Developments and Future of AI in Africa

Dr Jacques Ludik

Founder & President of MIIA

Founder & CEO, Cortex Logic

CORTEX logic
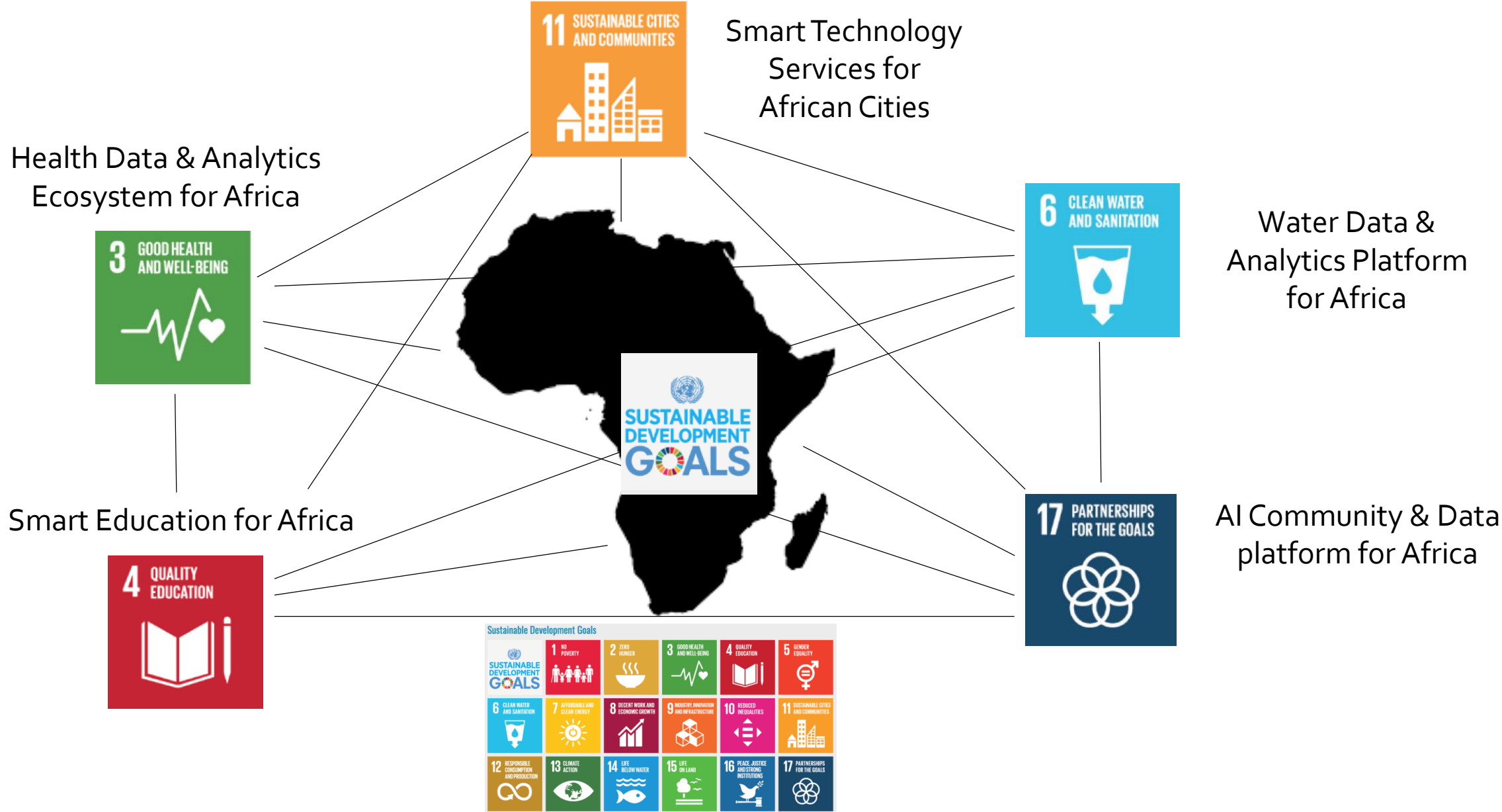AI Engine for Business

Machine Intelligence Institute of Africa
Transform Africa through Machine Intelligence

Health, Water, Smart Education & Smart Technology Services for African Smart Cities

- Summary
- Smart Technology Era
- AI Community & Data Platform for Africa
- Health Data & Analytics Ecosystem for Africa
- Water Data & Analytics Platform for Africa
- Smart Education for Africa
- Smart Technology Services for African Smart Cities
- Appendix
  - AI in Africa - the present
  - AI in Africa - the future

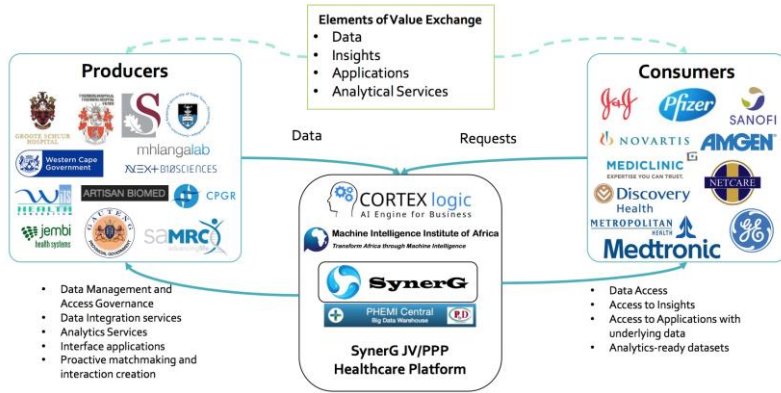# Health, Water, Smart Education & Smart Technology Services for African Smart Cities

Health, Water, Smart Education & Smart Technology Services for African Smart Cities

Mapping of AI for Good Summit Tracks to African Smart Technology Project

AI for Good Global Summit Track	Example Use cases	Mapping to Africa Project: **Health, Water, Smart Education & Smart Technology Services for African Smart Cities**	
AI and satellite imagery	show potential of AI to map poverty and aid with natural disasters using satellite imagery	AI Community & Data Platform for Africa	Smart Technology Services for African Smart Cities
AI and health	new opportunities for AI to help achieve Universal Health Coverage	Health Data & Analytics Ecosystem for Africa	AI Community & Data Platform for Africa; Smart Technology Services for African Smart Cities
AI and smart cities & communities	how AI could assist the delivery of citizen-centric services in smart cities	AI Community & Data Platform for Africa; Smart Technology Services for African Smart Cities	Water Data & Analytics Platform for Africa
Trust in AI	help achieve transparency and explainability in AI algorithms	AI Community & Data Platform for Africa	Smart Technology Services for African Smart Cities

Smart Technology Era

THE FOURTH INDUSTRIAL REVOLUTION

Shaping a Better Future in the Smart Technology Era

We stand on the brink of a technological revolution that will
fundamentally alter the way we live, work, and relate to one another...

THE FOURTH INDUSTRIAL REVOLUTION
The Smart Technology Era is here...

Builds on the digital revolution
and characterized by the
fusion of new technologies that are blurring the lines
between the physical, digital and biological worlds,
impacting all disciplines, economies and **industries**,
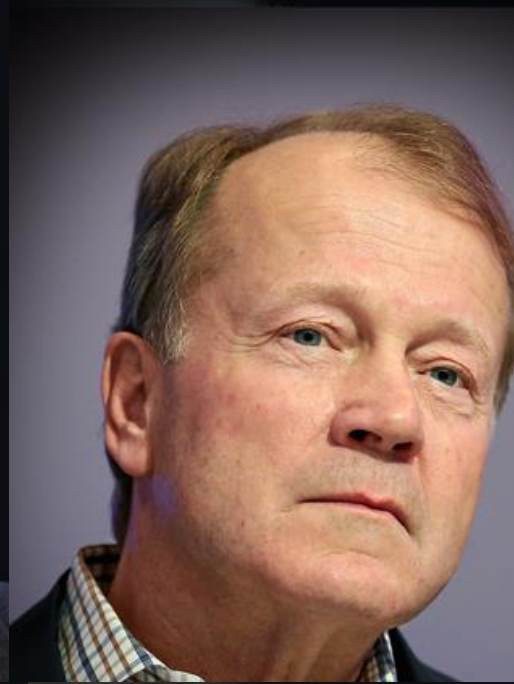and even challenging ideas about what it **means** to be human

We cannot wait until there are massive dislocations in our society to prepare for the Fourth Industrial Revolution

Robert J. Shiller
Yale University

If you don't innovate fast, disrupt your industry, disrupt yourself, you'll be left behind.

John Chambers
Chairman and Chief Executive Officer, Cisco, USA
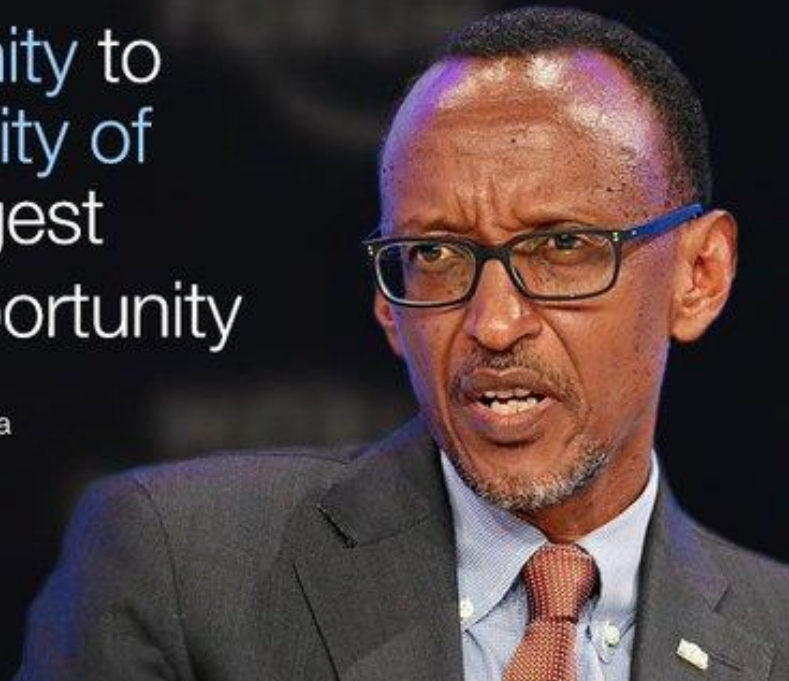
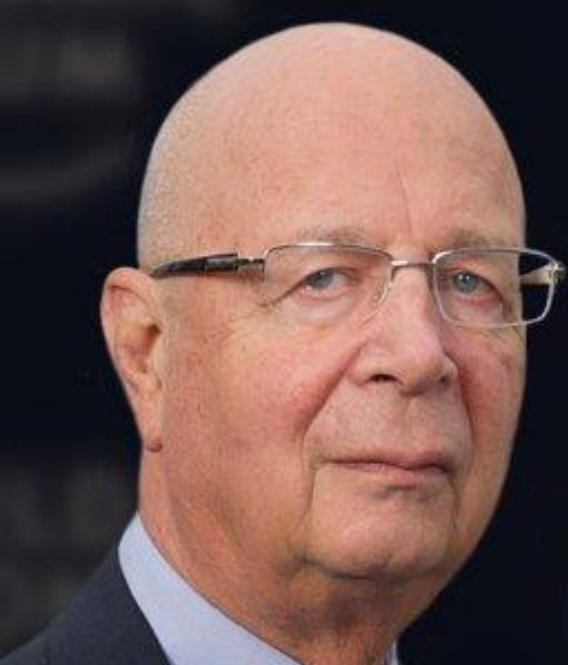The Fourth Industrial Revolution should be a revolution of values

Amira Yahyaoui
Founder and Chair, Al Bawsala

The opportunity to raise the quality of life is the biggest business opportunity

Paul Kagame
President of the Republic of Rwanda

In the new world, it is not the big fish which eats the small fish, it's the fast fish which eats the slow fish

Klaus Schwab

We need to start sharing not the burden, but the responsibility

Federica Mogherini
Vice-President of the European Commission

A secular shift in commerce is coming, and for companies ready to embrace it, there's a $14 trillion opportunity at stake
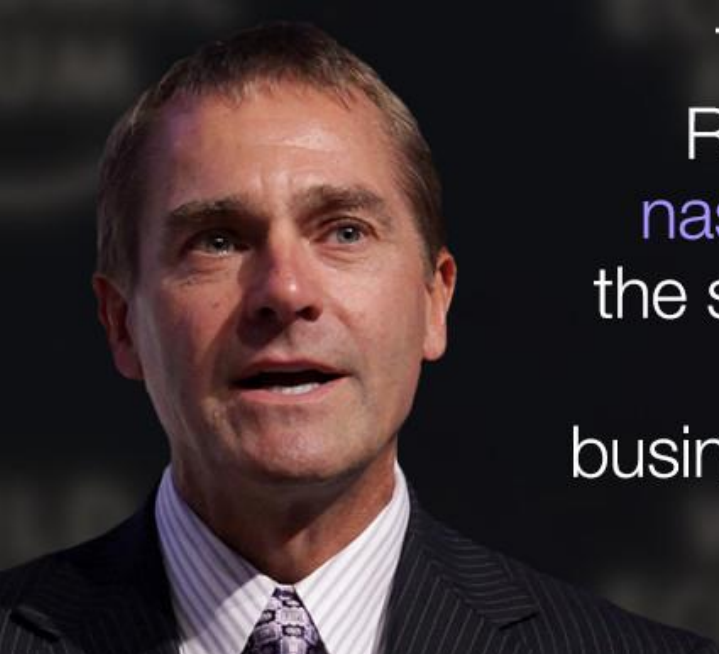
Devin Wenig
President and CEO of eBay

Africa is an article of faith. I believe in this continent

Sunil Bharti Mittal
Founder and Chairman, Bharti Enterprises
Co-Chair of the World Economic Forum on Africa

The Fourth Industrial Revolution is still in its nascent state. But with the swift pace of change and disruption to business and society, the time to join in is now

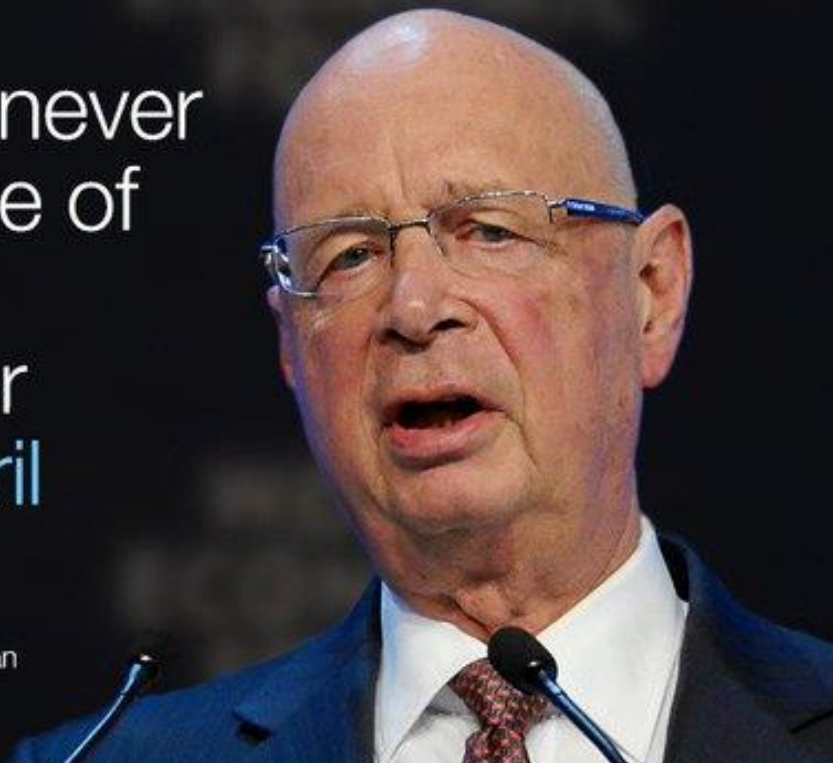Mexico is one of the only nations whose constitution recognizes the right of its people to a broadband internet connection

