intellecap

Imagine Africa 2030: Technologies that will shape Africa's tomorrow

Visual Executive Summary

Executive Summary

Africa has registered impressive economic growth over the past decade and a half, displaying remarkable resilience in the midst of volatility and turmoil in global markets. Time is now ripe for the continent to turn the chapter and embark on a journey towards a major economic transformation. For this, Africa needs a new economic growth model powered by the strength of the real economy, entrepreneurship and innovation. This report aims to explore the critical role emerging technologies can play in helping Africa address its age-old development challenges and achieve exponential growth over the next decade. Our research and interviews with a range of emerging technology specialists from around the world and experts with deep experience on the social entrepreneurship and impact space in Africa helped us develop a framework for analyzing the potential of emerging technologies to amplify impact creation in the African context.

The report highlights our vision of how emerging technologies can trigger a set of big shifts to help Africa leapfrog and combat its development challenges. Our research indicates that although early evidence of these shifts is already visible signaling the beginning of Africa's innovation journey, significant whitespaces currently exist. The report identifies these key innovation whitespaces based on scanning of 100 technology use cases in Africa. It concludes by identifying a set of opportunities these whitespaces present for key stakeholders to help nurture a vibrant and high impact technology innovation ecosystem and in the process, become a part of Africa's journey towards economic transformation. The following visuals help stitch together and narrate the key findings, insights and takeaways from the report.

Africa contends with age-old development challenges which need a fresh look

While achieving food and nutrition security is widely recognized as arguably the greatest development challenge for Africa, securing water security and low carbon energy security are other mega challenges that are intertwined with the food security crisis. In addition, Africa needs to build holistic healthcare ecosystems, create a future ready workforce and financially include majority of its population.

Africa's Development Challenges

SECURING FOOD & NUTRITION SECURITY

218 MILLION
Undernourished people in SSA including 54 million children under 5

70%
% by which food production needs to rise by 2050 to feed the African population

CREATING A FUTURE-READY WORKFORCE

5 MILLION
No. of new graduates every year in Africa who do not get jobs

83%
% of jobs in Ethiopia at risk of being replaced by automation

ACHIEVING LOW CARBON ENERGY SECURITY AND COMBATTING CLIMATE CHANGE

2/3
People in Africa with no access to electricity

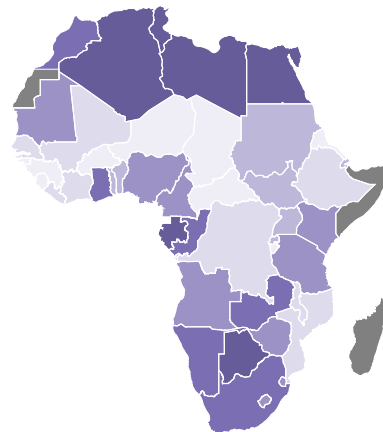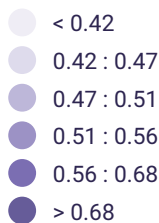**4/5**
People in Africa rely on solid biomass for cooking

2080
Year by which Africa is projected to achieve universal electricity access

THE HUMAN DEVELOPMENT INDEX IN AFRICA
(1= Perfect / 0 = Bad)

- < 0.42
- 0.42 : 0.47
- 0.47 : 0.51
- 0.51 : 0.56
- 0.56 : 0.68
- > 0.68

Source: UNDP - 2014

MANAGING COMPETING USAGE OF WATER AND THE INTERPLAY BETWEEN WATER, ENERGY AND FOOD SECURITY

40%
People in SSA living in water scarce environment

3/4
Children in Africa who suffer from diarrhea and other water-borne diseases

700 MILLION
People in Africa can be displaced due to water stress and water scarcity

BUILDING HOLISTIC HEALTHCARE ECOSYSTEMS

60 YEARS
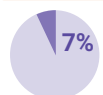Life expectancy at birth in Africa compared to global average of 71 years

6 MILLION
Number of health workers Africa will need by 2030

ACHIEVING FINANCIAL INCLUSION

77%
% of Adults in Africa who do not have a bank account

7%
% of banking penetration in Central Arica

Promising technologies that can help Africa address its challenges and create exponential change

While achieving food and nutrition security is widely recognized as arguably the greatest development challenge for Africa, securing water security and low carbon energy security are other mega challenges that are intertwined with the food security crisis. In addition, Africa needs to build holistic healthcare ecosystems, create a future ready workforce and financially include majority of its population.

