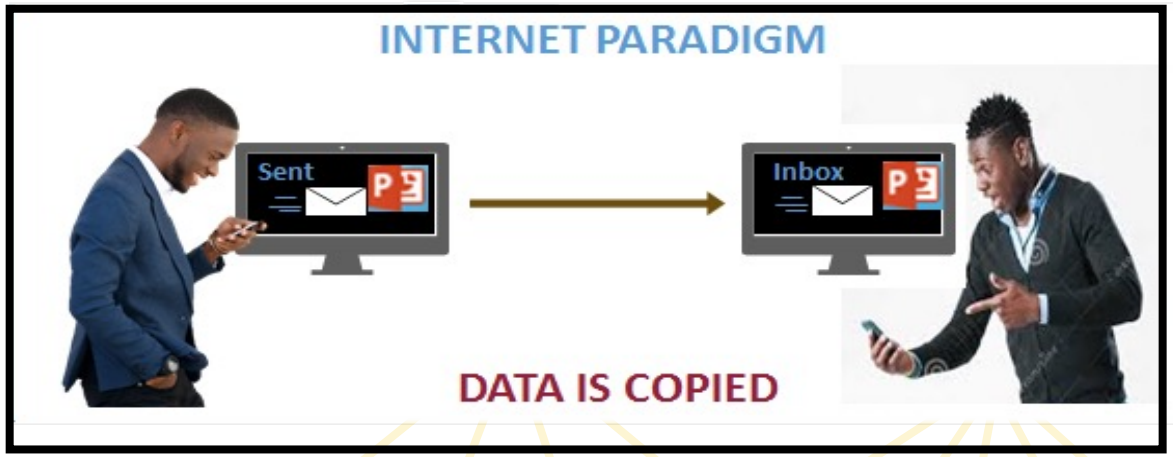
A distributed network with a shared ledger