China is paying more attention to the quality, not the quantity, of economic growth

Jiang Jianqing
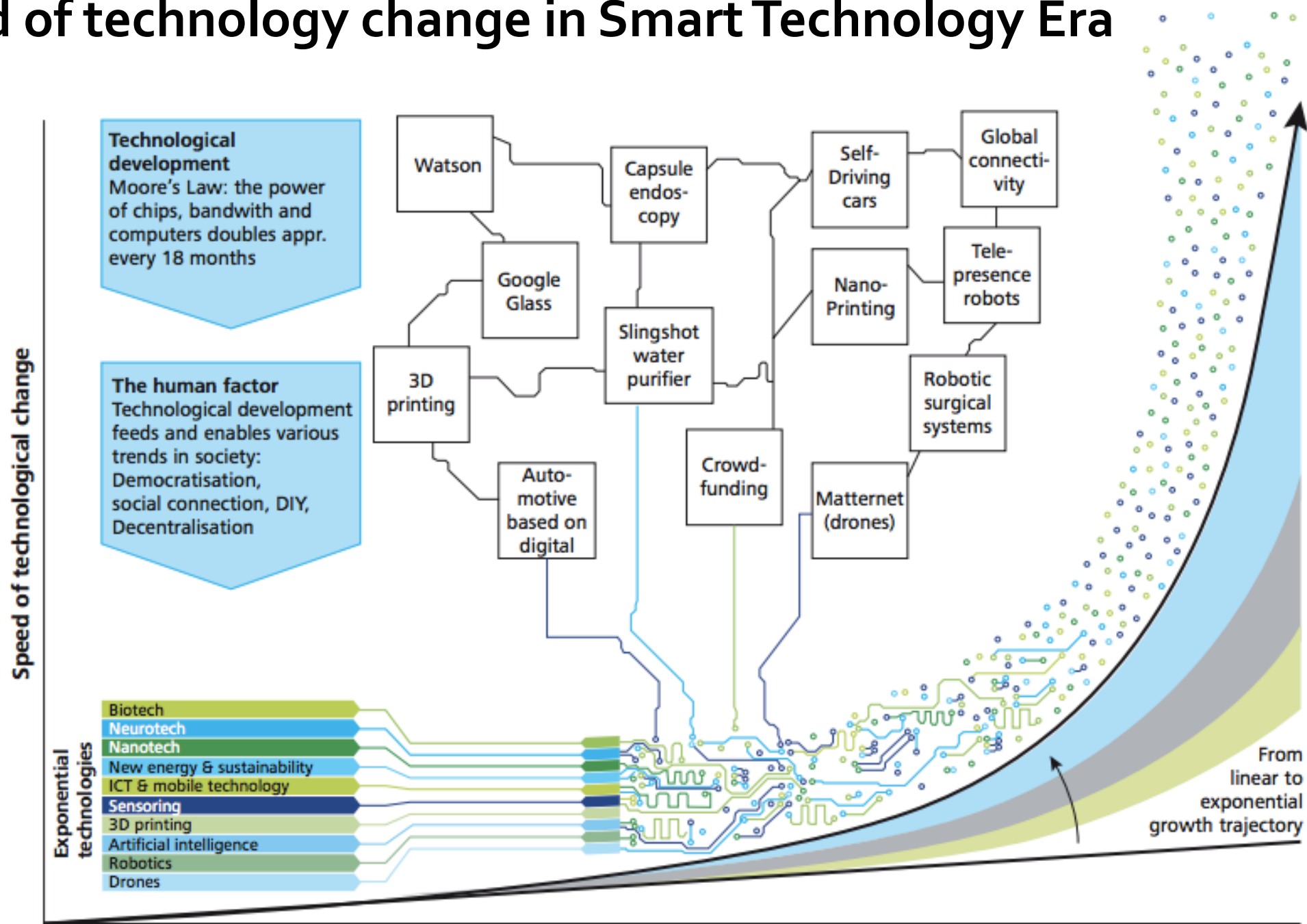Chairman of the Board, Industrial and Commercial Bank of China Limited

There has never been a time of greater promise, or greater peril

Professor Klaus Schwab
Founder and Executive Chairman of the World Economic Forum

Speed of technology change in Smart Technology Era

Speed of technological change

Technological development
Moore's Law: the power of chips, bandwith and computers doubles appr. every 18 months

The human factor
Technological development feeds and enables various trends in society: Democratisation, social connection, DIY, Decentralisation

Watson

Google Glass

3D printing

Capsule endoscopy

Slingshot water purifier

Auto-motive based on digital

Crowd-funding

Self-Driving cars

Nano-Printing

Matternet (drones)

Global connecti-vity

Tele-presence robots

Robotic surgical systems

Exponential technologies
Biotech
Neurotech
Nanotech
New energy & sustainability
ICT & mobile technology
Sensoring
3D printing
Artificial intelligence
Robotics
Drones

From linear to exponential growth trajectory

Unlimited opportunities with mobile & exponential technologies

The possibilities of billions of people connected by mobile devices, with unprecedented processing power, storage capacity, and access to knowledge, are unlimited.

×

And these possibilities will be multiplied by emerging technology breakthroughs in fields such as artificial intelligence, robotics, the Internet of Things, autonomous vehicles, 3-D printing, nanotechnology, biotechnology, materials science, energy storage, and quantum computing.

2020

4 BILLION	$4 TRILLION	25+ MILLION	25+ BILLION	50 TRILLION
Connected People	Revenue Opportunity	Apps	Embedded and Intelligent Systems	GBs of Data

"AI is the new electricity."

Andrew Ng Baidu
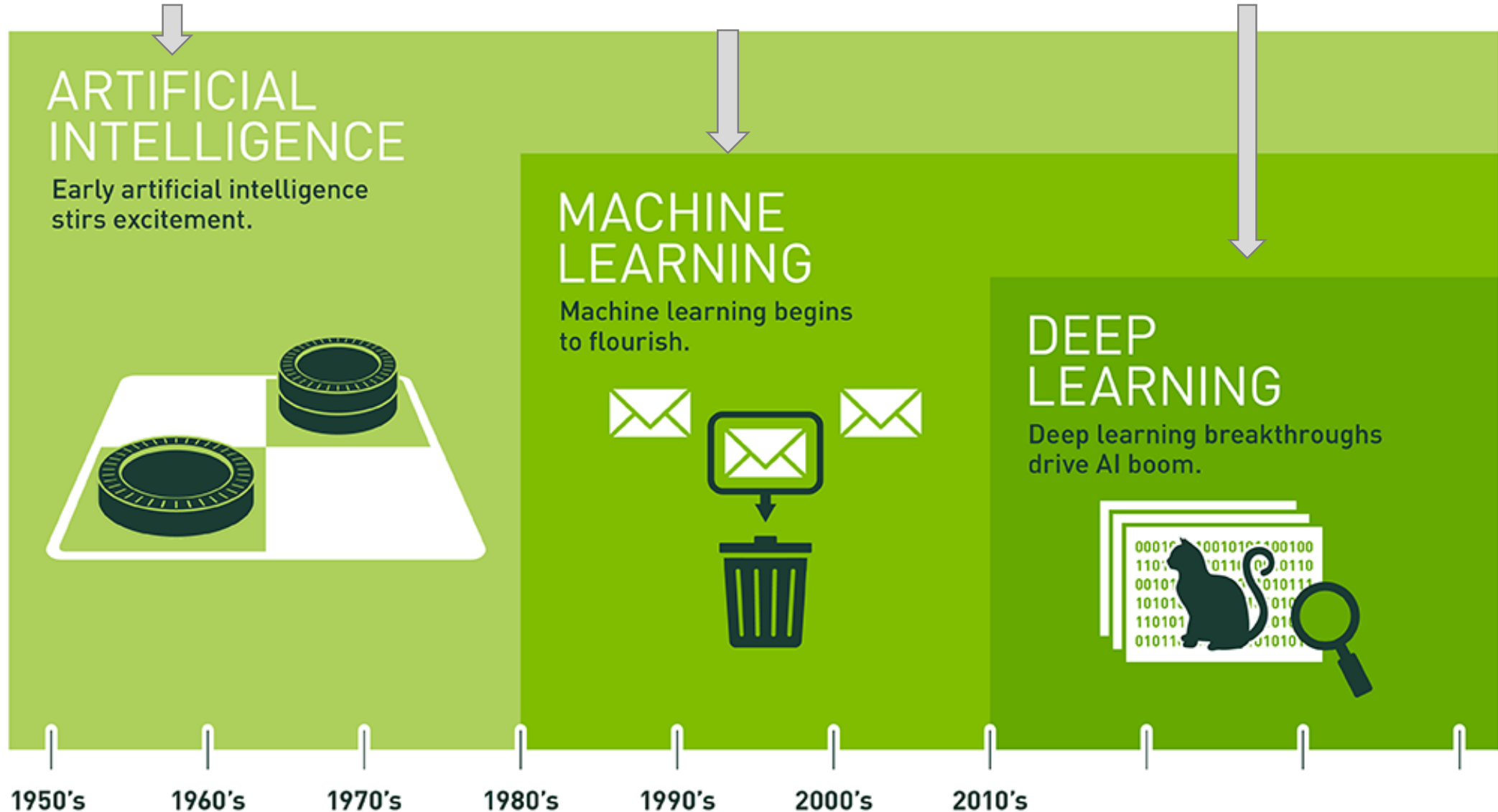

WORLD ECONOMIC FORUM

The **artificial intelligence** revolution is here

Marc Benioff says it will change your life

The Intelligence exhibited by machines or software, and the branch of Computer Science that develops machines and software with INTELLIGENCE

A branch of AI, concerns the construction and study of systems that can LEARN from data

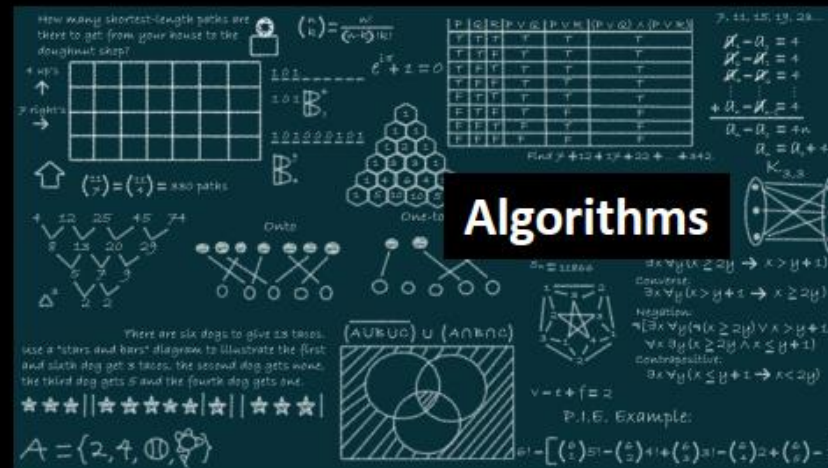Set of algorithms in ML that attempt to MODEL HIGH-LEVEL ABSTRACTIONS in data by using model architectures composed of multiple non-linear transformations

ARTIFICIAL INTELLIGENCE
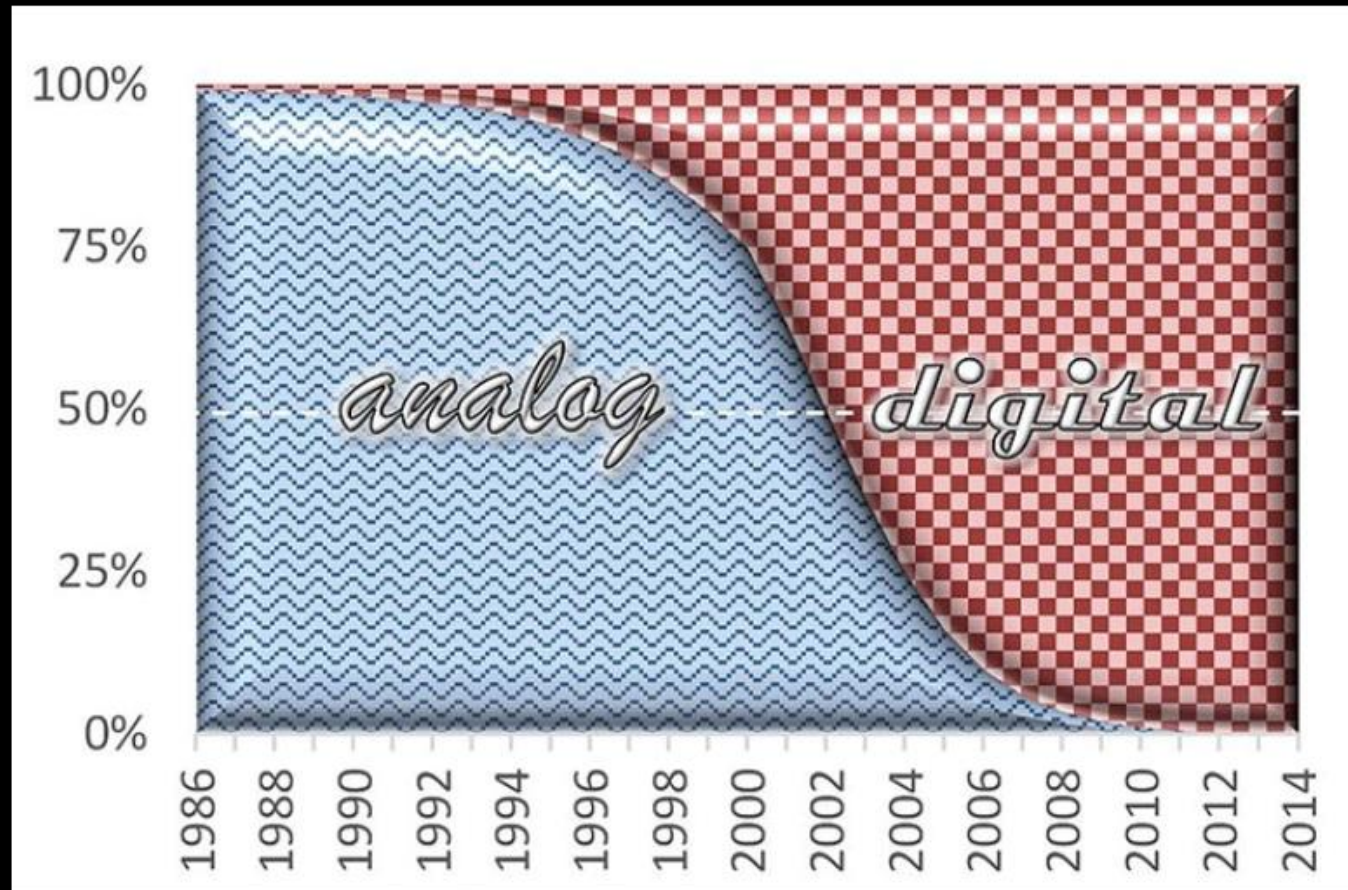Early artificial intelligence stirs excitement.