Promising Emerging Technologies for Africa

Internet of Things

IoT uses an array of sensors to enable capturing of real time data from a wide range of sources including computing devices, mechanical and digital machines, objects, animals and people.
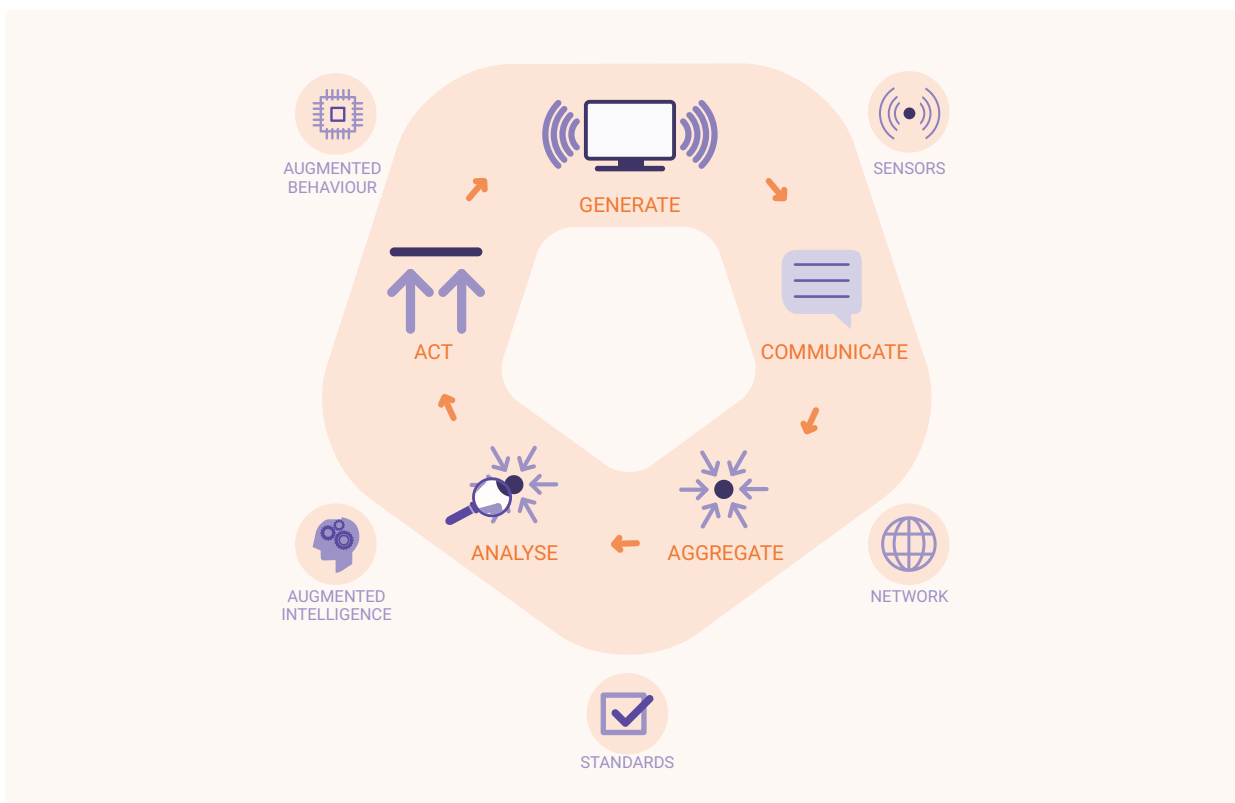
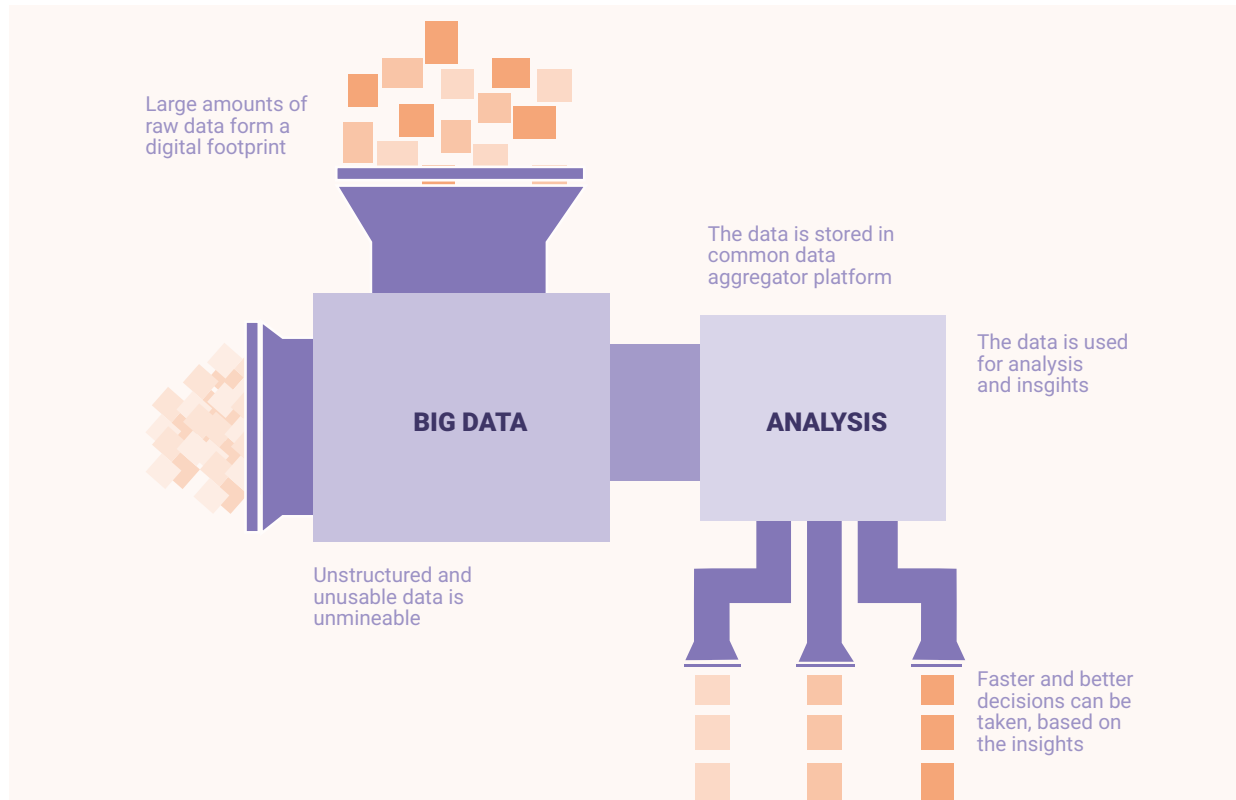| Key Benefits	Market and investment trends	Example use cases
• Monitors and manages objects • Automates processes and optimizes systems • Saves time and reduces costs • Increases efficiency and improves quality	• **50 bn** connected devices by **2022** from **10 mn** in **2010** • IoT market is expected to grow to **$7.1 trillion** in **2020** from **$1.9 tn** in **2013** • 70 deals totaling **$846 mn** in IoT start-ups in **Q1 2016**	• Dell • Huawei (Africa) • Microsoft