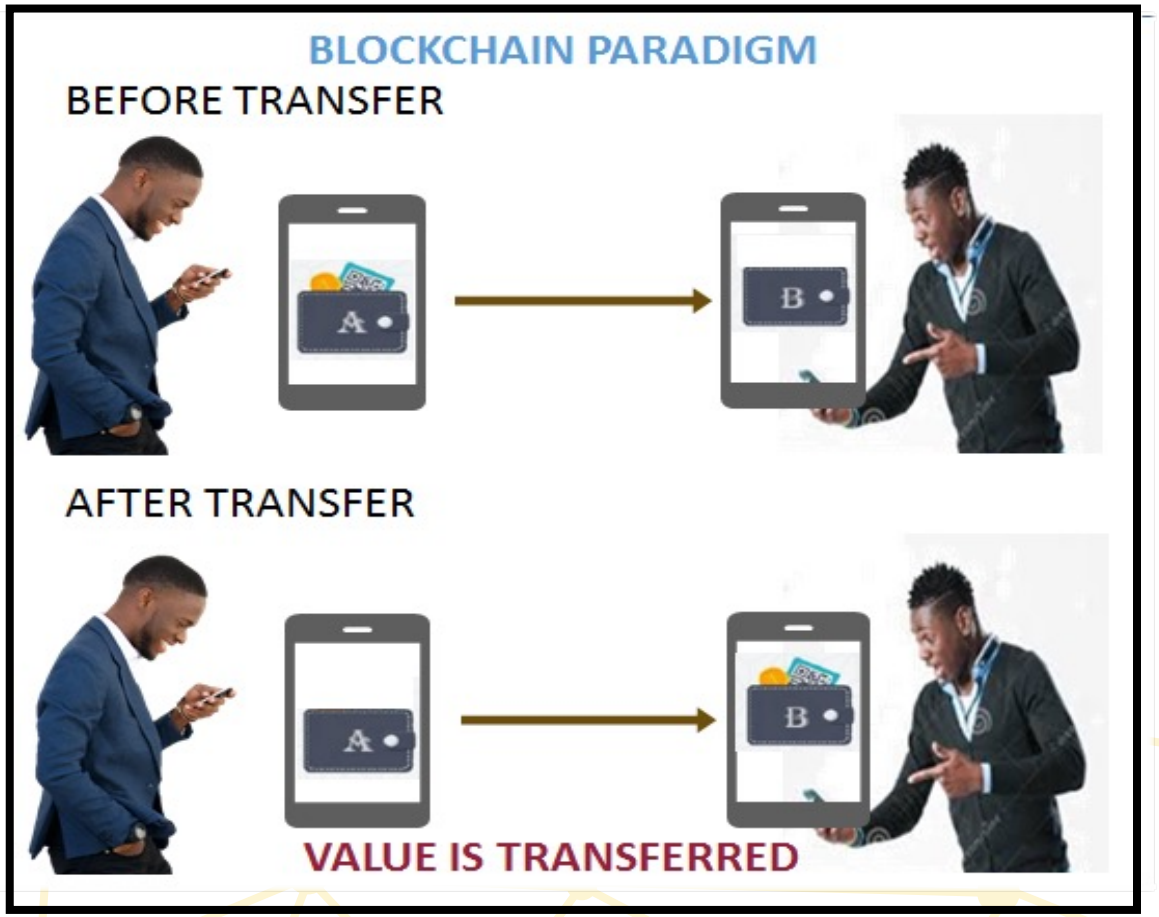


Psychology & game theory

Mathematics (algorithms, network theory)

Blockchain enables value exchange





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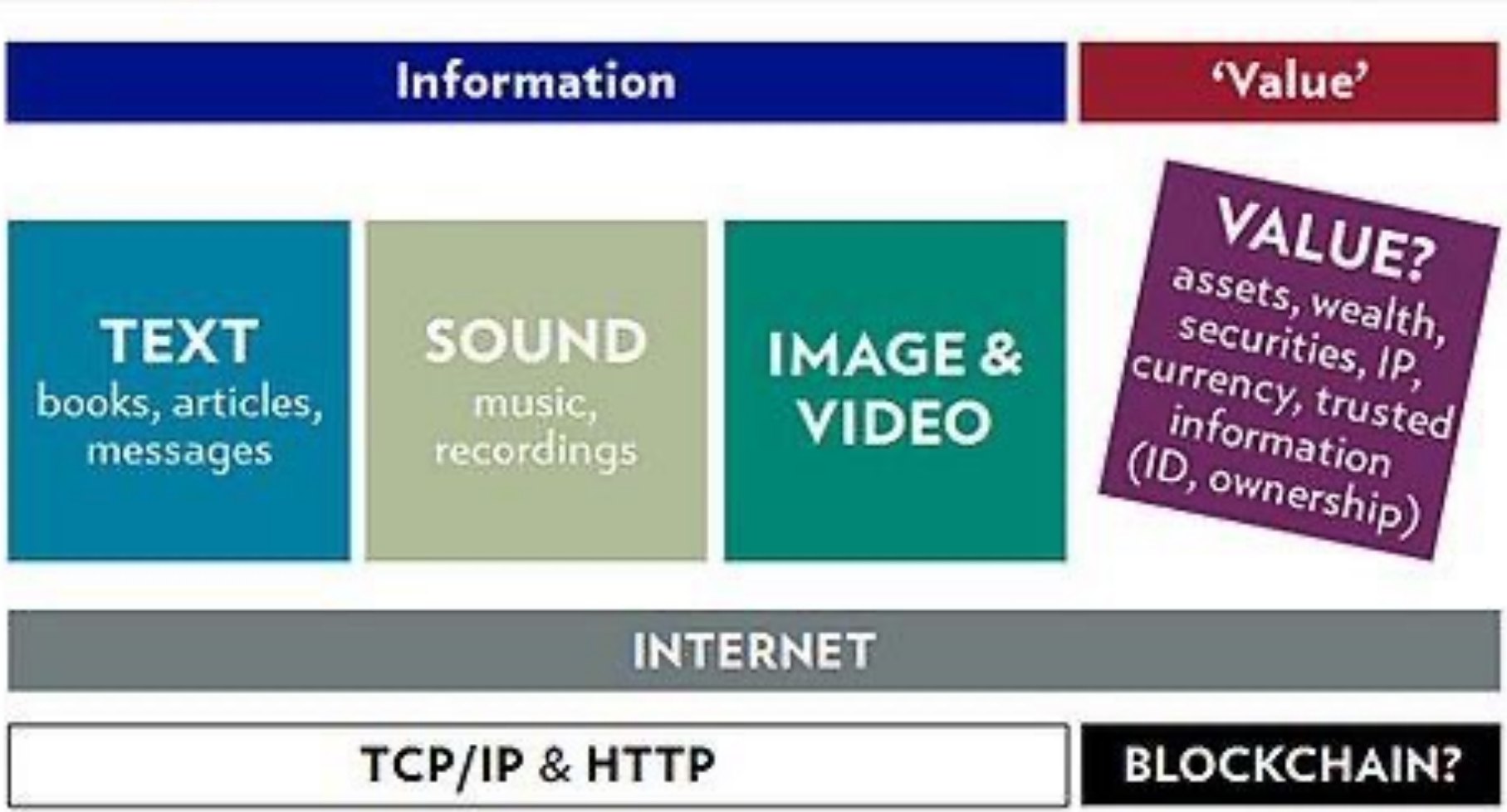
Creating an internet of “value”