MACHINE LEARNING
Machine learning begins to flourish.

DEEP LEARNING
Deep learning breakthroughs drive AI boom.

1950's   1960's   1970's   1980's   1990's   2000's   2010's

The Deep Learning Recipe

Compute

Algorithms

Hilbert, M., & Lopez, P (2011), *Science*, 332 (6025), 60-65
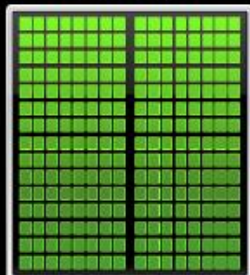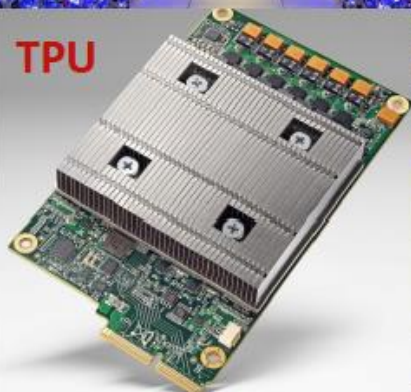
DRIVING FORCE #2

Computational Power
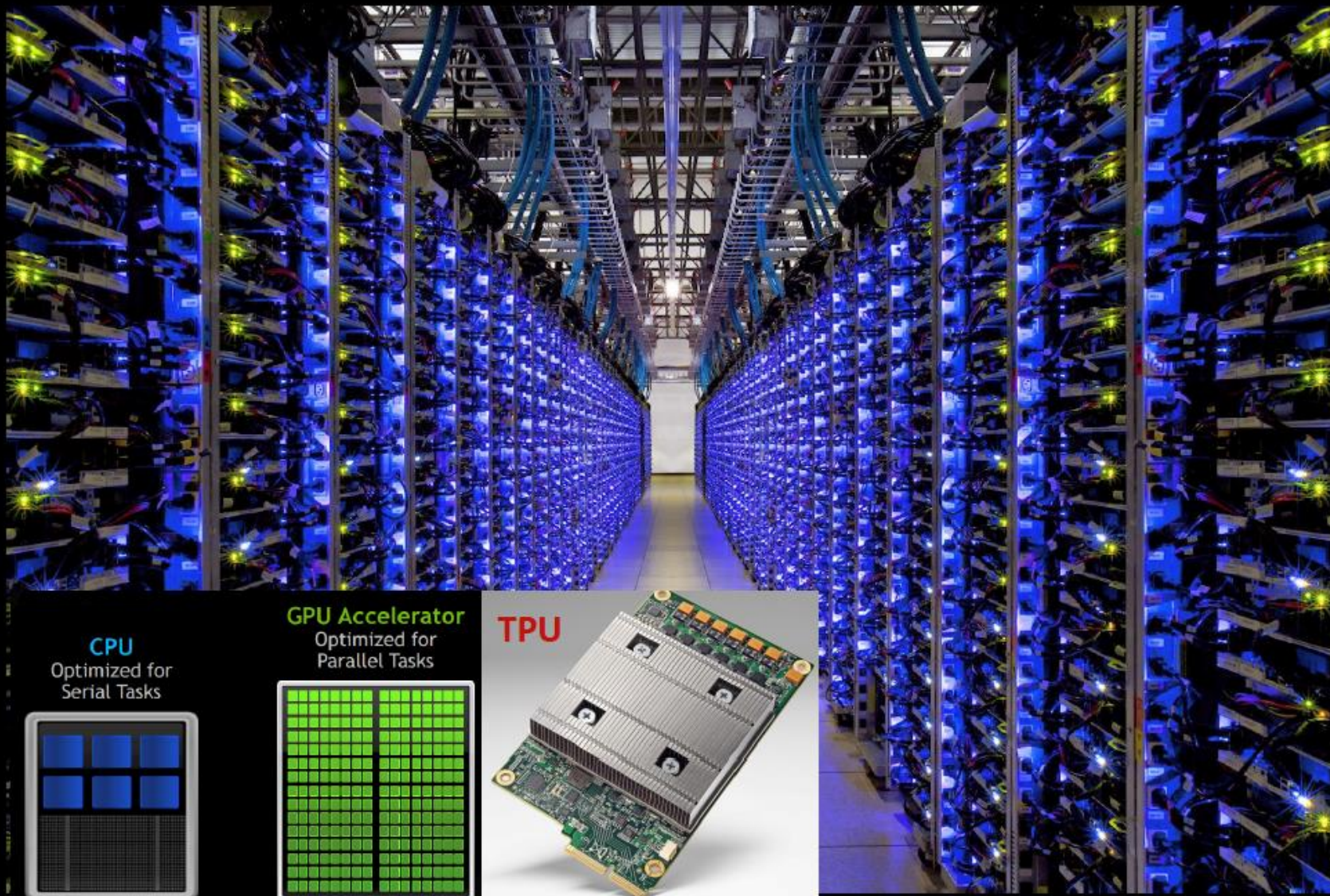
CPU
Optimized for
Serial Tasks

GPU Accelerator
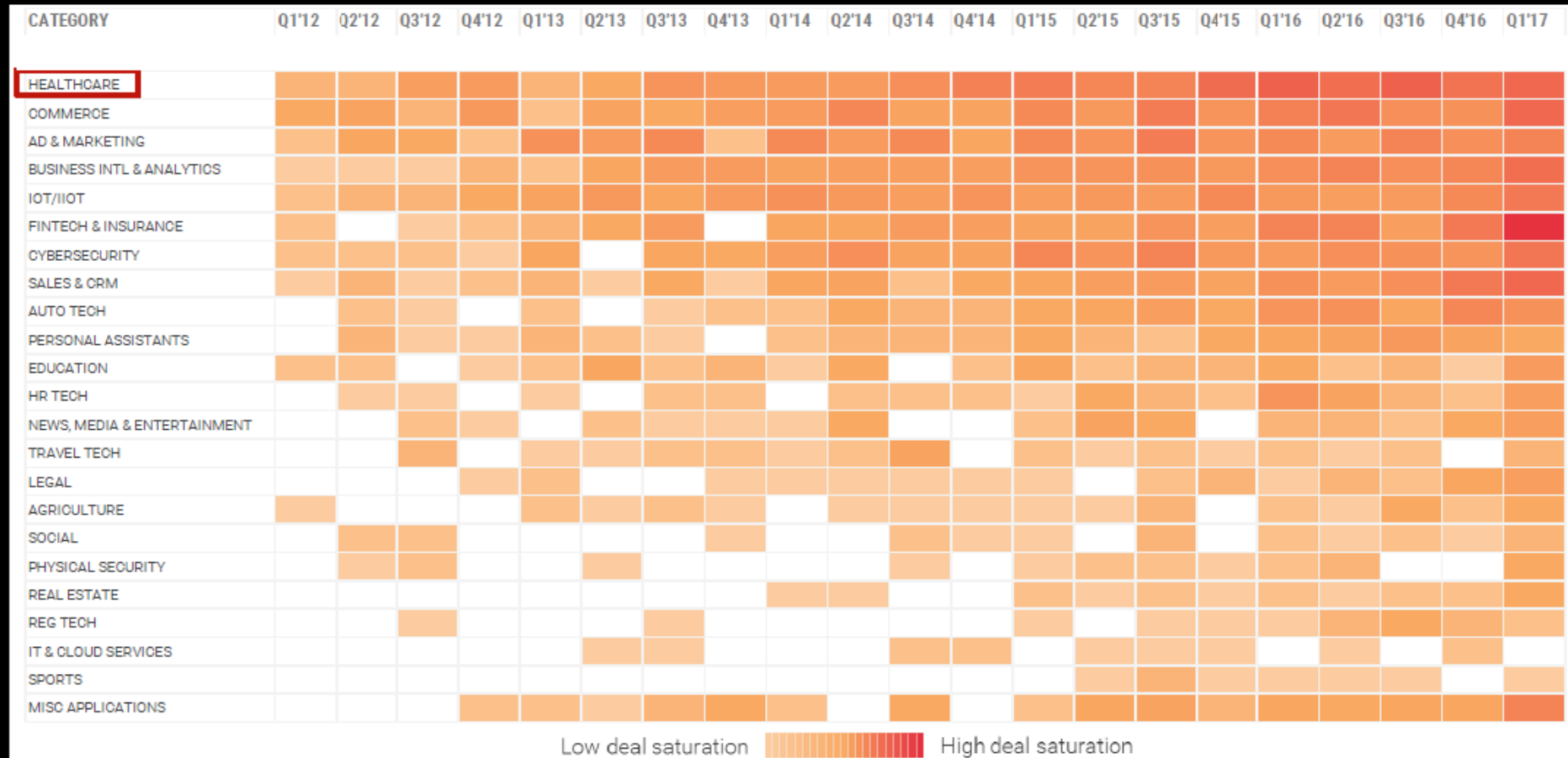Optimized for
Parallel Tasks

TPU

The Next Era:
Deep Learning for Biomedical Research

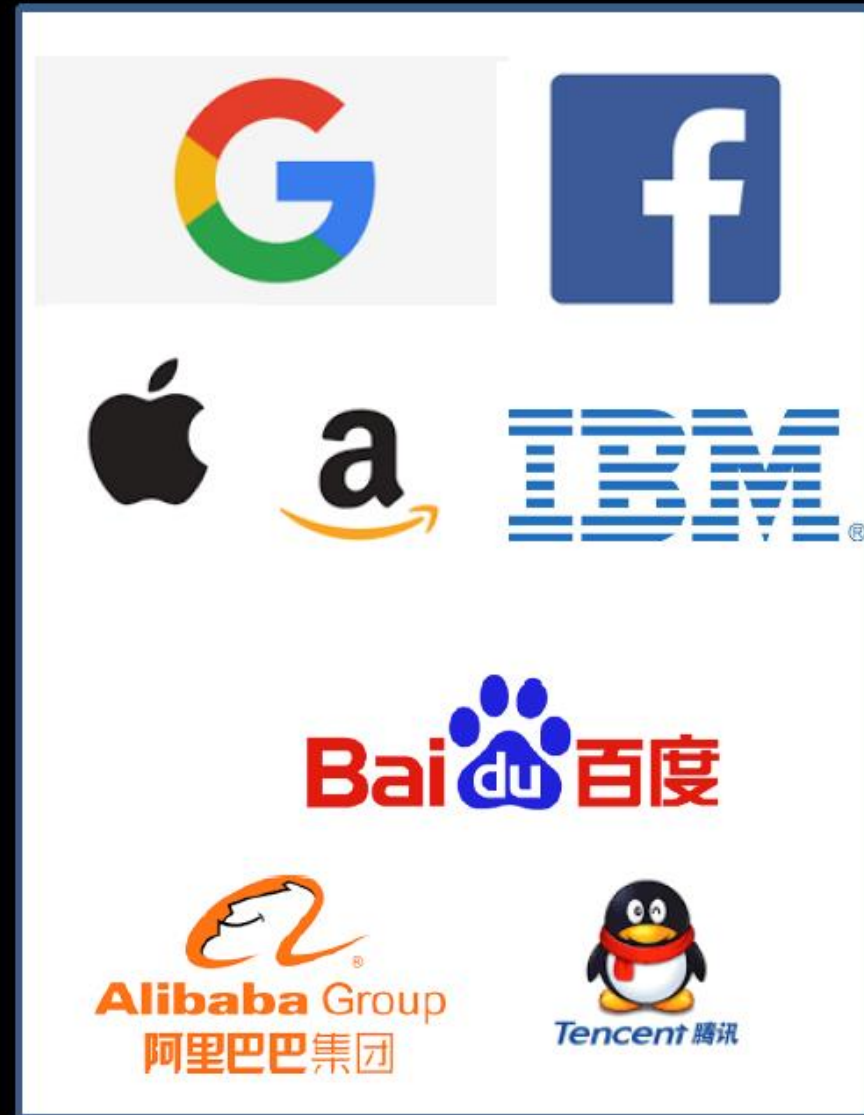# AI heatmap: Deals Distribution by Category
Q1'12-Q'17 (as of 3/23/17)

Healthcare emerges as hottest area of investment

New Players are Entering the Healthcare Space

AI Community & Data Platform for Africa

Machine Intelligence Institute of Africa

Transform Africa through Machine Intelligence

Innovative Community & Accelerator for
Machine Intelligence & Data Science Research and Applications
to help transform Africa