▶ Big Data

Big data refers to the use of advanced data analytics including predictive analytics for extracting value from voluminous or complex data sets

Large amounts of raw data form a digital footprint

The data is stored in common data aggregator platform

BIG DATA

ANALYSIS

The data is used for analysis and insgihts

Unstructured and unusable data is unmineable

Faster and better decisions can be taken, based on the insights

Key Benefits

- Enables faster and better decisions
- Facilitates new solutions development
- Helps reduce operations costs
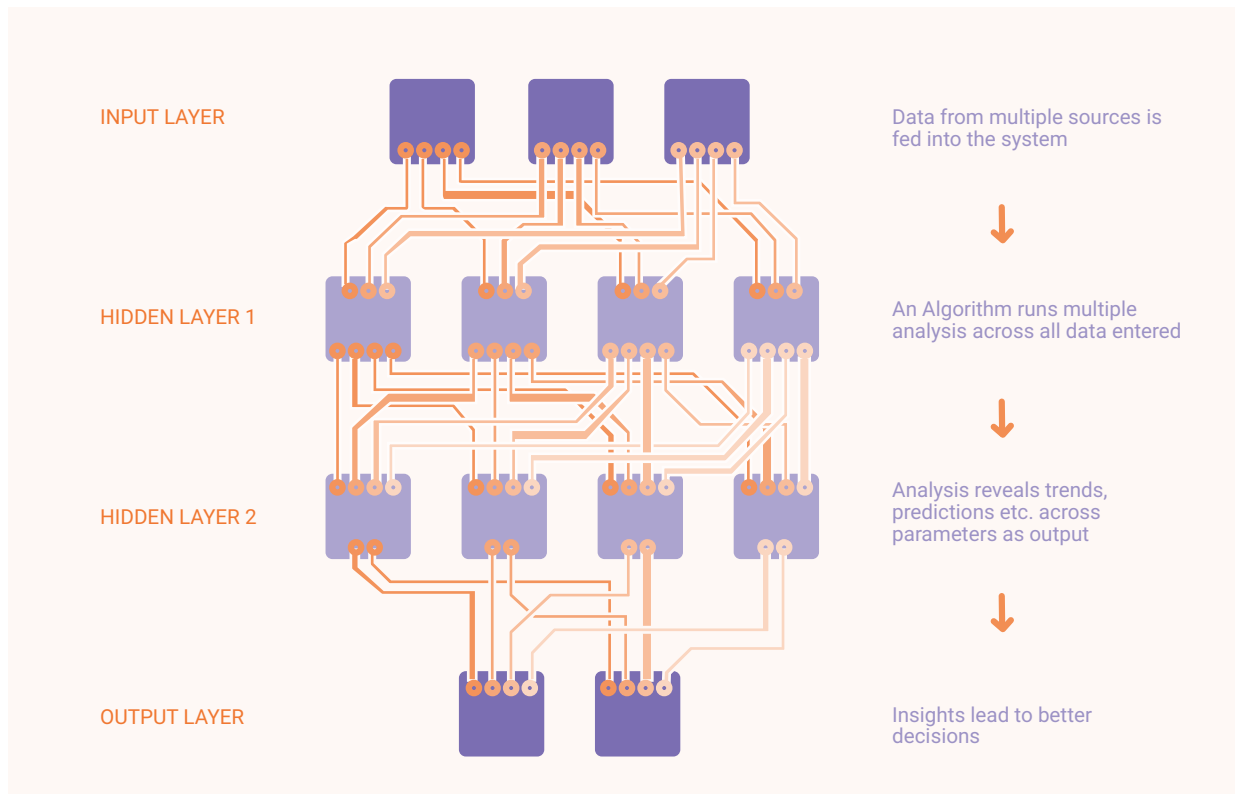- Helps target new market segments

Market and investment trends

- Big Data market will be **$53.4 bn** in **2017** from **$7.2 bn** in **2011**

- By **2020**, the size of the global data universe will be at least **44 zettabytes**

- Big Data startups received **$6.64 bn** worth venture capital investment in **2015**

Example use cases

- LifeQ (Africa)
- Palantir
- SAS Institute

▶ Artificial Intelligence

AI constitutes advanced algorithms applied to large data sets for observing patterns, gathering insights, problem solving, predicting and real-time decision making