Source: Credit Suisse, Julius Baer

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2 The rise of cryptocurrencies & digital assets

“Programmable” value

SOLIDITY

```
contract Mortal {
    address owner;

    function Mortal() { owner = msg.sender; }

    function kill() {
      if (msg.sender == owner) selfdestruct(owner);
    }
}

contract Greeter is Mortal {
    string greeting;

    function Greeter(string _greeting) public {
        greeting = _greeting;
    }

    function greet() constant returns (string) {
        return greeting;
    }
}
```

ERC 20

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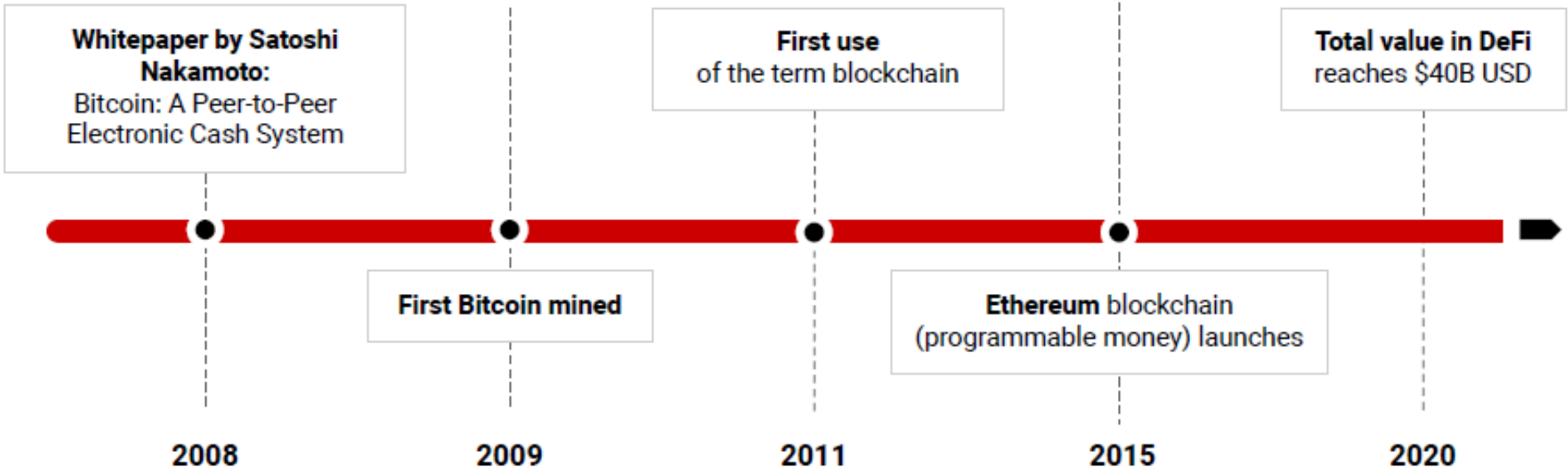
Current status



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FinTech, DeFi and CBDCs

FinTech - Financial + Technology

Startups are using technology to offer existing financial services at lower costs, and to offer new technology-driven solutions.

DeFi - Decentralized Finance

The DeFi movement uses smart contracts to create “Dapps” (decentralized applications) to enable the development of a global, open alternative to every financial service in use today (e.g. savings, loans, trading, insurance, etc.). **These Dapps are accessible to anyone in the world with a smartphone and internet connection.**

CBDCs - Central Bank-issued Digital Currencies

There are now moves by central banks to utilise the blockchain to create Central Bank-issued Digital Currencies which is the digital form of a country’s fiat money. Central bank digital currencies are now in active pilot programs by many central banks across the world.

NFTs – Non-Fungible Tokens

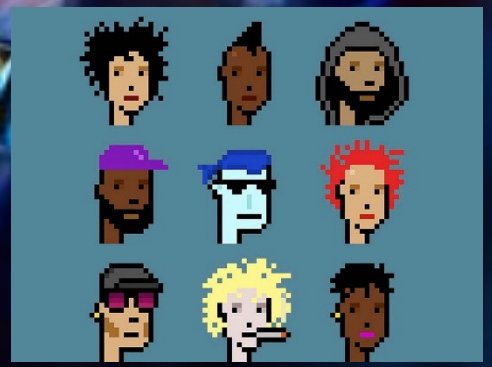
What is fungibility?
It is the ability to break something up into smaller units of value – e.g. a Rand can be broken up into cents and each cent has the same value.

What is non-fungibility?
It is something that cannot be broken up (in it's native form) into units of equal value. E.g. a piece of art; a house; a ticket, etc.