MIIA community is growing! About 2320+ registrations across MIIA channels

International and intra-African collaboration

Partners

| Academic | Research | Non profit | Business | Incubators | Government |

MIIA Activities & Growth Path in 2018

2320+ registrations across MIIA channels

2016

2017

Sponsors
Cortex Logic
Google for Nonprofits
techsoup
slack

Partners

Founded
Launched MIIA & Website

1st Meetup
JUMO 9 Jun

2. Silicon Cape TechTalk on AI

3. AI, ML, Bots, Big Data in Investment
27 Jul

4. AI, ML, Bots in Insurance
31 Aug

5. AI & Government
16 Sep

6. AI & Education
16 Sep

7. Rise to the Challenge – AI

8. AI, ML, Bots, in Wealth Mgt.
12 Oct

9. Smart Tech & 4th Industrial Rev @ Launch Lab
26 Oct

10. MIIA Meetup @ Rise

11. MIIA Meetup @ Launch Lab
30 Nov

12. Data Science Bootcamp collaboration, DS Nigeria
21 Jan

Data Science Nigeria

13. MIIA Meetup @ CiTi
23 Feb

14. How AI is Transforming Manufacturing Webinar

15. Data Science / Industrial IoT Hackathon on Mining Data
20-21 Mar

16. MIIA Meetup in Cape Town @ CiTi
3 May

17. MIIA Meetup in Sandton
11 May

18. "How can AI disrupt industries?" in Cape Town@ Far-ventures
25 May

19. Real-world Machine Learning applications in Security & Mining
9 Mar

20. DS Apps to help businesses thrive in Smart Tech Era
16 Aug

21. All Things Data CPT Conference
12-15 Oct

22. Machine Intelligence & Applications

23. SA Innovation Summit

24. Deep Learning & Applications
13 Sep

25. Deep Learning Indaba
11-15 Sep

26. Deep Learning Hackathon
16 Sep

27. exe-ML
21-22 Sep

28. 2nd Data Science Bootcamp
26-27 Oct

29. AI Africa Conference
26-27 Oct

30. Making the Invisible visible
1 Nov

31. Leader-ship & AI
2 Nov

32. Impact & Applications of AI
3 Nov

33. AI & Inclusion RoundTable
6 Nov

34. Global Symposium on AI & Inclusion
8-10 Nov

35. How AI is transforming corporate decision making
22 Nov

36. Data Protection: Global Compliance Management
6 Dec

37. AIMS / MIIA event
6 Dec

38. Artificial Intelligence transforming Human Resources Summit 2018
14-16 Feb

39. Deep Learning Meetup
20 Feb

40. DataCon Africa 2018
26-28 Feb

41. Building AlphaZero AI
15 Mar

42. SatRday 2018
17 Mar

43. AI: Implications & Impact, City.AI
27 March

44. SABEX 2018 SA Biomedical Eng Conference
4-6 April

45. Deep Learning IndabaX, UCT
6 April

46. CIO Challenge
12 April

47. AI opportunities & pitfalls - PwC
18 April

48. AI opportunities & pitfalls - Rise CPT
25 April

49. Global Investors Group
17 May

50. AI for Good Global Summit, Geneva
15-17 May

51. AI Policy Reflections & Future Strategies, UN
18 May

52. Eskom Digital Day
24 May

53. Sanlam AI Tech Talk
29 May

54. Finnovation Africa 2018
6 June

55. RPA & AI 2018
20 & 21 June

56. SAS AI 2018
28 June

57. AI for SDGs -LaunchLab
4 July

58. Blockchain, AI - Finance 2018
1 Aug

59. ITWeb AI 2018
1-2 Aug

60. Bank Customer Experience 2018
7-8 Aug

61. LeadereX 2018
4 Sep

62. AI EXPO Africa 2018 in Cape Town
9-11 Sep

63. ITU Smart ABC 2018
10-13 Sep

64. Deep Learning Indaba 2018 at Stellenbosch University
9-15 Sep

65. Data Analytics for CI 2018
19-20 Sep

66. BDA Master Class, ADF
26-27 Sep

67. Nigeria AI
10-14 Oct

68. Regenyses AI
23-24 Oct

69. AfricaCom
13-15 Nov

70. IBRO-Simons Neuro-Science
7-28 Jan 2019

Oct 2015 | Mar/Apr 2016 | May 2016 | Jun 2016 | Jul 2016 | Aug 2016 | Sep 2016 | Oct 2016 | Nov 2016 | Dec 2016 | Jan 2017 | Feb 2017

Mar 2017 | Apr 2017 | May 2017 | Jun 2017 | Jul 2017 | Aug 2017 | Sep 2017 | Oct 2017 | Nov 2017 | Dec 2017

Feb 2018 | Mar 2018 | April 2018 | May 2018 | Jun 2018 | Jul 2018 | Aug 2018 | Sep 2018 | Oct 2018 | Nov 2018

Machine Intelligence Institute of Africa

Transform Africa through Machine Intelligence

Innovative Community & Accelerator for
Machine Intelligence & Data Science
Research and Applications
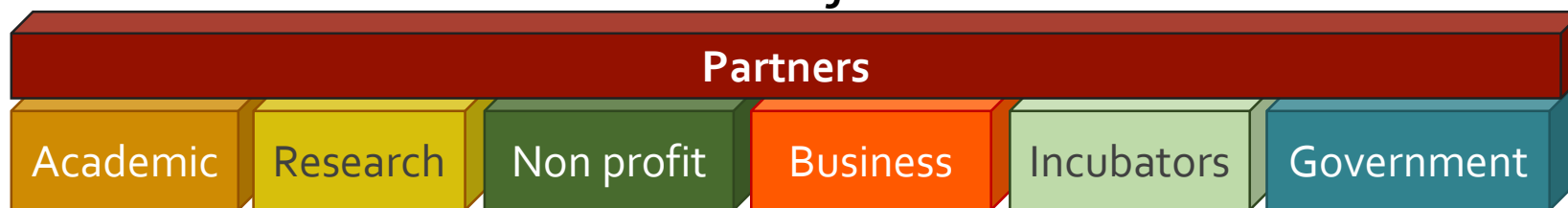to help transform Africa

Data Science Nigeria

Data Science Nigeria

...leading the future with precision.

Projects

Applications

Research

Technology

Expected Benefits

Addressing an African problem or opportunity

Support entrepreneurial activity

Supports community building / learning / collaboration

Advances research & technology

Address African problems

- Poor education & skills development
- Poor healthcare
- Lack of employment and access to financial resources
- Lack of sustainable governance systems & crime prevention
- Poor infrastructure (transport) & energy shortages
- Food shortages and ineffective agriculture

- Lack of technology and manufacturing competitiveness
- Increasing water stress (lack of clean drinking water)
- Poor sanitation (lack of access to clean toilets)
- Rising pollution in the developing world
- Weakening of representative democracy

Partners

Academic

Research

Nonprofit

Business

Government

Incubators

Relevant Industries

Healthcare

Education

Agribusiness Forestry

Finance

Infrastructure Utilities

Transport & Logistics

Manufacturing & Services

Energy Oil & Gas, Mining

Tourism, Retail, Property

Legal Governance

Zindi - "Kaggle" for Africa
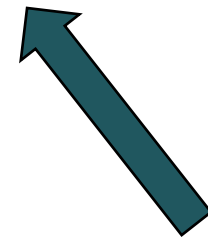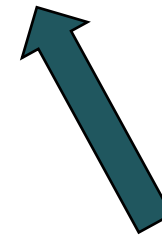
What is Zindi?

A **social enterprise** whose mission is to build the data science capacity in Africa. Our vision is for a vibrant community of data scientists across Africa to be mobilized, solving the region's most pressing problems.

Zindi is an **online platform** that will host competitions, datasets, tutorials, jobs board, and discussion forums.

Zindi will work with companies to develop, curate, and prepare **data-driven challenges.** Solutions are ranked automatically by prediction accuracy.

The Zindi platform offers data scientists the opportunity to access **jobs** and cash prizes, to build their profile and skills, and to connect with their peers throughout the region.

Zindi enables companies, organizations, and governments to host competitions to **solve** their specific **problems** and attract the best data science talent in Africa.

ZiNDi

The Zindi Ecosystem

GOVERNMENTS
Interested in leveraging data to drive large scale change in key industries and portfolios

NON PROFIT ORGANISATIONS
Interested in finding data-driven solutions to 'local' developmental issues

COMPANIES
Interested in finding solutions to commercial problems and in attracting data science talent

● Solutions
● Discussions
● Talent

● Data and problems
● Competition rewards
● Job postings

ANALYTICS COMMUNITIES
Universities, Innovation hubs and communities of analytics practitioners

CONSULTANTS
Specialist providers of advanced analytics and data science solutions

OTHER EXPERTS
Coders, Freelancers, Students

ZiND!

Health Data & Analytics Ecosystem for Africa

Healthcare Data & Analytics Ecosystem for Africa

Elements of Value Exchange
- Data
- Insights
- Applications
- Analytical Services

Producers

Data

Requests

Consumers

CORTEX logic AI Engine for Business

Machine Intelligence Institute of Africa
Transform Africa through Machine Intelligence

SynerG

PHEMI Central Big Data Warehouse

SynerG JV/PPP Healthcare Platform

- Data Management and Access Governance
- Data Integration services
- Analytics Services
- Interface applications
- Proactive matchmaking and interaction creation

- Data Access
- Access to Insights
- Access to Applications with underlying data
- Analytics-ready datasets

Real-world Data & Real-world Evidence in Drug Discovery and Development
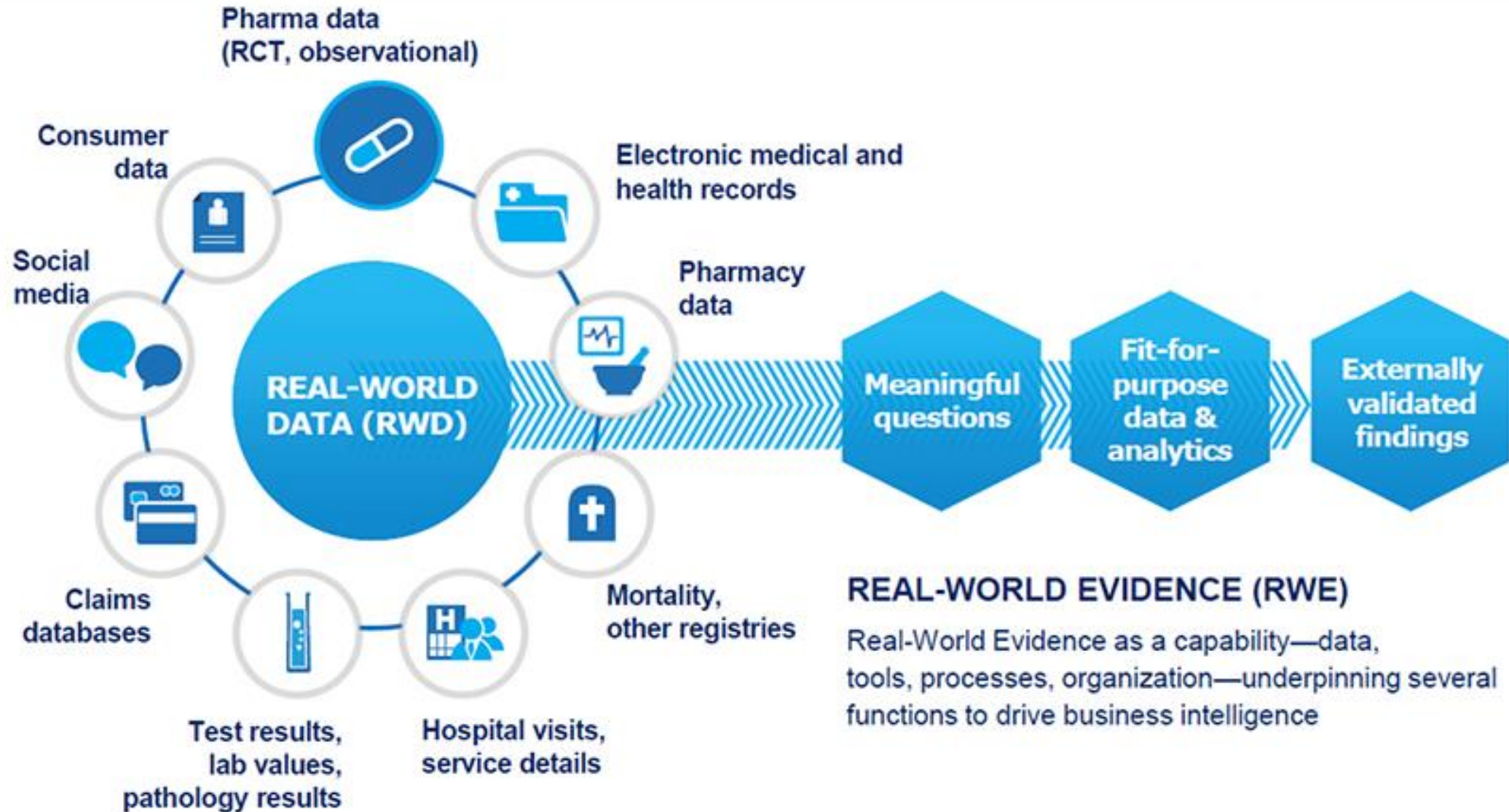
Precision Oncology enabled by Data

Pharma Industry

- Identify clinical trial patients
- Identify candidates for treatments
- Pharmacovigilance information
- Novel targets or applications
- Patient feedback on experimental treatment
- RWE for quicker FDA approvals

Health Insurance Industry

- Identify possible treatments with high probability of success
- Evidence for value-based reimbursement
- Increased confidence for experimental treatments

Public Sector Payors

- Increased confidence following public procurements of drugs
- Negotiation power with producers based on evidence
- Precision medicine approach with improved outcomes
- RWE on populations → better planning

PHEMI Central
Big Data Warehouse

Public Datasets

Compare and enrich

Private Dataset of RWD

Data Analytics
Data Science
Insights Generation
Interpretation
Transformation

An African Precision Medicine Company
Mosaic

Governance Layer
- Privacy
- Security
- Confidentiality

PHEMI

PHEMI Central
Big Data Warehouse

Digital Assets of RWE

Doctor
Hospital
Patient

Electronic Health Record

Whole Genome
Whole Exome
Single Cell Seq

Genomics

Laboratory

An African Precision Medicine Company
Mosaic

Novel Pharmacogenomics insight

Test Drugs and Drug Candidates

Organoid Cell Culture

6 CLEAN WATER AND SANITATION

Water Data & Analytics Platform for Africa

Water Data & Analytics Platform for Africa

Water cycle
Water & sanitation challenges
Water value chain

Water control area levels

- Earth
- Continent
- Sub-continent
- Country
- Province
- Municipality
- District
- Consumer
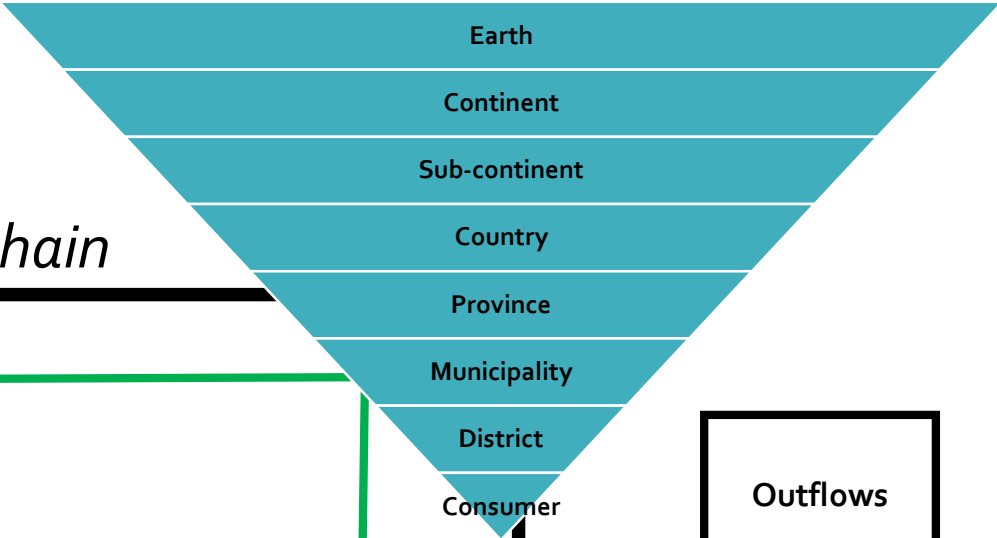
Generic Water Control Area

- Inflows
- Sea water
- Precipitation

- Surface Conveyance: Rivers, streams, canals, tunnels and estuaries
- Surface storage: Dams and wetlands
- Infiltration
- Underground storage: Aquifers
- Consumption