INPUT LAYER

Data from multiple sources is fed into the system

↓

HIDDEN LAYER 1

An Algorithm runs multiple analysis across all data entered

↓

HIDDEN LAYER 2

Analysis reveals trends, predictions etc. across parameters as output

↓

OUTPUT LAYER

Insights lead to better decisions

Key Benefits

- Enable autonomous systems
- Enhances speed and quality of decisions
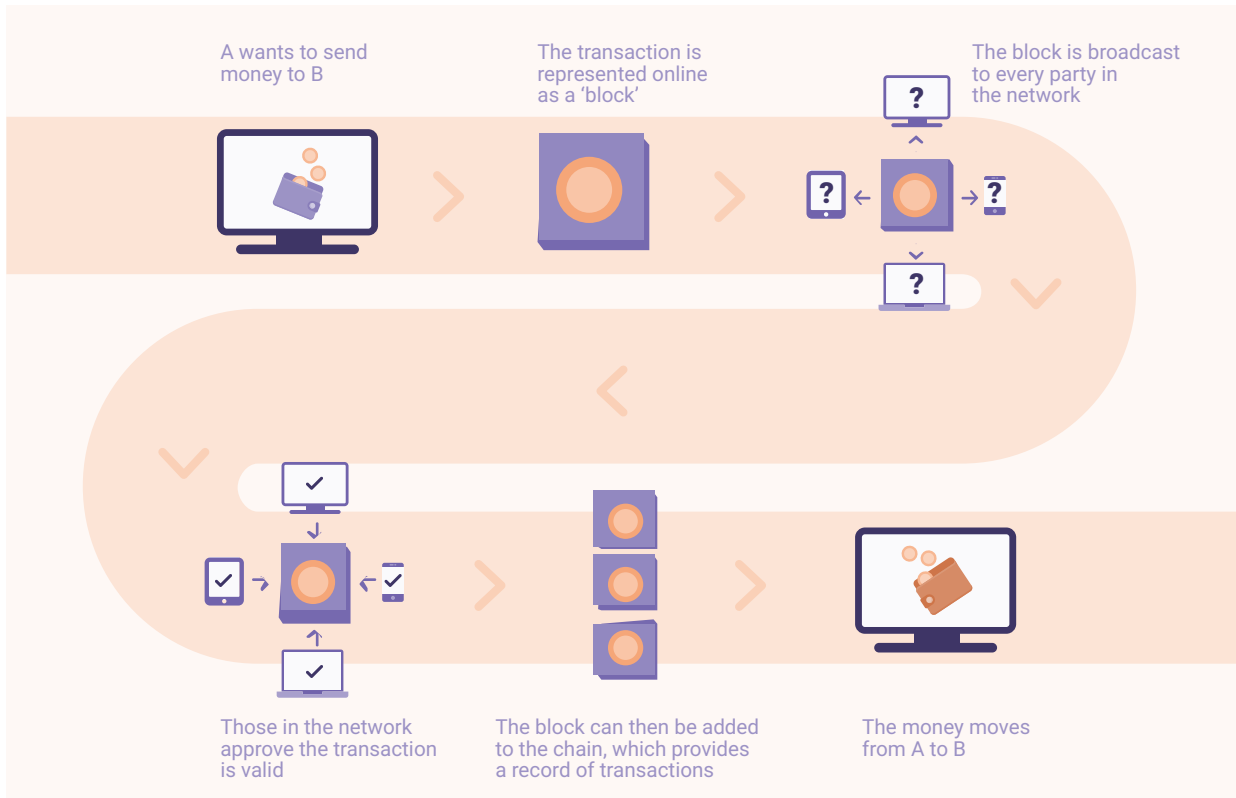- Improves efficiency and accuracy

Market and investment trends

- Over **40** deals in **Q3** of **2016**
- Google has made **11 acquisitions**
- **2.2 bn** bots by **2020**
- AI will drive revenues of over **$47 bn** in **2020**

Example use cases

- Azuri (Africa)
- Google DeepMind
- IBM Watson

▶ Blockchain

A Blockchain is a tamper-proof record of transactions distributed across all participants in a Blockchain network. Via digital authentication and verification, the technology removes intermediaries and reduces transaction time and fraud.

A wants to send money to B

The transaction is represented online as a 'block'

The block is broadcast to every party in the network

Those in the network approve the transaction is valid

The block can then be added to the chain, which provides a record of transactions

The money moves from A to B

Key Benefits

- Reduces transaction time
- Removes intermediaries
- Reduces tampering and fraud
- Increases trust through shared processes

Market and investment trends

- Total **$1.4 bn** invested in start-ups

- In **Q1 2016,** blockchain funding overtook bitcoin funding

- In **2016,** investment in blockchain fell by **18%**

- In **Q1 2016,** there were **39** deals totalling **$173 mn** in Bitcoin & Blockchain start-ups

Example use cases

- Bitnation
- BitSoko (Africa)
- Ethereum

▶ Robotics

Robotics refers to use of robots to automate and standardize quality of work with minimal errors. It covers a large variety of robots including drones.

COMMUNICATIONS SATELLITE

GPS SATELLITE

Instructions from a pilot are sent to a satellite

The satellite relays information to the drone, while the drone also communicates with the satellite.