An **NFT** is a digital representation of something that cannot be broken up into equal units of value. The important thing is that it provides **proof of ownership**. An NFT can represent both a physical entity (e.g. a digital title deed for a house) or a digital entity (a piece of digital art). There is currently a lot of experimentation happening in the space, with the rise of "digital collectibles", where **digital scarcity** is being built into these collectibles.

```
Anchor.m
  /*      Hypertext "Anchor" Object                                Anchor.m
  **      ========================
  **
  **      An anchor represents a region of a hypertext node which is linked to
  **      another anchor in the same or a different node.
  */
  #define ANCHOR_CURRENT_VERSION 0
  #import &lt;ctype.h&gt;
  #import &lt;objc/Object.h&gt;
  #import &lt;objc/typedstream.h&gt;
  #import &lt;appkit/appkit.h&gt;
  #import "Anchor.h"
  #import "HTUtils.h"
  #import "HTParse.h"
  #import "HyperText.h"
  #import "HyperManager.h"
  @implementation Anchor:Objec
```

Tim Berners Lee's source code sold for $5.4 million!

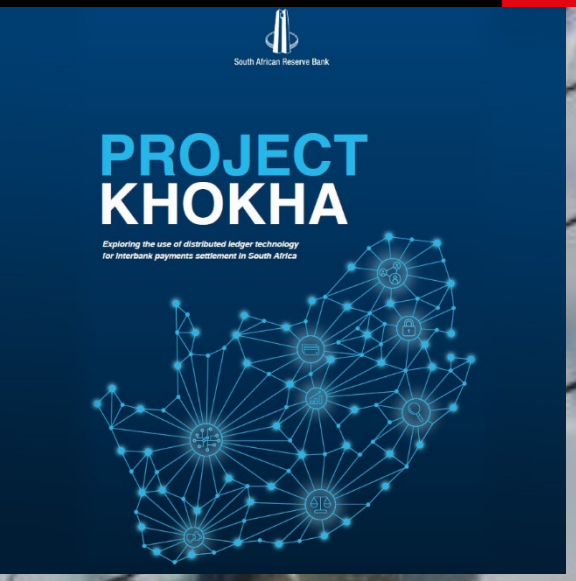


SOLD AT CHRISTIES FOR $16.9 million!

Digital artist, Beeple sold his piece "Everydays — The First 5000 Days" for $69.3 million

PROJECT KHOKHA

BLOCKCHAIN FOR CENTRAL BANKING IN SOUTH AFRICA



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KNOW YOUR CUSTOMER (KYC)