- Outflows
- Evaporation
- Evapo-transpiration
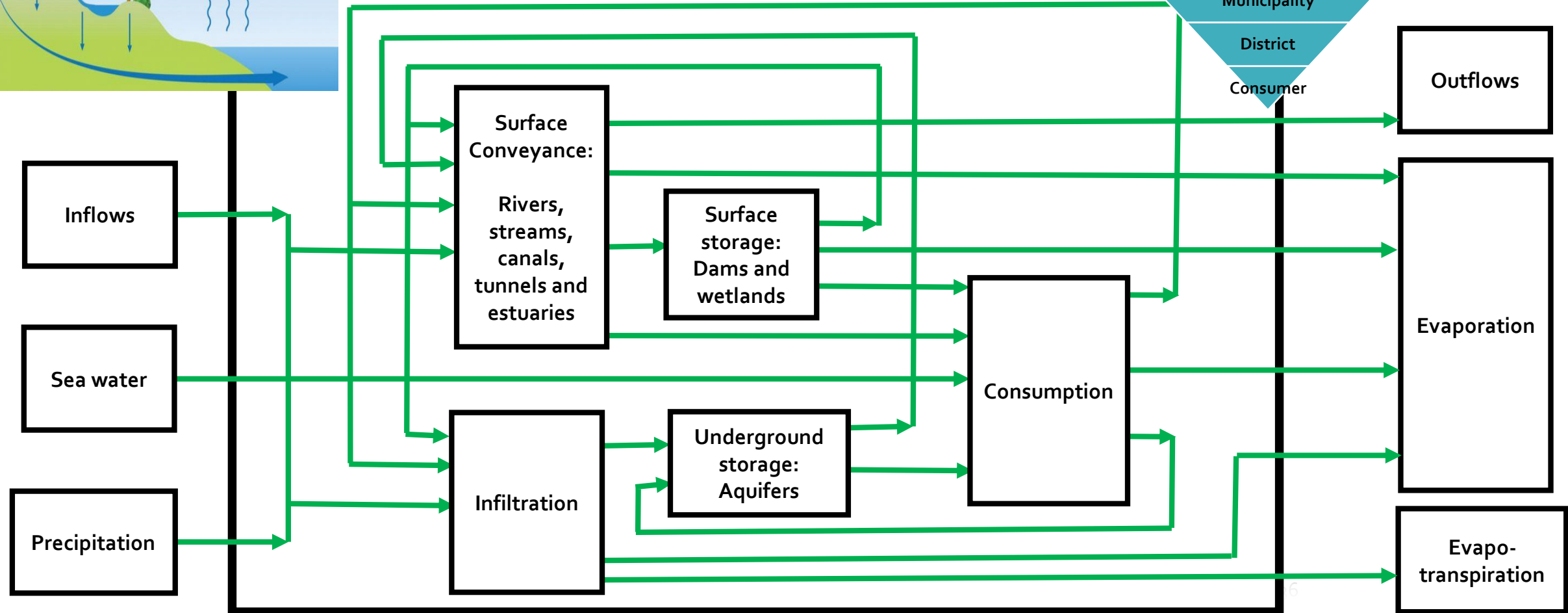
Smart Education for Africa

Smart technology empowered education-entrepreneurship ecosystem to transform Africa

Everyone should have **affordable access to the digital** world!

Extreme acceleration of **21st century skills**

Use **4th Industrial Revolution tech to help Africa leapfrog** w.r.t. education, healthcare, energy, agriculture, finance, employment, & competitiveness

Smart Technology COE

Technology entrepreneurship accelerator

4IR Inter-disciplinary Learning & Research

Technology Entre-preneurship

Startup Incubation of world-class high-tech 4IR companies

START-UP
START-UP
START-UP

Collaboration platform
Secure digital certification
Partnerships

Machine Intelligence Institute of Africa

Transform Africa through Machine Intelligence

Innovative Community for Machine Intelligence & Data Science Research & Applications to help transform Africa

Data Science Academy

Relevant training & upskilling for Modern Data Scientists

Smart Education

Secure digital certification (global id) using Blockchain
Secure collaboration platform
Personalized learning using cognitive computing, smart data, learning analytics
Breakthrough interdisciplinary research

World-class certified MOOCs with practical relevant curricula
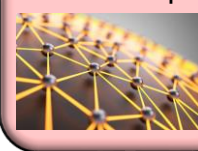
Efficient, transparent & agile tech-empowered government & public sector; decentralized governance & regulatory services use of Blockchain technology

thestudent **hub**

era online
master everything

New generation eLearning & study support system

Smart Technology CoE (Center of Excellence)

Technology entrepreneurship accelerator for 4IR education-entrepreneurship ecosystem

Smart Technology COE

CoE Learning & Research

Technology Entrepreneurship Masters program

Machine Intelligence & Data Science Masters

Inter- & trans-disciplinary on-line learning & research Masters & PhD

CoE Startup Incubation

Startup incubation of world-class high-tech competitive 4IR companies

Smart Education
Smart Agriculture
Smart Healthcare
Smart Energy, BioTech
NanoTech, NeuroTech
Cognitive IoT, Quantum Computing, Blockchain Tech

CoE Collaboration

Collaboration platform for university network

Secure digital **certification**

Collaboration vehicle in Education-Entrepreneurship **ecosystem**

Partnerships with regional & world organisations

Smart Technology COE

CoE Learning & Research

(1) **Technology Entrepreneurship Masters program** to develop technology innovation & application, leadership skills and capability for entrepreneurship
- Provide students with interdisciplinary opportunities to apply 21st century skill sets
- Cultivate students to become top engineers, managers, entrepreneurs or founders of enterprises at forefront of innovative tech
- Provide training opportunities for students interested in working in industry/commercial sector, CoE companies, or starting their own companies with high-end technologies

(2) **Machine Intelligence & Data Science Masters** program with interdisciplinary curriculum and applications in multiple industries

(3) **Facilitate Inter- & trans-disciplinary on-line learning & research – Masters & PhD** (innovations happen where disciplines meet)
- Blend world-class certified MOOCs with personalized learning & practical, relevant curricula (within experiential "inverted classroom")
- E.g., multiple opportunities for breakthroughs in Machine Intelligence research and its practical applications

CoE Startup Incubation

Startup incubation of world-class competitive 4IR companies within predefined business areas that addresses Africa & emerging market problems using fusion of state-of-the-art technologies (e.g., define & help develop business plans for COE incubated companies)
- One of them a **Smart Education** business to help revolutionize education within SA local universities as reference and role out to other higher educations institutions across Africa
- Others: **Smart Agriculture; Smart Healthcare; Smart Energy; BioTech; NanoTech; NeuroTech; Cognitive IoT, Quantum computing, Blockchain Tech**

CoE Collaboration

- Create secure mesh-structured **collaboration platform** for university students/customers/alumni network
- Pioneer Blockchain–enabled **certification for Education**
- **Vehicle for collaboration** with Business & Industry stakeholders, Community organizations such as MIIA and other Smart Tech CoEs in educational-entrepreneurship ecosystem
- **Partner** with WEF, World Bank, IMF, ADB, UNESCO, etc. (Measure & monitor UN's new Sustainable Dev Goals & African aspirations, etc.)

Smart Technology COE at University

University faculties / departments

University Technology Transfer company

Smart Technology COE

MIIA

Smart Education

Smart Energy

Cognitive IoT

Smart FinTech

Smart Agriculture

Quantum computing

Nanotechnology & Material Science

Smart Healthcare

BioTech

CoE companies

4IR Education-Entrepreneurship Ecosystem

Technology providers

Regional Technology Hubs

Research orgs

Government

Community organizations

Higher Ed collaboration platform

MIIA

Higher Ed collaboration platform

University A
Smart Tech COE

University B
Smart Tech COE

VCs

Technology providers

Higher Ed collaboration platform

Technology providers

Start-up Incubators

Community organizations

University C
Smart Tech COE

Start-up Incubators

Mesh structured network of collaboration across Africa & beyond

South Africa
Smart Tech CoEs
Technology Hubs   Government
Silicon Cape, JoziHub, etc.
                         Community orgs
Higher Ed collaboration platforms   MIIA
        Technology providers
Start-up Incubators   VCs
        Research orgs

Kenya
Smart Tech CoEs
Technology Hubs   Community orgs
Higher Ed collaboration platforms
Research orgs   Start-up Incubators
Technology providers   VCs
        Government

Nigeria
Smart Tech CoEs
Technology Hubs   Community orgs
    Higher Ed collaboration platforms
Research orgs
Government   Start-up Incubators
            VCs
    Technology providers

Rwanda
Smart Tech CoEs   VCs
Technology Hubs   Community orgs
Higher Ed collaboration platforms
Research orgs
Government   Start-up Incubators
        Technology providers

MIIA and Smart Technology CoE
within 4IR education-entrepreneurship ecosystem

Community involvement to help shape Smart Technology CoE
Technology Entrepreneurship Masters program
Machine Intelligence & Data Science Masters program
Inter- & trans-disciplinary on-line learning & research : Masters & PhD
Join CoE incubated companies
Join University & Ecosystem Collaboration platform

Smart Technology COE

Technology entrepreneurship accelerator

4IR Inter-disciplinary Learning & Research

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START-
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to help transform Africa

MIIA

MI & DS Community Partner
in 4R education-entrepreneurship ecosystem

Join MIIA to share and participate in community chat on Slack, blogging & networking
Participate in Machine Intelligence & Data Science application, research or technology projects
Become a MIIA community activity leader, arrange events, meetups, training, etc.
Help get funding to grow MIIA and its activities to help transform Africa from a community perspective

Value Drivers of a Thriving Business in the Smart Technology Era

Increase Operational Efficiency, Effectiveness and Revenue

Increasing Automation Improving Processes Equipment Availability

Increase Throughput Increase Yield, Quality, Cross-sell, Up-sell, Recommend

⬆ **Productivity**　　⬆ **Revenue**

⬇ **Reduce Risk**　　⬇ **Lower Costs**

Process and Equipment Failure Customer Churn Fraud, Waste & Abuse Cyber Security

Eliminate Redundancy Energy & Raw Material Usage, Operations & Maintenance

Create Strategic Value

Acceleration

➡ Faster, Better & more Proactive Decisions

Smarter R&D, Forecasting

Innovation

Collaboration

Enhance Scalability

New Business Models

New Revenue Growth

Opportunities

Enhance Customer Experience Targeted Sales & Marketing

▶ Realtime, on demand, digital, personalized service delivery, assistance & advice

▶ Improve Risk selection & assessment

▶ Enhancing efficiencies (e.g. automated & augmented underwriting)

▶ Reducing process times and costs (e.g. robo-claims adjuster)

▶ Targeted Sales & Marketing

⬆

Deep 360 degree insights about the customer

45

Smart Technology Services for African Smart Cities

Recent smart city trends: empowered citizens on the rise
Tailored public services to increase resource efficiency

80 percent of the population currently lives in cities. Population growth and aging, climate change and pollution—all these are the de facto trending topics in our current societies and all of them contribute to the pressure on public resources availability[1]. Faced with the challenge of maintaining citizens' quality of life and living, the smarter move for governments was to combine and use the increasing availability of data and advances in research on the technology of things, and this way optimize the delivery of services. How is it called? Smart city. What is the goal? To tailor public services to increase resource efficiency.

Deloitte.

Category	Value
Governance & Education	20,93
Energy	16,65
Healthcare	15,26
Security	14,11
Infrastructure	13,75
Building	10,21
Transportation	9,09
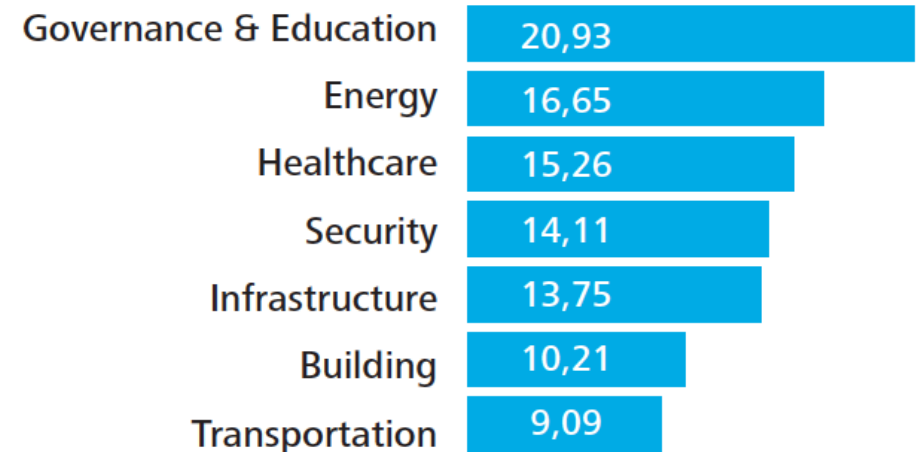
Smart Cities 3.0

Conclusion: is third time always a charm?

Smart cities are a constant data flow. However, we have learnt that data gathering is not the problem, rather its digestion is the challenge. While technology is crucial, it has a use-it-or-lose-it dimension and requires well-spread digital and analytical skills among the agents delivering the change. We need indeed fully prepared and properly trained professionals to ensure that the information is effectively managed, because the terabytes have to be converted into effective and efficient public policies. Furthermore, data privacy and data transparency are a "must" to ensure both innovations and the proper utilization of the projects being deployed. Data privacy will establish trust, and data transparency will give rise to government control and accountability.

Smart cities 3.0 build on the heritage of version 2.0. The final stage of this concept actively seeks to engage citizens to work in collaboration with private corporations and the public sector to build better cities in which to live. Citizens are not only expected to increase their use of applications to contribute to the decision-making process, but also to be part of the development of such innovative gadgets[28]. Although citizens are already becoming increasingly aware of all the potentials of living in a smart world, they should be fully integrated in the dynamics which are already in place between private and public sectors. If the aim is to design tailored solutions for day-to-day problems, and to work for a sustainable city life unhindered by a scarcity of resources, all members of society need to work collaboratively. Smart cities shall be therefore inherently linked to the efforts of citizens, businesses and governments, and their interconnections through devices, sensors, and applications.