When the drone leaves the line of sight, the ground-control station switches to a satellite link to control the aircraft

SATELLITE ANTENNA

GROUND CONTROL STATION

INDIVIDUAL BENEFICIARY

*objects not to scale

Key Benefits

- Improves productivity and efficiency
- Enhances ability to work in hazardous or inaccessible conditions
- Improves quality of human supervision

Market and investment trends

- Global Robotics Industry is expected to grow from **$28.3 bn** in **2015** to **$151.7 bn** in **2022**

- Consumer drones sales to increase to **$2 bn** in **2016**

- 42 deals totalling **$185 mn** in Robotics start-ups including Drone start ups in Q1 2016

Example use cases

- Alphabet (Google)
- iRobot
- Zipline (Africa)

▶ 3D Printing

3D Printing or additive manufacturing is a process that creates a three dimensional physical objects from a digital design. It can manufacture highly customized parts, which would otherwise be difficult based on traditional manufacturing

3D CAD MODEL   .STL FILE   SLICED LAYERS

AM PROCESS   FINISHING TOUCHES   FINAL PRODUCT
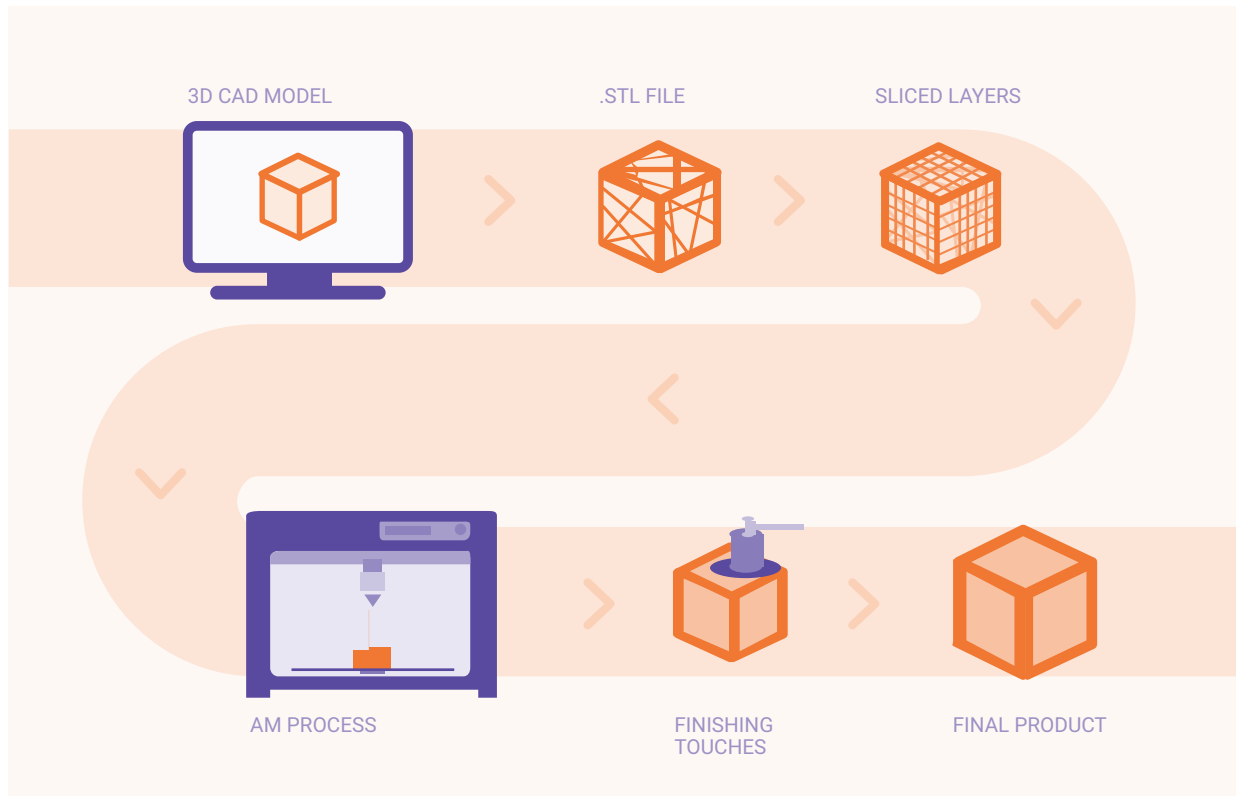
Key Benefits

- Makes highly complex designs easily
- Creates highly customize items
- Reduces wastage in manufacturing processes
- Can democratize manufacturing

Market and investment trends

- The global 3D printing market is set to reach om **$9.6 bn** in **2020**

- Medical industry applications are growing fastest at **17.3%** at **CAGR**

Example use cases

- 3D Systems
- Robo Beast (Africa)
- Stratasys

→ Emerging technologies amplify impact creation through five major levers

Emerging technologies can amplify impact through five major levers viz., speed, deep insights, customization, democratization and system change. Their high impact potential is characterized by their abilities to deliver real time data at speed and provide deep insights for decision making. This allows for customization of solutions. The growing importance of the individual spurs innovations for democratizing access to products and services. Through a combination of forces, emerging technologies can disrupt whole industries and solution systems. Each lever, valuable in its own right, sets the stage for the next level.