DIGITAL IDENTITY PROOF OF CONCEPT BY THE FINANCIAL SECTOR IN SOUTH AFRICA

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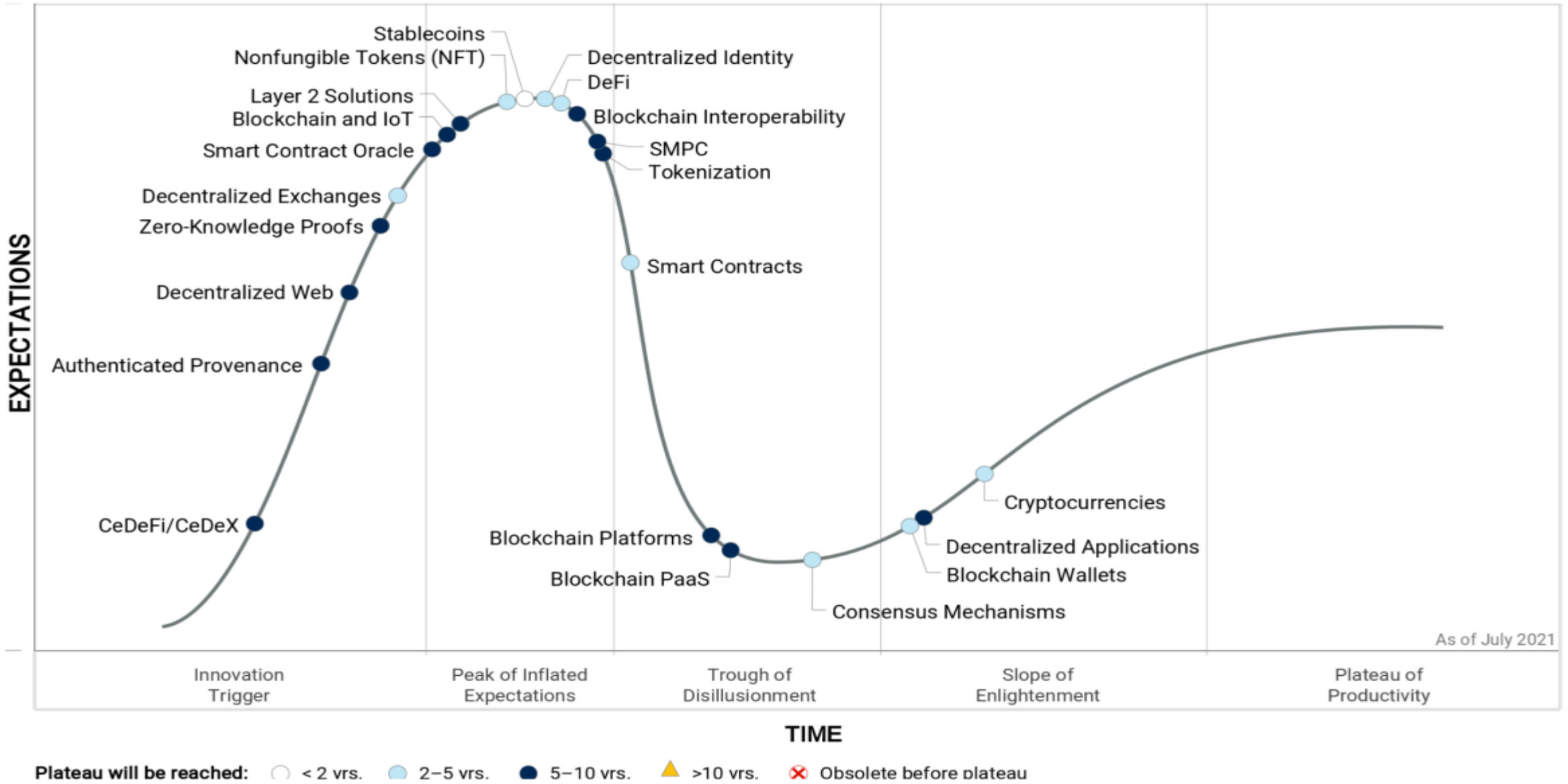
INTER-GOVERNMENTAL FINTECH WORKING GROUP (IFWG)