Smart Citizens

- Will take responsibility for the place they live, work and love in

- Value access over ownership, contribution over power

- Will ask forgiveness, not permission

- Know where they can get the tools, knowledge and support

- Value empathy, dialogue and trust

- Appropriate technology, rather than accept it as is

- Will help the people that struggle with smart stuff

- Ask questions, before they come up with answers

- Take part in design efforts to come up with better solutions

- Work agile, prototype early, test quickly, start all over

- Will not stop in the face of huge barriers

- Continuously share their knowledge and their learning

waag society
institute for art, science and technology

we code for amsterdam
Amsterdam Smart Citizens Lab

Smart Cities
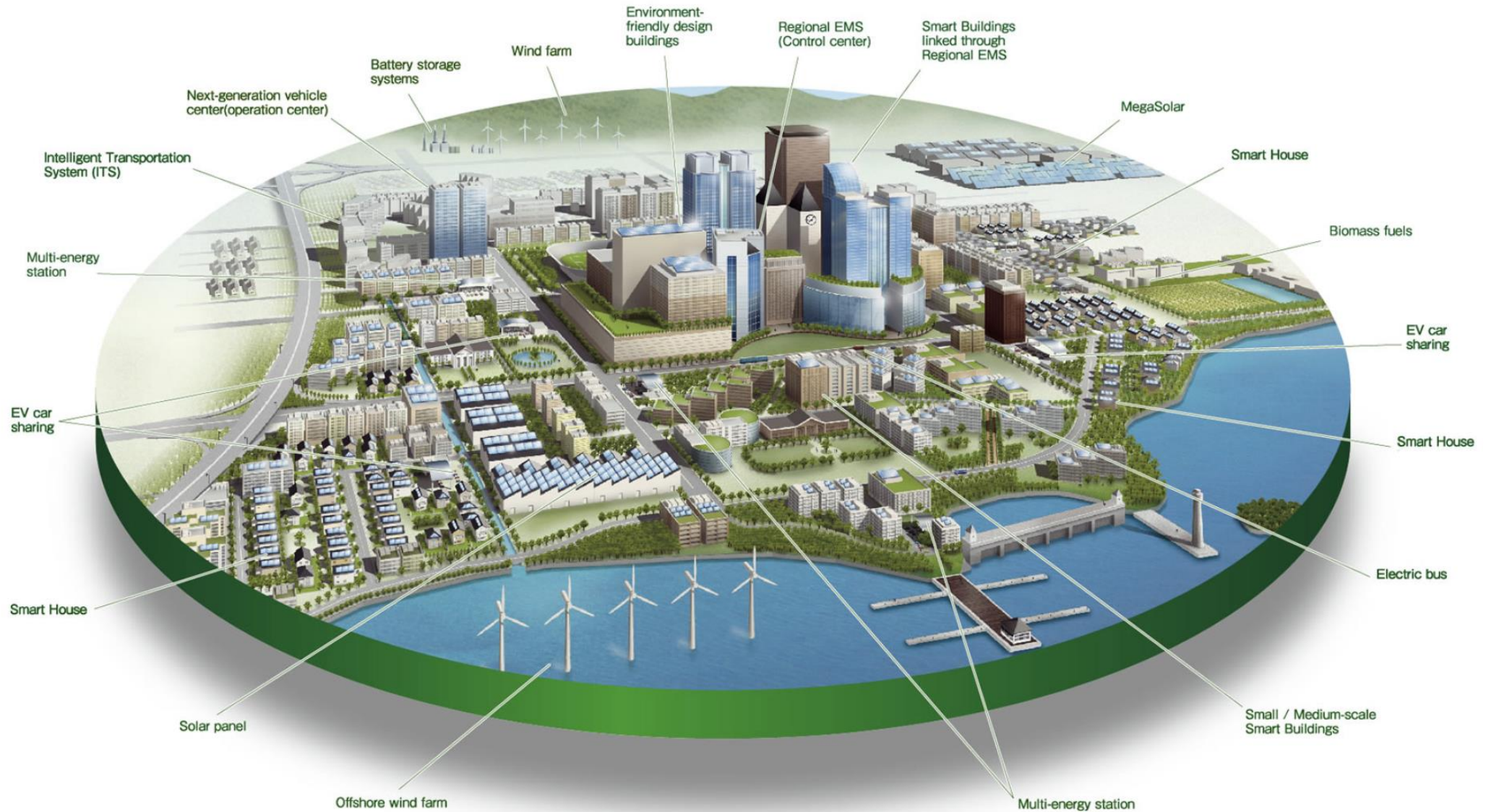
Urban Feeds Dataflow
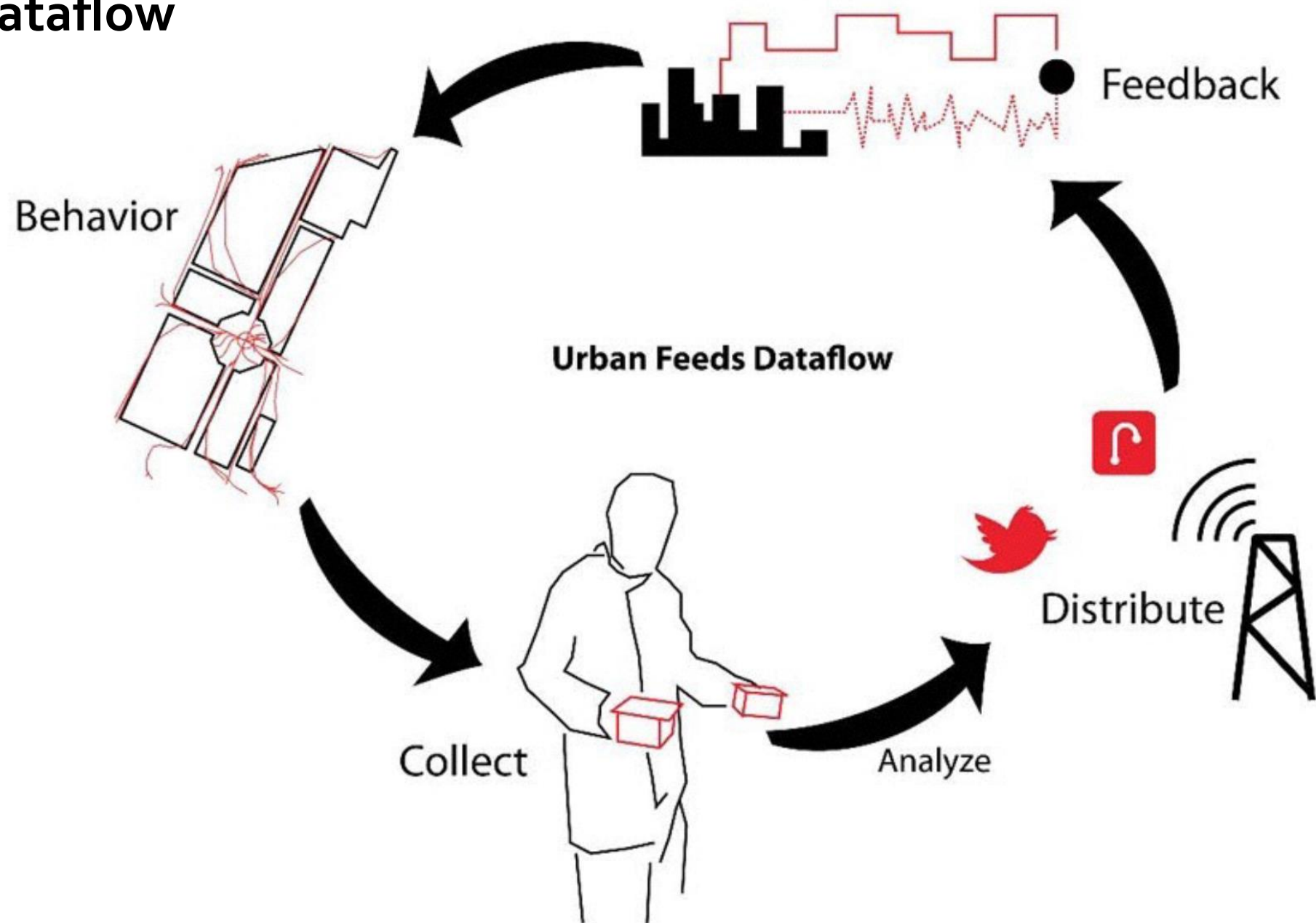
Smart Citizen Approach

1 MEET

First, after an open invitation in the local newspaper and online via newsletters of partner institutes, people sign up and meet at a space in town center that is perceived to be safe (to speak up) and neutral (without its own hidden agenda). A collection of presentations and exercises is used to introduce the participants to each-other and sensitize them to possible questions, approaches and outcomes, as well as on the roles they will have to take to turn it into a success.

2 MATCH

Step two consists of encouraging people to form groups based on shared interests, experience and/or levels of commitment. To make the resulting groups more effective (and possibly self-sufficient, care should be taken to mix people), with different (levels of) expertise and background. It was made clear that the groups themselves will be responsible to get to the desired results, so they should self-organize as much as possible, for example by using on-line tools for sharing calendars and progress.

3 MAP

The next step is helping the groups to understand and map in more detail both the problems and/or opportunities, and possible approaches to solve them. The help of experts is sought and valued because problems related to the environment are complex in nature, and much is already known. This step ends with developing a sensing strategy: what is to be measured, in which quantities, and which kind of technologies are used to get there.

4 MAKE

The fourth step consists of making the hard- and software to be able to measure the desired variables. This typically means putting together one or more existing, low-cost sensors with a circuit to (pre-)process and store or send the resulting data to a server that will collect it for further analysis and visualisation. It typically entails devising and building a specialised casing that will help the electrics to withstand the conditions that the sensor will be put in (rain, cold, warmth or even submerged). The Amsterdam Smart Citizens Lab strongly encourages the use of open source software and hardware for reasons of bootstrapping the development process, adaptability and flexibility in application and development, typically lower cost, availability of development expertise and the sharing and further development of the outcomes.

5 MEASURE

The fifth step consists of carrying out the measuring strategy from step three with the hardware and software developed in step four. It starts with calibrating the hardware, and then deploying the sensor(s) in one or more locations, during a specific amount of time as prescribed in the strategy. Typically, things turn out different that expected in terms of actual data collected, which gives rise to ad-hoc changes in the measuring strategy and sometimes to changes in hard- and software. The data are collected for further analysis.

6 MASTER

Step six consists of mastering the data: analysing and possibly visualising them to understand what they means. Typically, existing software is use to perform this step. Depending on the complexity, the help of external experts is sought, that help in technical procedures for cleaning and analysing data, as well as interpreting and giving credibility to the results.

7 MOBILIZE

The final step entails mobilizing either citizens, public authorities, or both, to take action on the findings. This is potentially a huge step, involving (mass) media, spokespersons, ambassadors, political parties and spin doctors. Depending on the desired results and the vested interests, this is also the hardest step that might take years to get to. Small-scale mobilization, however, is also possible, which would consist of one's behaviour or convincing neighbors to do so.

Empower Smart Citizens

Lessons Learned

- Thorough issue mapping is needed
- From sensing to action is challenging
- Sensors need improvement
- However, this is **not** about accuracy
- Citizens **love it**

Empower people to:

- Acquire, Read & Manipulate Data
- Understand their environment
- Turn data and insight into action
- Using public networks of low cost, open source sensors

Resulting in:

- Better informed, more engaged citizens
- Impactful dialogues between citizens and governments
- More data, more insight, better policies
- More enjoyable, social, inclusive, healthy & livable cities
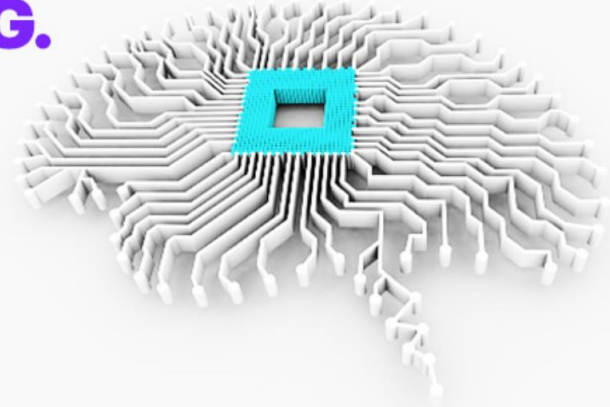
START THE JOURNEY

Ready to use AI to enhance citizen experience?
Start with five steps for achieving sustainable success:

1
Put humans at the center
Start with a design that is ethical, compliant, and responsible and that centers around people: citizens/customers and workers.

2
Develop an enterprise AI strategy
Develop an enterprise AI strategy that defines your long-term vision, roadmap, and governance while delivering near-term value.

3
Map user journeys and prioritize
Use service design to map user journeys into service blueprints that can help identify and prioritize AI opportunities.

4
Keep goals in sight
Implement targeted solutions to help achieve your goals through intelligent automation, superior judgment, and enhanced interaction.

5
Never stop improving
Keep assessing strengths and weaknesses and continually address what you learn.

Safer Cities

Public Safety & Justice
- Call Center & Dispatch
- Catastrophe Modeling
- Community Policing
- Courts Management
- Digital Patrol
- Operational Intelligence
- Prison Management
- Video Management

Healthier Cities

Health & Social Services
- Population Health Management
- Remote Patient Monitoring
- Social Programs
- Virtual Health

Educated Cities

Education
- Classroom Devices for Learning
- Facilities Management
- Future-Ready Skills
- Learning Management Systems
- Physical Safety
- Predictive Analytics for Education

Sustainable Cities

Urban Mobility
- Connected Vehicle Analytics
- Disruption Management
- Fare & Toll Management
- Fleet & Asset Management
- Parking Management
- Traffic & Transit Optimization

Energy & Water
- Atmospheric Air Quality Management
- Carbon Management
- Energy Distribution Management
- Water & Sewer

Buildings, Infrastructure, Planning
- Land Management
- Sanitation
- Smart Buildings
- Street Lights

Digital Cities

Government Admin
- Citizen Services
- Connected Field Services
- Decision Management & Support
- Personalization
- Regulations, Licensing & Permitting
- Virtual Town Hall

Government Finance
- Financial Management
- Fraud Detection & Prevention
- Grants Management
- Tax

Tourism, Recreation, Culture
- Destination Management
- Sports & Events
- Tourism portals

Microsoft

Building Blocks of Citizen-driven Smart Cities: Connectivity, Convenience, Commute

Through our primary research, we determined that a smart citizen has three quintessential needs: *higher levels of connectivity, greater convenience, and better modes of daily commute.*

Appendix I

AI in Africa - The Present

BUSINESS › TECHNOLOGY › ARTIFICIAL INTELLIGENCE HITS AFRICAN COMPANIES

AFRICA CEO FORUM *Shaping the future of Africa*

Posted on Thursday, 16 March 2017 17:46

Artificial Intelligence hits African companies

By **Bright Simons**

ALT **Fear not, robots will not be stealing Africa's jobs any time soon. It has been a mantra of capitalism since the beginning: using a tractor boosts your yield compared to using a spade. Your factory can multiply your output. Technology boosts productivity.**

The rise of artificial intelligence in Africa

by Nouha Abardazzou on '16 September 2017'

ECX e-Trade platform: In 2015, The [Ethiopia](#) Commodity Exchange (ECX) has teamed up with IBM and IBM Business Partner Wavetec, to build a coffee-traceability solution based on state-of-the-art analytic, mobile and internet of things (IoT) technology. Today, the IoT solution tracks coffee through all stages of the supply chain.

Aeroview platform: Aeroview is a platform developed by the Cape Town based start-up Aerobotics. It uses AI, satellites and drones to assist farmers and help them optimise the yield through analysing processed maps to identify problem areas in crops. Aeroview is available worldwide and has users in South Africa, Australia, New Zealand, Australia, Malawi, Zimbabwe and Mozambique.

The rise of artificial intelligence in Africa

by **Nouha Abardazzou** on '16 September 2017'

Healthcare

SOPHiA: Medical institutions in Morocco, Cameroon and South Africa have integrated SOPHiA artificial intelligence for clinical genomics into their clinical workflow to improve patients' care.

Drones: Rwanda has adopted the world's first national drone delivery network for medical aid, which is used to deliver blood to patients in remote areas. The California based Robotics company "Zipline" is working directly with Rwanda's National Centre for Blood Transfusion to make 50 to 150 deliveries a day of blood to 21 transfusing facilities

Scanning platform: An optical accessory that fits onto Android smartphones is now used by healthcare professional, in six African countries, to examine women for early signs of cervical cancer.

Neurala fights poaching in Africa with AI-powered drones

BY **MIKE WHEATLEY**

UPDATED 00:31 EST .
19 MAY 2017

Deep learning startup Neurala Inc. 🗗 is applying its technology to a partnership with the Lindbergh Foundation that aims to combat illegal elephant poaching in Africa with artificial intelligence-powered drones.