▶ **Impact Amplification Framework**

SYSTEM CHANGE

DEMOCRATIZATION

CUSTOMIZATION

DEEP INSIGHT

SPEED
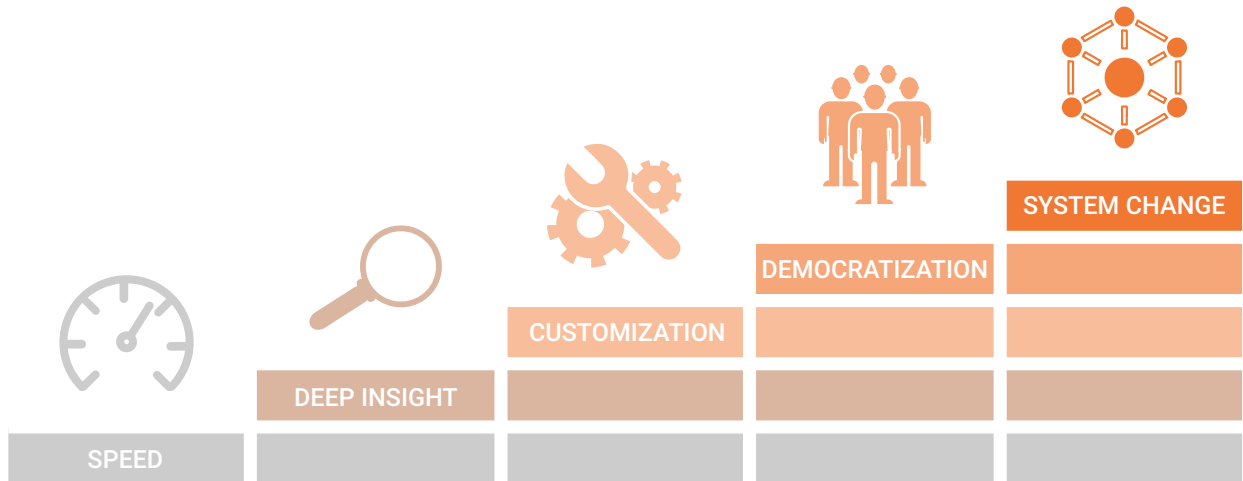
→ We feature a set of emerging technology innovations that can find application and be scaled in Africa over the next decade

Many of the existing as well as potential emerging technology use cases that are unfolding in different parts of the world can be applied in Africa to help the continent leapfrog. In this report we highlight 30 such example use cases across the five levels of impact amplification which can prove highly relevant in the African context. These use cases give us preview of what is possible today – and what will shape our problem solving towards an Africa in 2030.

Emerging Technology Innovations for Africa

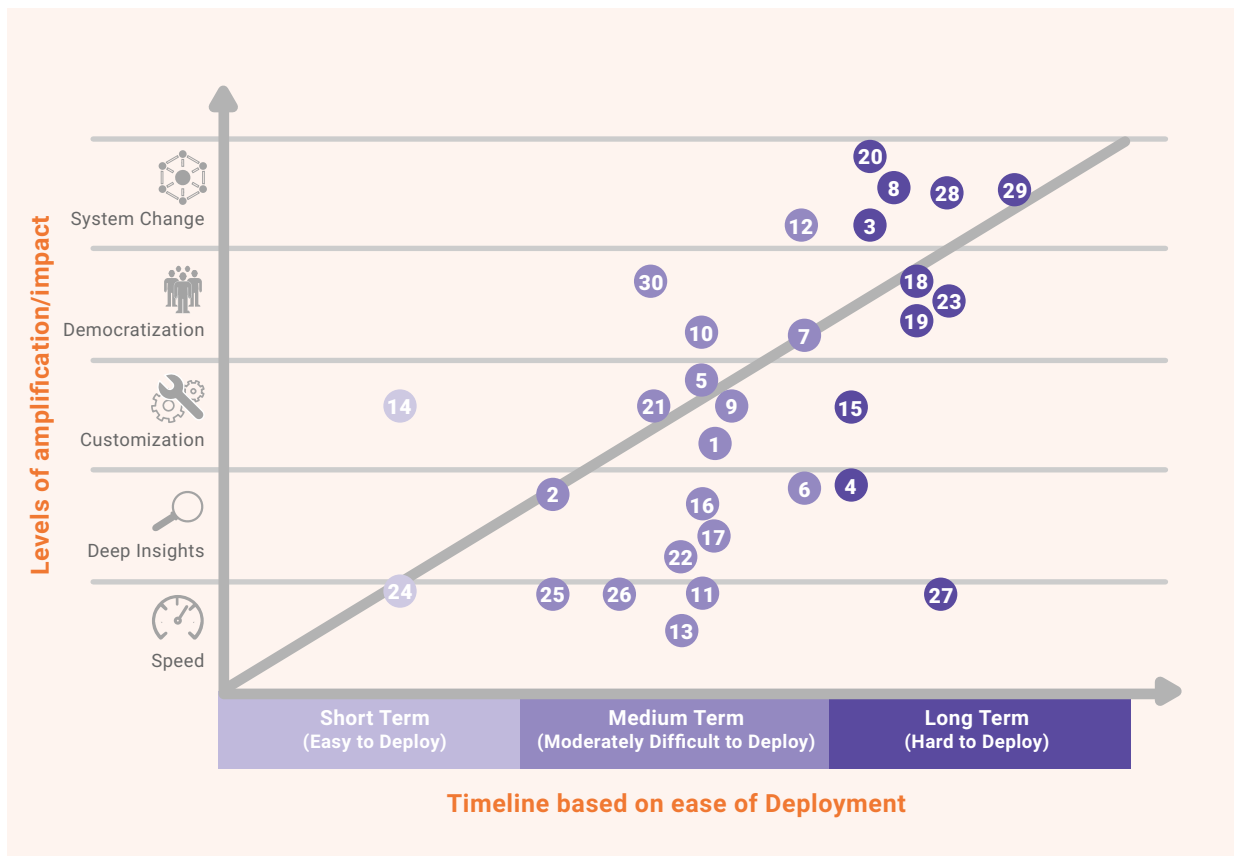| BoP MARKET BARRIERS	LEVELS OF IMPACT AMPLIFICATION				
	SPEED	DEEP INSIGHT	CUSTOMIZATION	DEMOCRATIZATION	SYSTEM CHANGE
PRODUCTIVITY	Wearables enabled "on-demand" economy provides new income opportunities and empowers informal & self-employed workers	Sensor-enabled real-time livestock, crop and soil monitoring and weather predictions improves decision-making, optimizes use of agricultural inputs and enhances agricultural productivity	Blockchain enabled social benefit transfer reaches beneficiaries without leakages, ensures process integrity and increases government efficiency	IoT enabled mapping and monitoring of water quality and use provides communities with greater control and management of their water resources	Convergence of technologies decentralizes manufacturing and disrupts economics of traditional manufacturing
QUALITY	Sensor-enabled real time monitoring of temperature & humidity improves delivery and storage of medicine	Blockchain enables verified, reliable and quality data to enable digital identity creation	AI enables customization of online education based on individual needs and preferences	AI and Big Data enabled data mining & sharing facilitates better policy formulation	Emerging technologies reduce the need for intermediaries in the development sector and makes aid transfers to beneficiaries more need-based
REACH / AVAILABILITY	Drones, AI & IoT facilitate rapid last mile delivery of healthcare and humanitarian assistance	Drones, AI, and Big Data enable accurate prediction & detection of conflict, natural disasters and emerging disease outbreaks	IoT strengthens cloud powered sharing of farm equipment between small farmers on on-demand and low cost basis to help overcome under-cultivation and poor harvests	Blockchain enabled peer-to-peer trading democratizes access to energy	Convergance of emerging technologies enable solar power based decentralized autonomous microgrids replace the conventional power grid as the primary source of household energy