FINTECH INNOVATION HUB IN SOUTH AFRICA

Hype Cycle for Blockchain, 2021

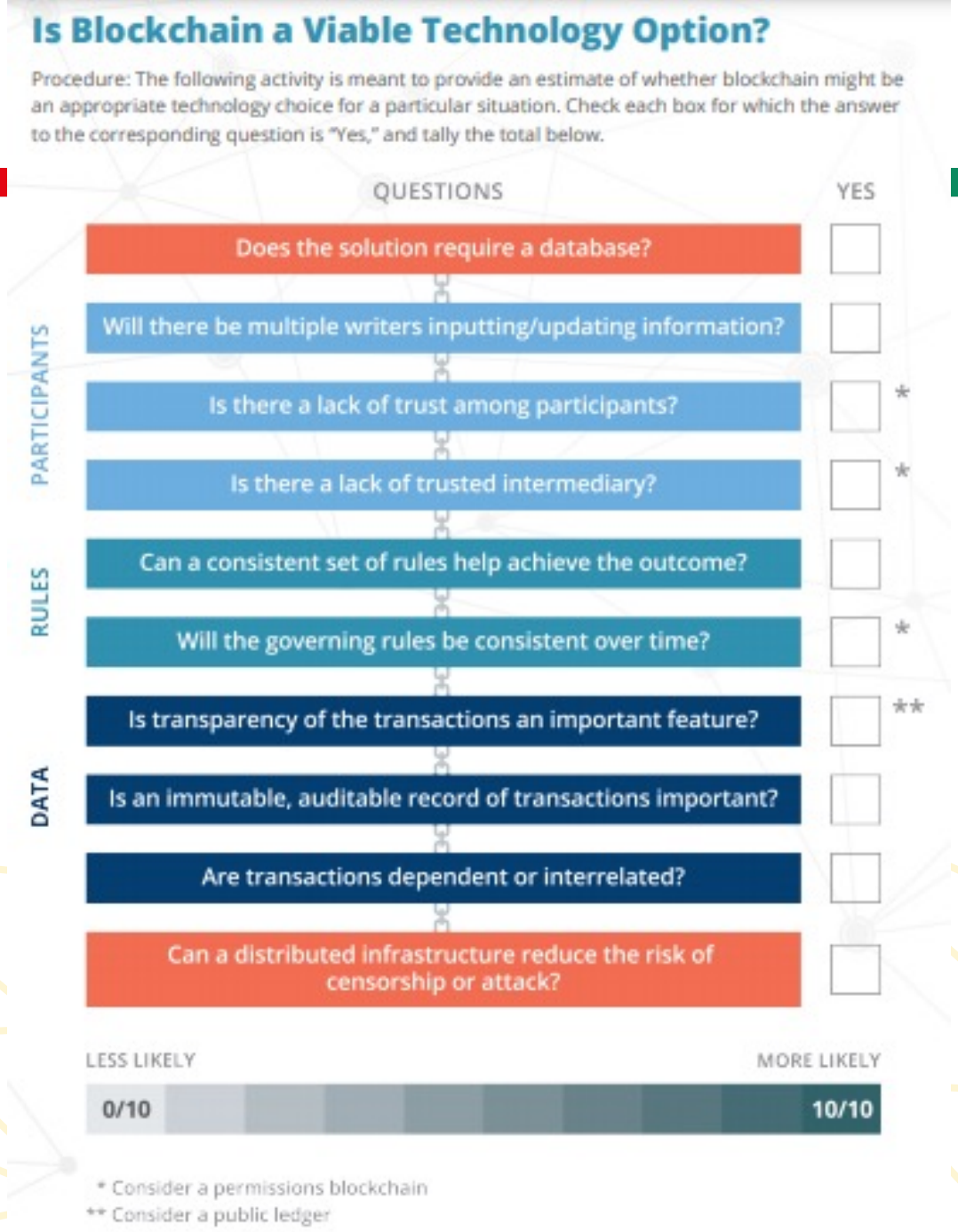


Source: Gartner (July 2021)

3 Blockchain in Education

What are the blockchain “killer apps” beyond finance?

Checklist tool



Is Blockchain a Viable Technology Option?

Procedure: The following activity is meant to provide an estimate of whether blockchain might be an appropriate technology choice for a particular situation. Check each box for which the answer to the corresponding question is "Yes," and tally the total below.

	QUESTIONS	YES
PARTICIPANTS	Does the solution require a database?	
	Will there be multiple writers inputting/updating information?	
	Is there a lack of trust among participants?	*
	Is there a lack of trusted intermediary?	*
RULES	Can a consistent set of rules help achieve the outcome?	
	Will the governing rules be consistent over time?	*
DATA	Is transparency of the transactions an important feature?	**
	Is an immutable, auditable record of transactions important?	
	Are transactions dependent or interrelated?	
	Can a distributed infrastructure reduce the risk of censorship or attack?	

LESS LIKELY — MORE LIKELY

0/10 — 10/10

* Consider a permissions blockchain

** Consider a public ledger

https://beeckcenter.georgetown.edu/wp-content/uploads/2018/06/The-Blockchain-Ethical-Design-Framework.pdf

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Challenges in Education where blockchain could apply?

- **Inefficient paper-based record-keeping processes:**
  - Student details are entered multiple times in different institutions (e.g. moving between schools or from a university to a school, etc.);
  - Complex bureaucratic processes if paper-based records are lost;
  - Security issues regarding centralised management and control of student and qualification data;
  - Challenges if an educational institution ceases to exist;

- **Lack of trust in educational merits and academic degrees because of falsification and fraud:**
  - “Fax” or “email” copies of transcripts
  - Verification of student results can be complex and expensive;

- Others?

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Examples of blockchain being used in Education

- **Digital Portfolios:**
  - Obtained qualifications & degrees
  - Experience-proven proficiencies
  - Completed course certificates
  - Micro-certificates/badges for achievements
  - Additional credits and awards
  - Testing scores and attendance records.

- **Educational credentials management**
  - E.g. **Blockcerts**, developed by MIT, an open-standard platform created for storage and verification of digital certificates, including academic transcripts and credentials.
  - The **Digital Credentials Consortium** was founded in 2018 by leading universities (Delft University of Technology, Harvard, Hasso Plattner Institute, MIT, Tecnológico de Monterrey in Mexico, Technical University of Munich, University of California, Berkeley & Irvine and the University of Toronto)

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Opportunity in SA?

Credentials

South Africa has particularly high levels of fraudulent degrees, with occasional large scale scandals.

Credentials, like university degrees, can be put on the blockchain to increase trust in institutions, as well as to track provenance in the case of fraudulent claims.

A blockchain solution with the Universities of South Africa could allow for easy, fast, and free access to verifiable degrees.

Currently:

Universities issue degrees

Private and public institutions need to pay 3rd party companies to verify degrees. Universities do not receive any funds generated

With Blockchain:

Universities issue degrees

Universities could then publish the degree on a blockchain

Any individual could then verify a degree by searching on the blockchain for the degree holder's name.