Despite increased efforts to combat poaching in several African countries, the statistics remain rather grim. The Lindbergh Foundation says more than 100,000 elephants were killed in Africa from 2010 to 2012, with a further 40,000 killed in 2013. It reckons an elephant is killed once every 14 minutes in Africa – a rate that will see the animals extinct in just 10 years. Rhino poaching, meanwhile, has increased by 9,000 percent in South Africa since 2007, with one slaughtered every nine to 11 hours, the foundation said.

AI helps answer thousands of health queries in Zambia via SMS

SMS has proven an exceptionally useful technology in parts of Africa
GIANLUIGI GUERCIA/AFP/Getty Images

By Anna Nowogrodzki

For many people in Zambia with health queries, sending a text message is the best way to get it answered. U-report, a free SMS-based service set up by UNICEF and run by volunteers, receives many thousands of questions a month, many specifically about HIV and AIDS.

Also popular in Uganda, U-report has seen usage triple in the last three years, and about a thousand new users register every day. The volume of messages is growing so fast that the volunteers can't keep up, so UNICEF is testing software that reads and responds to many of the messages automatically.

In Zambia, there are roughly 27,000 new HIV infections a year, according to UNICEF, and 40 per cent of these are in those aged 15 to 24. With people constantly texting U-report for all kinds of HIV information and advice, the automated version uses machine learning algorithms to sort messages into eight categories: symptoms, HIV testing, treatment, pregnancy, transmission, prevention, definition, and male circumcision.

Next generation mobile money marketplace for emerging markets

JUMO'S WORLD

Drive largest scale, lowest cost financial marketplace for emerging markets

Vision	Maximise usable information by productising intelligence in a scalable way
Mission	Understand customers and automate prediction and analytics to empower users and drive highest business, partner and ecosystem value

Predictive Models
Credit Risk
Affordability
Fraud detection
Anomaly detection
Response modelling
Segmentation
Churn prediction
Reject Inference

Analysis in Support of Business
Automated & scalable Analytics
Dashboard
Customer Segmentation Analysis
Social Network Analysis
Feature Generation
Problem-solving Analysis
Product innovation
Machine Learning based decisioning;
Forecasting & Simulation
What If Scenario Analysis
Optimisation

Product Providers

Mobile Network Operators
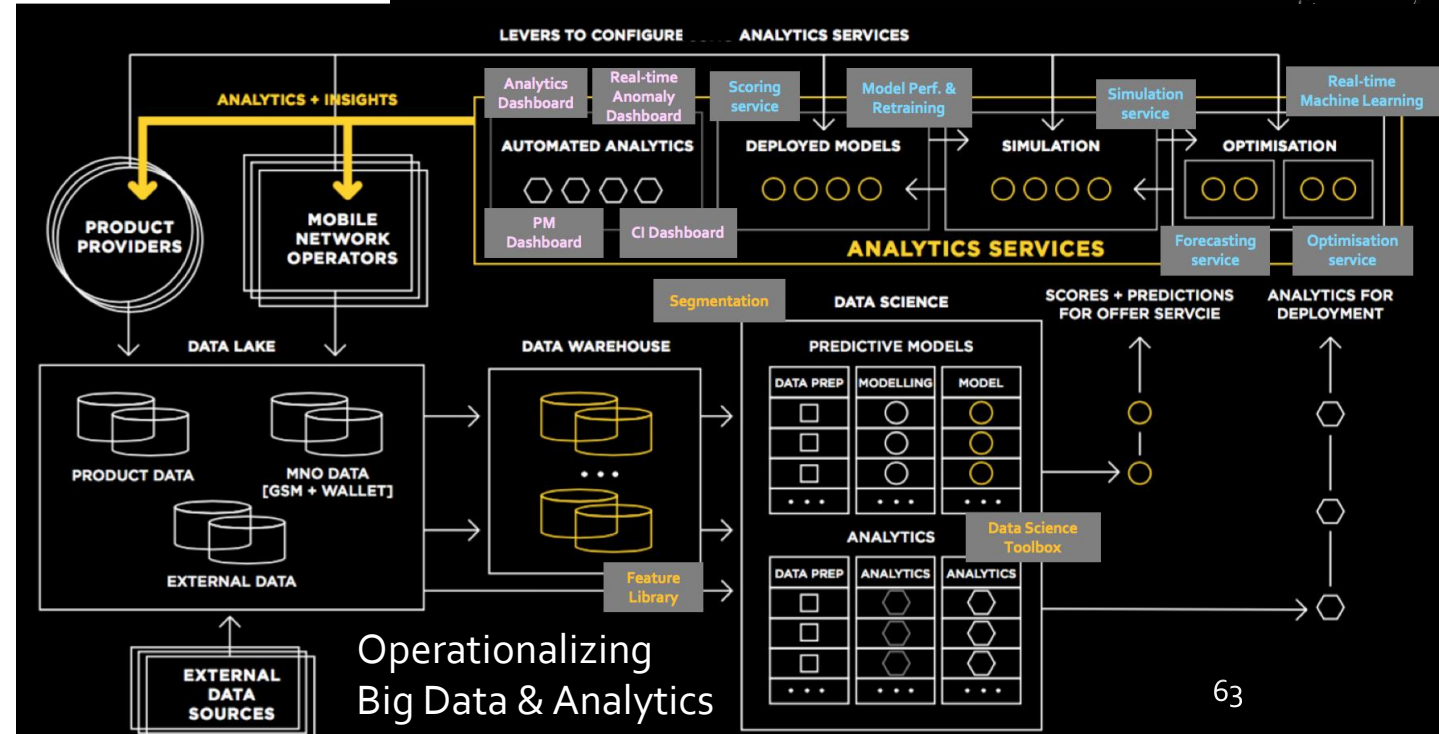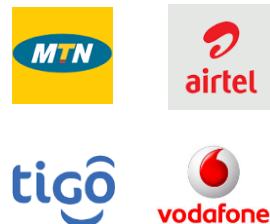
Operationalizing Big Data & Analytics

63

Growth and Churn prevention in Mobile Money Ecosystem

- **Transaction Growth**: Agent average number of *wallet incoming transactions* increased by 14%, and outgoing transactions increased by 22%. *Customers incoming wallet transaction volume* increased by 500%, and outgoing transaction volumes by 324%.
- **Revenue Growth**: GSM data showed similar trends. *Agent GSM revenue* went up by 41% overall, by 54% for agents with 5+ loans, and by 100% for agents with 10+ loans. *Consumer GSM revenue* went up by 32% overall, by 14% for consumers with 5+ loans, and by 9% for consumers with 10+ loans.
- **Ensuring Customer Loyalty/Product Gravity**: For agents, our customers displayed monthly churn ranging between 0-1%, while other customers displayed churn ranging between 1-17%, with other agents displaying an average of 4.5% higher churn / month.
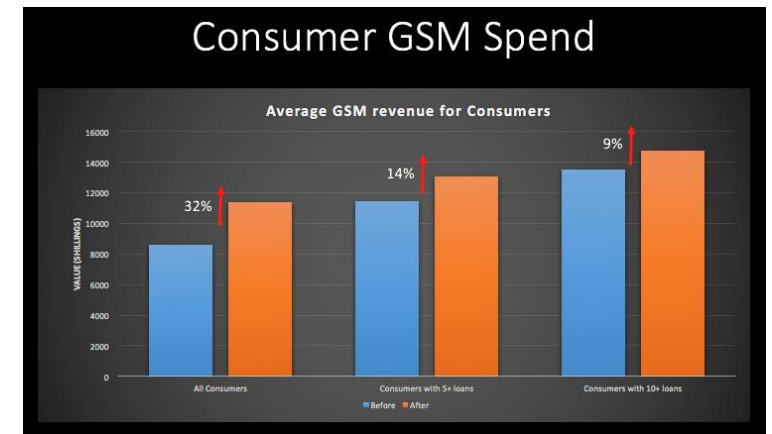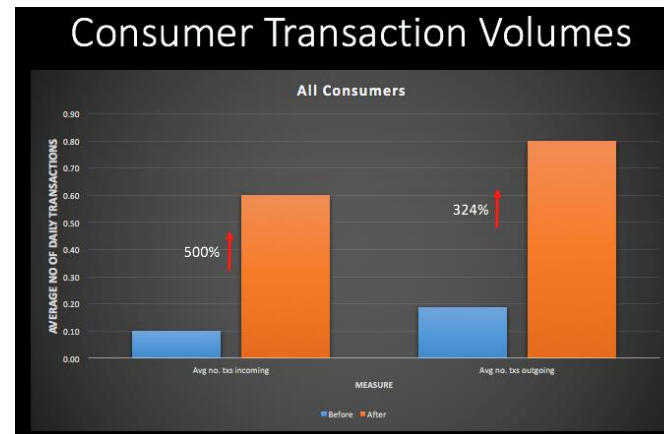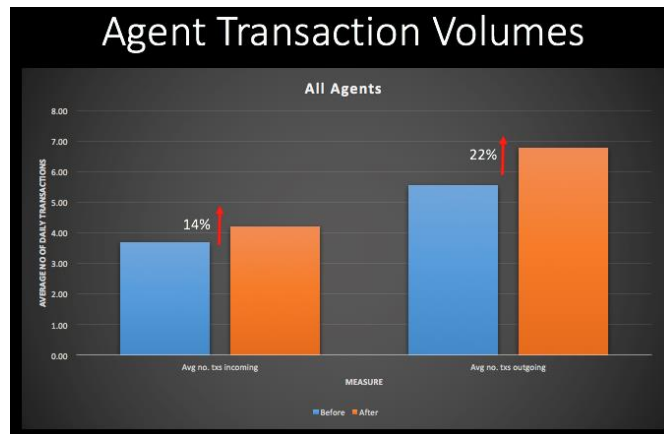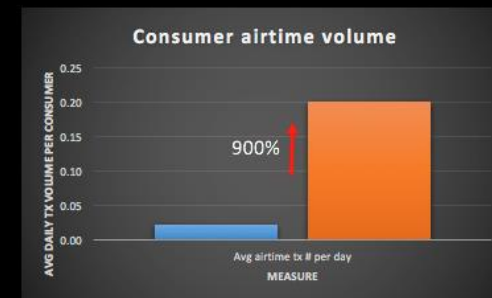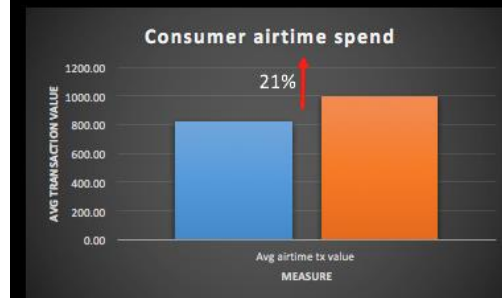
Predictive Modelling & Analysis: Lapse & Non-Active Members

104, 512 main member policies
(raw: 160,695)
372,545 member & dependents
(raw: 572,161)

BM BYTE MONEY
Cortex Logic Making Machine Intelligence Work

90,877 payment transactions
from Jan 2016 - May 2017

Predicting Lapse Propensity
Predictive Model accuracy of 94% (test data)

Predicting Non-Active Members
Predictive Model accuracy of 95% (test data)

Average probability to Lapse by Plan Brand

Average probability to Lapse by Age, Gender, Plan Active, Plan Cover
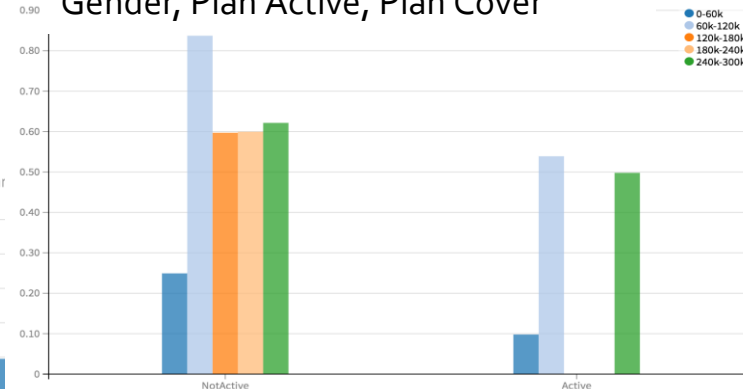
Average probability to Lapse by Plan Premium
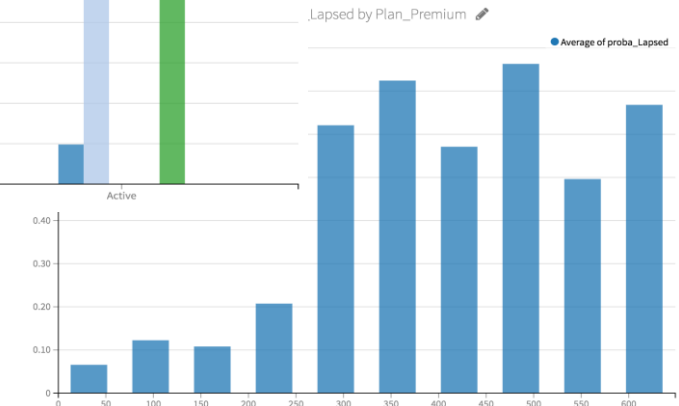
Churning in Insurance Industry

- **Problem**: The leading insurance brand in the "call center" market experienced a <u>40% cancellation rate of all there policies issued within 90 days after the sale</u>.

- **Data Science solution**: A solution was developed using a variety of customer data sources such *email correspondence*, *voice recordings*, *text interactions* and *demographics.* The "proposed sale" is then analyzed overnight by the system and the ***price adjusted*** to *reflect the risk* and or *reject the sale the next day before the bulk of the costs relating to the issue of a policy is incurred*.

- **Cost Savings**: The estimated cost saving is between <u>R100m and R120m per annum</u>.

Medical Scheme Fraud Detection

- **Problem**: A major medical scheme administrator realized that they had a significant problem in terms of fraud amongst their schemes. It was estimated that around 10% of all contributions were lost due to fraudulent activity by service providers and members.

- **Results**: Some data mining highlighted <u>R70m worth of "fraud/abuse"</u> across the three schemes. This was after the existing fraud detection has been "passed". The 3 schemes represent approximately 15% of the total members of this administrator. If the results are extrapolated the outcome is clearly much more significant.