BoP MARKET BARRIERS	LEVELS OF IMPACT AMPLIFICATION				
	SPEED	DEEP INSIGHT	CUSTOMIZATION	DEMOCRATIZATION	SYSTEM CHANGE
VIABILITY	IoT and AI enable doctors and medical health workers offer faster and more accurate prevention, diagnostic and treatment decisions and reduces costs	AI enabled efficient energy distribution helps minimise distribution losses	AI enabled targeted product development for customers without prior banking history or in underserved segments	Blockchain enabled health information exchange and transfer of health data ownership to patients provides them greater control over use of their data and enables data privacy and security	Emerging technologies enable FSPs to better assess client needs, risks and deliver customised and affordable products to wider customer segments without expanding physical branches
MOTIVATION	Wearables facilitate inculcation of good health and hygiene habits in school and household settings	Blockchain enabled open source data market places facilitate peer-to-peer research collaborations and exchange of real-time and longitudinal data	Wearables enable tracking of health of mothers and their fetus in low resource environments	Blockchain, IoT and AI enable creation of new trust networks and consensus-based decision-making, boosting peer-to-peer lending, loan syndication & early stage investing	Emerging technologies empower farmers by providing them greater control over the value chain by removing middlemen and enhancing their economic earnings
SCALE	Blockchain enabled trustless exchange enhances cross border trade and reduces need for third party intermediation	Blockchain & AI enabled verification in the pharmaceutical supply chain increases traceability and provision of safe, high quality and authentic medicine	Blockchain enabled transparent and tamper-proof property ownership registration helps prove ownership and resolve disputes, prevent fraud and further financial inclusion	Blockchain supports process integrity during elections and increases transparency	Convergence of emerging technologies enable data driven and patient-centric solutions across the healthcare value chain and help create new healthcare delivery systems

While some innovations are 'low hanging fruits', others call for a long-term perspective

Mapping these innovations against a set of deployment dependencies including policy and regulatory environment, need for infrastructure, required financial and human capital, degree of required behavioral change helps us construct an indicative timeline for their arrival. The report concludes that while some of these innovations are 'low hanging fruits, others will require a long-term perspective for successful deployment and scale-up.