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YOMA & ZLTO

VERIFIABLE DIGITAL IDENTITIES/CREDENTIALING FOR THE MASSES

REGISTREE

CONNECTING STUDENTS, UNIVERSITIES AND EMPLOYERS VIA PRIVACY-RESERVING TECHNOLOGIES

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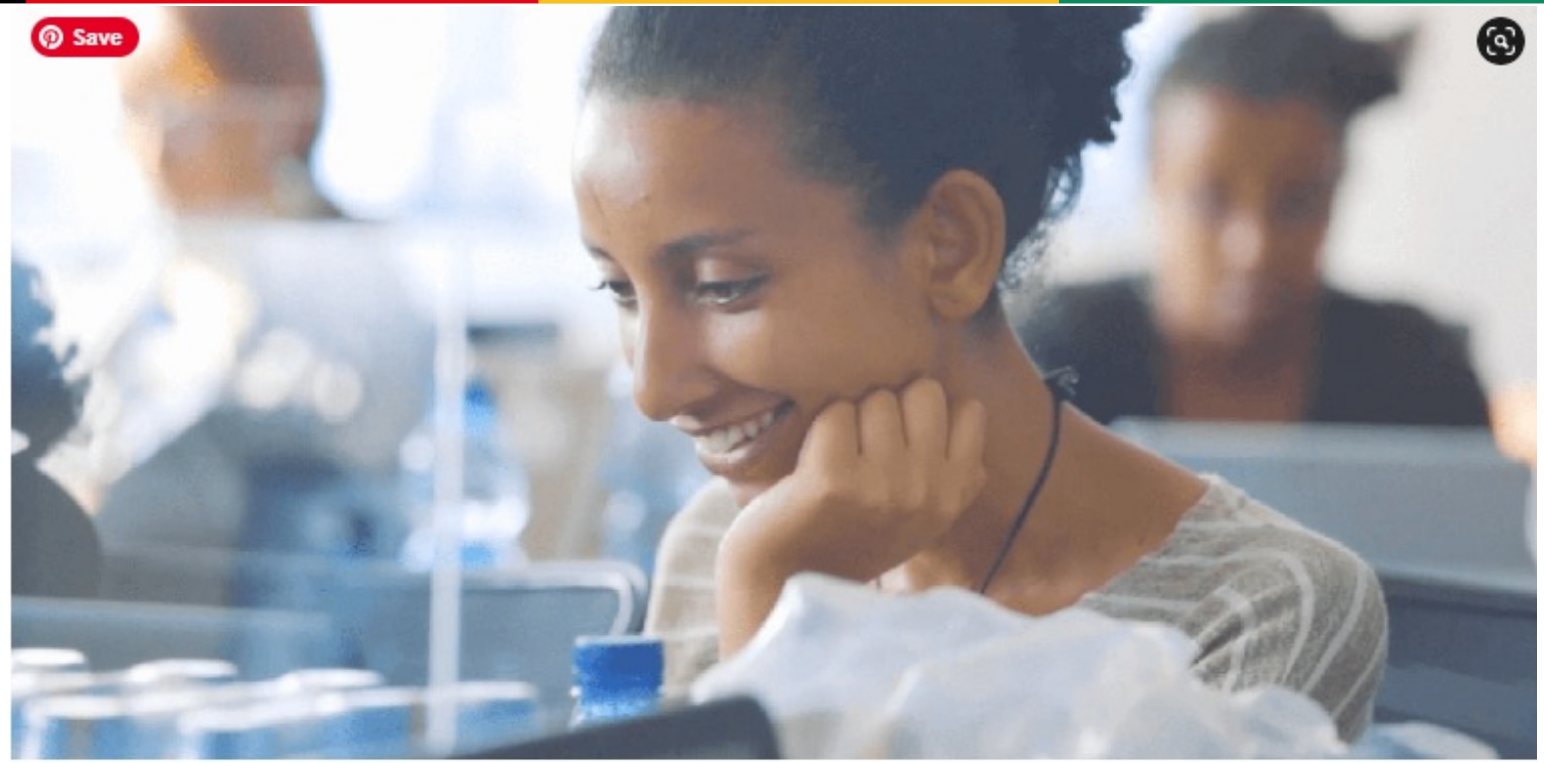
Cardano launches blockchain deployment in Ethiopia with 5M students and teachers

April 27, 2021



Cardano has announced a new partnership with the Ethiopian Government to implement a national, blockchain-based student and teacher ID and attainment recording system to digitally verify grades, remotely monitor school performance.

This will be delivered this using an identity solution – **Atala PRISM**, built on Cardano, which will enable authorities to create tamper-proof records of educational performance across 3,500 schools, 5 million students, and 750,000 teachers to pinpoint the locations and causes of educational under-achievement and allocate educational resources effectively shares **John O'Connor** – African Operations Director IOHK.

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5 The SA National Blockchain Alliance (SANBA)

What is SANBA?

SANBA is a partnership between government, business, academia and civil society to catalyse the use of blockchain technologies within South Africa

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SANBA Objectives

CONNECT academia, civil society, business and government into a pre-competitive collaboration space to support RD&I in blockchain

FACILITATE skills development, advocacy and education on “all things blockchain”.

CATALYSE blockchain adoption in all sectors of South Africa.

LEVERAGE the blockchain ecosystem as a lobbying platform to tackle issues blocking blockchain adoption in South Africa.

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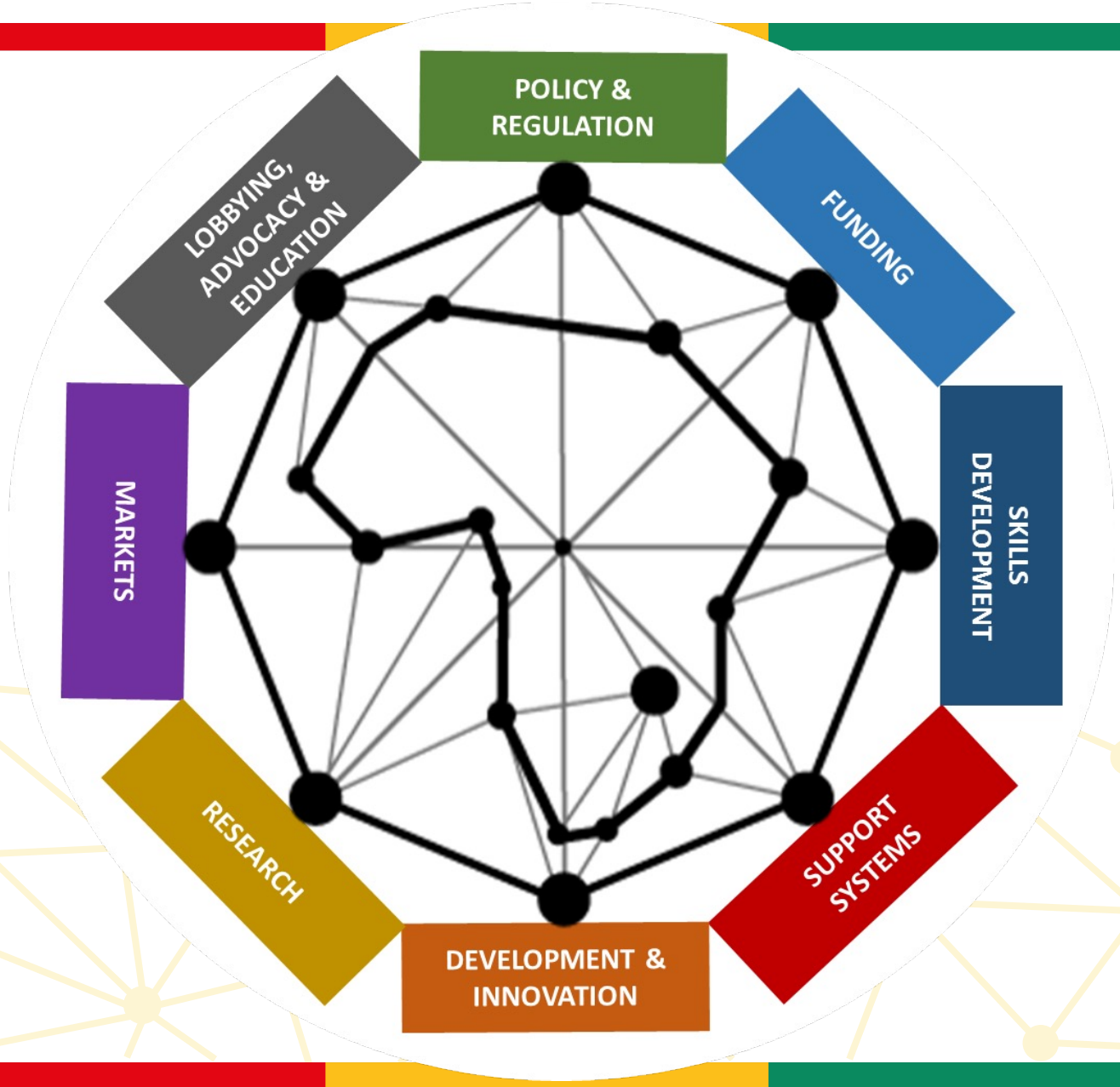
SANBA: A GOVERNMENT-SUPPORTED ECOSYSTEM FOR BLOCKCHAIN RESEARCH, DEVELOPMENT AND INNOVATION



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Thank-you!