Innovation Deployment Timeline

List of Emerging Technology Innovations

1 — IoT strengthens cloud powered sharing of farm equipment between small farmers on on-demand and low cost basis to help overcome under-cultivation and poor harvests

2 — Sensor-enabled real-time livestock, crop and soil monitoring and weather predictions improves decision-making, optimizes use of agricultural inputs and enhances agricultural productivity

3 — Emerging technologies empower farmers by providing them greater control over the value chain by removing middlemen and enhancing their economic earnings

4 — Blockchain enabled open source data market places facilitate peer-to-peer research collaborations and exchange of real-time and longitudinal data

5 — AI enables customization of online education based on individual needs and preferences

6 — AI enabled efficient energy distribution helps minimise distribution losses

7 — Blockchain enabled peer-to-peer trading democratizes access to energy

8 — Convergance of emerging technologies enable solar power based decentralized autonomous microgrids replace the conventional power grid as the primary source of household energy

9 — AI enabled targeted product development for customers without prior banking history or in underserved segments

10 — Blockchain, IoT and AI enable creation of new trust networks and consensus-based decision-making, boosting peer-to-peer lending, loan syndication & early stage investing

11 — Blockchain enabled trustless exchange enhances cross border trade and reduces need for third party intermediation

12 — Emerging technologies enable FSPs to better assess client needs, risks and deliver customised and affordable products to wider customer segments without expanding physical branches

13 — Wearables enabled "on-demand" economy provides new income opportunities and empowers informal & self-employed workers

14 — Blockchain enabled social benefit transfer reaches beneficiaries without leakages, ensures process integrity and increases government efficiency

15 — Blockchain enabled transparent and tamper-proof property ownership registration helps prove ownership and resolve disputes, prevent fraud and further financial inclusion

16 — Blockchain enables verified, reliable and quality data to enable digital identity creation

17 — Drones, AI, and Big Data enable accurate prediction & detection of conflict, natural disasters and emerging disease outbreaks

18 — AI and Big Data enabled data mining & sharing facilitates better policy formulation

19 — Blockchain supports process integrity during elections and increases transparency

20 — Emerging technologies reduce the need for intermediaries in the development sector and makes aid transfers to beneficiaries more need-based

21 — Wearables enable tracking of health of mothers and their fetus in low resource environments

22 — Blockchain & AI enabled verification in the pharmaceutical supply chain increases traceability and provision of safe, high quality and authentic medicine

23 — Blockchain enabled health information exchange and transfer of health data ownership to patients provides them greater control over use of their data and enables data privacy and security

24 — Wearables facilitate inculcation of good health and hygiene habits in school and household settings

25 — Sensor-enabled real time monitoring of temperature & humidity improves delivery and storage of medicine

26 — Drones, AI & IoT facilitate rapid last mile delivery of healthcare and humanitarian assistance

27 — IoT and AI enable doctors and medical health workers offer faster and more accurate prevention, diagnostic and treatment decisions and reduces costs

28 — Convergence of emerging technologies enable data driven and patient-centric solutions across the healthcare value chain and help create new healthcare delivery systems

29 — Convergence of technologies decentralizes manufacturing and disrupts economics of traditional manufacturing

30 — IoT enabled mapping and monitoring of water quality and use provides communities with greater control and management of their water resources

Emerging technologies can trigger a set of big shifts to help Africa leapfrog

Africa's developmental challenges are intimidating but emerging technologies can trigger big shifts to help the continent leapfrog and combat those challenges. Our analysis of emerging technology-led innovations helped us discern trends that point towards what these big shifts might look like for Africa. We are encouraged to find that the seeds for these shifts have already been sown. Change has already begun and Africa needs to gear up and make the most of it.

Big Shifts

Africa's development challenges

Food & Nutrition Security

Future ready workforce

Energy security & climate change

Water security

Holistic healthcare ecosystems

Financial inclusion

Call for solution development with the INDIVIDUAL at the epicenter

Big shifts will place the spotlight on the INDIVIDUAL

SHIFT 1
From digital divide to digital bridge

SHIFT 2
From a wasteful to a circular economy
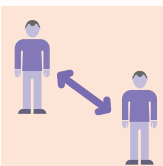
SHIFT 3
Beyond collaboration – Rise of the (P2P) economy
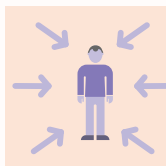
SHIFT 4
Power to the individual: the data revolution and personalization of everything

SHIFT 5
Disrupting citizen relationship with the government

Africa's innovation journey has begun but significant whitespaces and opportunities remain

Through a mapping of 100 technology use cases in Africa against the development challenges and the impact amplification framework, the report identifies certain key innovation whitespaces and a set of opportunities for key stakeholders to help create and nurture a high impact technology innovation ecosystem.

▶ Innovation Whitespaces Heat Map

HEAT MAP — RELATED MEGA CHALLENGE	LEVEL OF AMPLIFICATION				
	SPEED	DEEP INSIGHT	CUSTOMIZATION	DEMOCRATIZATION	SYSTEM CHANGE
Creating a future-ready workforce in a time of changing skill requirements	Low Activity	Low Activity	Low Activity	Low Activity	Low Activity
Expanding choices for the BoP and reducing their vulnerabilities via financial inclusion	High Activity	High Activity	Medium Activity	Low Activity	Low Activity
Managing competing usage of water and the interplay between water, energy and food security	Low Activity	Medium Activity	Low Activity	Low Activity	Low Activity
Securing affordable, nutritious food for 1 bn of people in Africa	Medium Activity	High Activity	Low Activity	Low Activity	Low Activity
Securing low carbon energy security and combatting climate change	Low Activity	High Activity	Low Activity	Low Activity	Low Activity
Shifting focus from reactive treatment responses to building holistic healthcare ecosystems	Medium Activity	High Activity	Medium Activity	Low Activity	Low Activity

KEY

Low Activity	Medium Activity	High Activity

N = 100