Deep
Learning Indaba

11-15 September

2017, Johannesburg, South

Africa

As 300 attendees have hailed from 23 African countries, as well as other countries across the world, this event was one of the largest machine learning teaching events globally

DSN
Data Science Nigeria
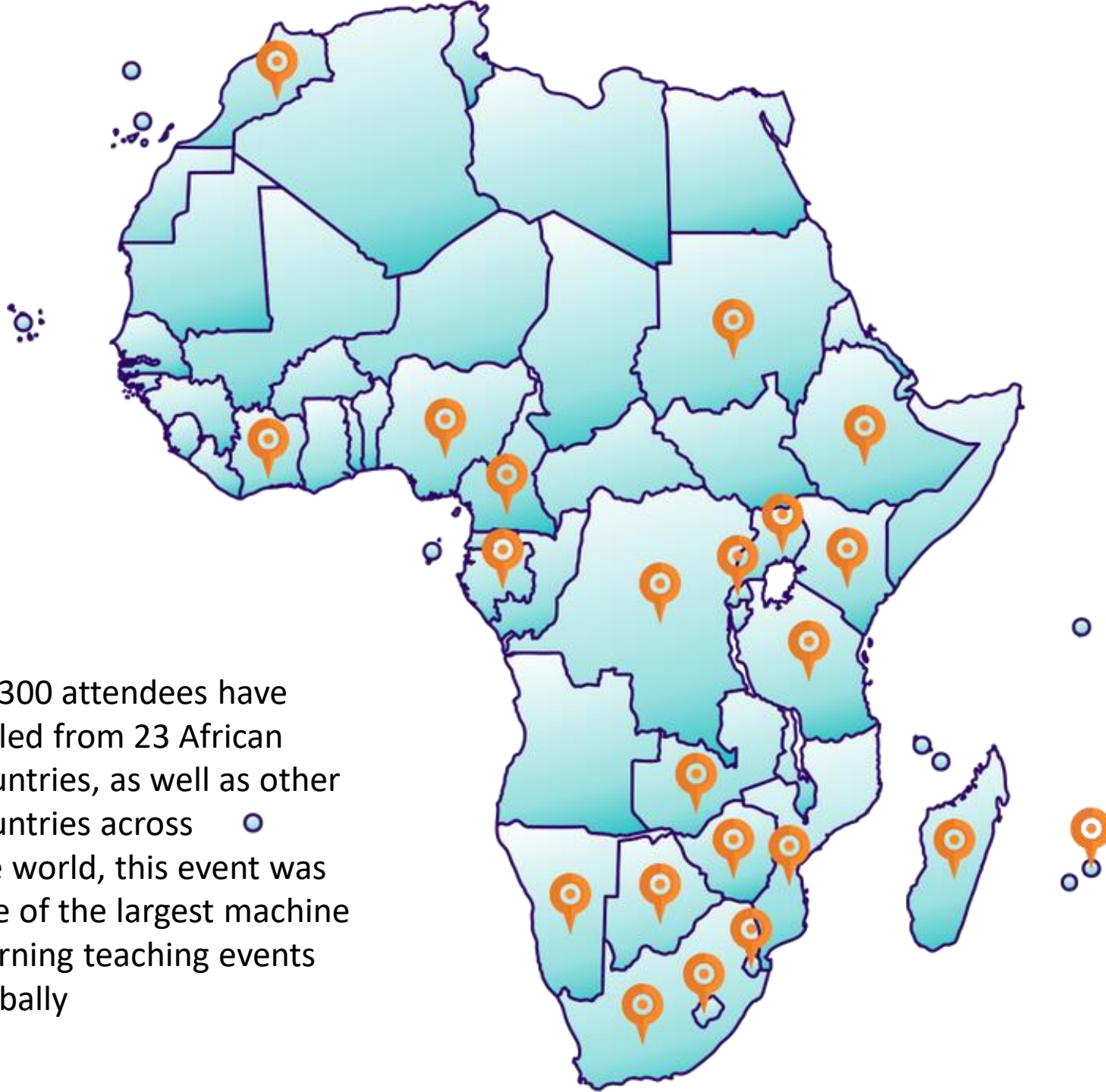
1ST NATIONAL SUMMIT ON THE BIG DATA ECONOMY:
DRIVING THE ECONOMY THROUGH DATA SCIENCE

Thursday, 12th October, 2017
Eko Hotel, Victoria Island, Lagos

&

2ND DATA SCIENCE NIGERIA BOOTCAMP

12th - 15th October, 2017
Lekki Peninsula Resort, Ajah, Lagos

(A world-class, all-expense-paid, residential bootcamp with global experts in Data Science/Machine learning and series of hackathon focussed on applying data science on Nigerian-centric data to answer fundamental socio-economic questions.)

PLUS PRE-BOOTCAMP QUALIFICATION ACTIVITIES

3-month Microsoft Professional Certificate Track in Data Science for bootcamp qualification
3-levels Hackathon on Kaggle for skill development
Post-event mentoring for best 20 participants by Microsoft 4Afrika

PARTNERS

Microsoft
4AFRIKA
TECHCABAL
nbs NATIONAL BUREAU OF STATISTICS
ONEFi
proshare
BUSINESS DAY
DataCamp
kaggle
KEOUN.NG
Machine Intelligence Institute of Africa — Transform Africa through Machine Intelligence
Hagof Analytics
Xlytics

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DSN Data Science Nigeria

1st National Summit on Big Data Economy
New frontiers in Data Science, Machine Learning and Artificial Intelligence for Nigeria's development

Sky Pavilion, Oriental Hotel, Victoria Island, Lagos | Thursday 12 October, 2017, 9am

Ngozi Dozie, (Director, OneFi)
James Agada (CEO CWG)
Babafemi Ogungbamila, CIO, Interswitch
Olufemi Awoyemi (CEO Proshare Nigeria)
Ayotunde Coker CEO Rack Centre
Babajide Ogunsanwo (Founder, Leadership-By-Data)
Emeka Okoye (CEO, Cymantiks)
Bernard Kjie Ewah (President/Chief Creative Officer, beeun.ng)
Oluseun Onigbinde, (Co-Founder BudgIT)
Uzoma Dozie (CEO Diamond Bank)
Dr Yemi Kale Statistician General of the Federation (Keynote Speaker)
Steve Babaeko (CEO X3M Ideas)
Dr Ndubuisi Ekekwe (Data Science Scholar and Entrepreneur)
Adetayo Bamiduro, (Co-founder, MAX.ng)
Dr Tunji Adegbesan (Founder, Gidimo)
Chika Nwobi (Founder/CEO, LSLAB)
Nadayar Enegesi, Director at Andela
Dele Tejuoso CEO Wifi Combat Academy
Olumide Olayinka (Partner KPMG)
Dipo Faulkner (Country Manager IBM)
Juliet Ehimuan-Chiazor (Country Manager, Google Nigeria)
Samuel Odeloye, Creator of Lara AI bot
Dr Sulaimon Afolabi (Data Scientist and Researcher South Africa)

For more Information on registration and participation
Please visit: www.datasciencenigeria.org
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PARTNERS

nbs
Microsoft
4AFRIKA
Interswitch
proshare
KPMG
ONEFi
Diamond Your Bank
BUSINESS DAY
Brandcrunch
DataCamp
CFAtech.ng
KEOUN.NG
I5 Lab

Machine Intelligence Institute of Africa

Transform Africa through Machine Intelligence

Deep Learning Hackathon

Cortex Logic — Making Machine Intelligence Work

IBM

GLOBAL SYMPOSIUM

ARTIFICIAL INTELLIGENCE & INCLUSION

November 8-10, 2017
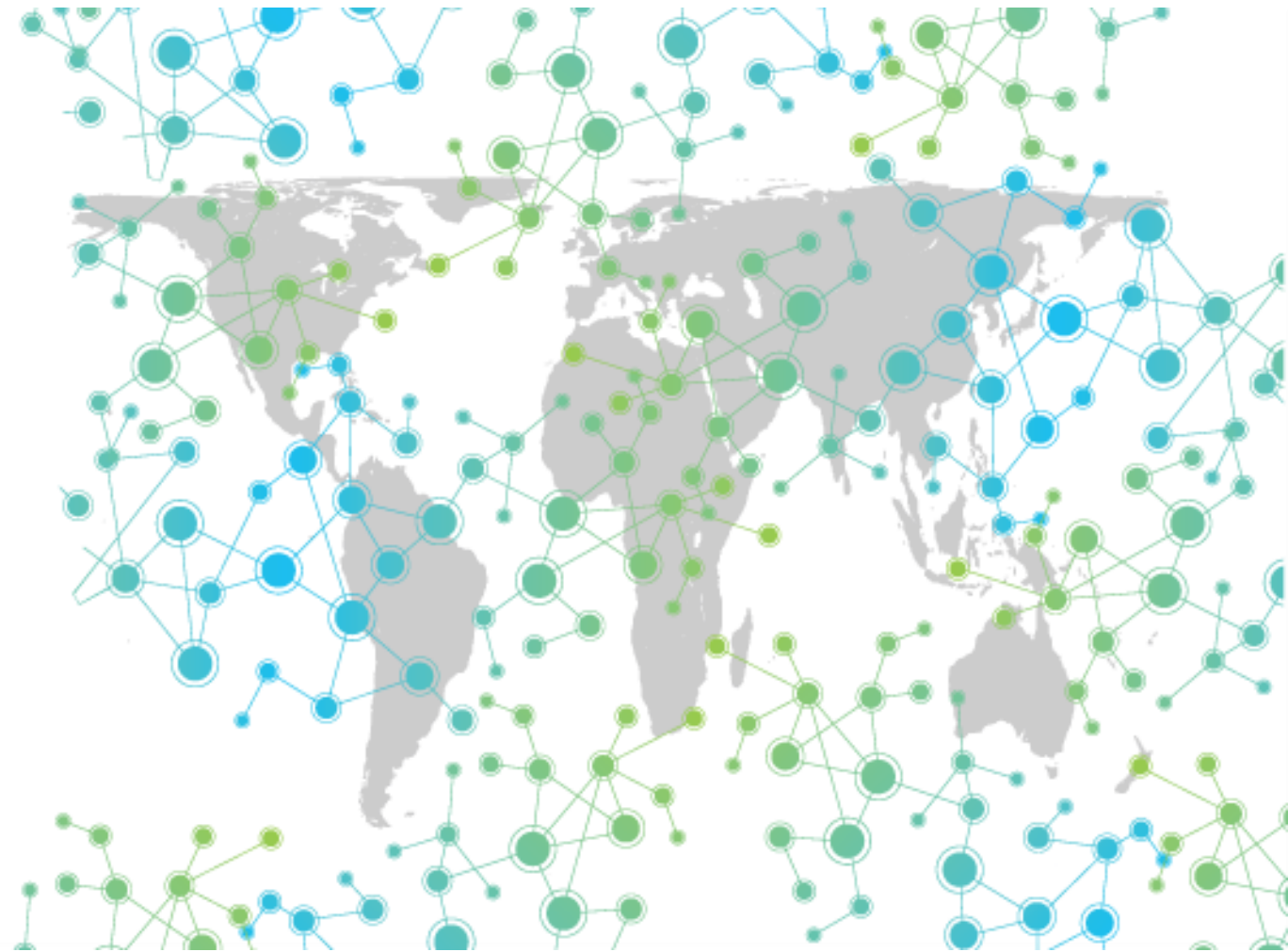
The Global Network of Internet and Society Research Centers (NoC) has organized the event which are co-hosted, on behalf of the NoC, by the Institute for Technology and Society of Rio de Janeiro and the Berkman Klein Center for Internet & Society at Harvard University, with support from the Ethics and Governance of Artificial Intelligence Fund. The aim of the Symposium is to deepen participants's understanding of Artificial Intelligence inclusion challenges and opportunities, to identify and discuss areas for research, education, or action, and inform and incubate new projects and other collaborative efforts among participants.

SQUARE **KI**LOMETRE **A**RRAY

Exploring the Universe with the world's largest radio telescope

Choose your local minisite

Search the SKA website

Project   Location   Design   Technology   Science   Industry   Outreach & Education   News, Media & Events   Technical Publications & Presentations   Contacts

Featured News

Subscribe

Dr. Catherine Cesarsky elected Chair of the SKA Board of Directors

The Board of Directors of the Square Kilometre Array (SKA) Organisation has approved the appointment, with immediate effect, of its new Chair, Dr. Catherine Cesarsky, following the recommendation from its Search Committee.

Dr. Catherine Cesarsky elected Chair of the SKA Board of Directors

Synchronisation System Designs Chosen for SKA telescopes

Molecule detection in young star system challenges search for Life assumptions

Website Latest   In the press

New issue of the 24th SKAO Bulletin available

35th edition of the SKA eNewsletter is now available

New issue of the 23rd SKAO Bulletin available

SKA People - Meet British radio

Explore the SKA

The SKA Headquarters

SKA Virtual Reality Experience

Taming the Data Deluge to Unravel the Mysteries of the Universe

Melanie Johnston-Hollitt
School of Chemical & Physical Sciences, Victoria
University of Wellington & Peripety Scientific Ltd.
Wellington, New Zealand
Melanie@PeripetySci.com

SKA IN AFRICA
Thousands of SKA antenna dishes will be built in South Africa (in the Karoo, not far from the Northern Cape town of Carnarvon), with outstations in other parts of South Africa, as well as in eight African partner countries.

HERA
The HERA (Hydrogen Epoch of Reionisation Array) radio telescope will be instrumental in detecting the distinctive signature that would allow astronomers to understand the formation and evolution of the very first luminous sources: the first stars and galaxies in the Universe.

C-BASS
The C-Band All Sky Survey project (C-BASS) is a project to map the sky in microwave (short-wavelength radio) radiation.
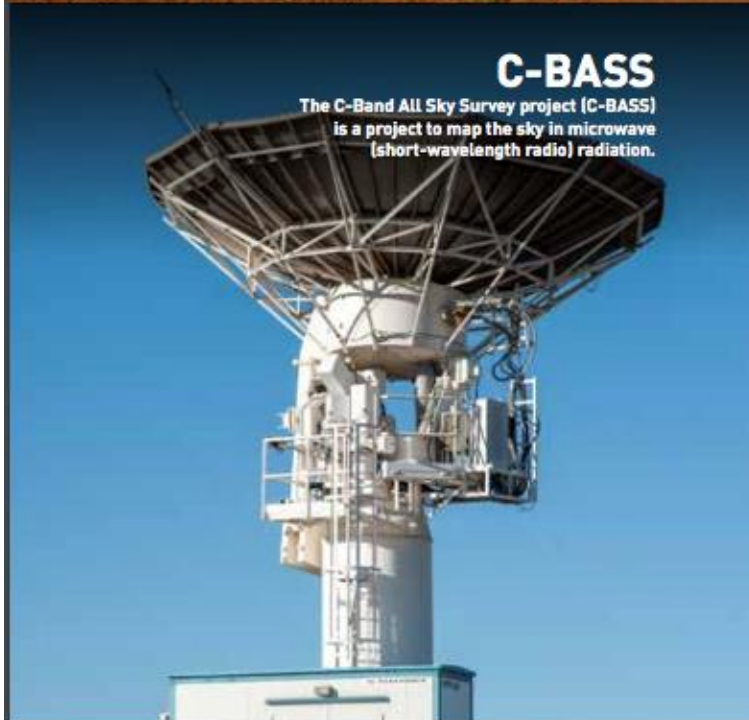
KAT-7
The seven-dish MeerKAT precursor array, KAT-7, is the world's first radio telescope array consisting of composite antenna structures.

Where will the SKA be? In Africa.

SKA Stations in Africa - Phase II

Phased roll-out of the AVN

Fast-track of Namibia and Botswana to ensure readiness for SKA Phase 2

Phase 1: Ghana

Phase 2: Zambia or Madagascar

Phase 2: Namibia

Phase 2: Botswana

Phase 3: Kenya

Phase 3: Madagascar or Zambia

Phase 3: Mauritius

Phase 3: Mozambique

Modeling and Monitoring Crop Disease in Developing Countries

John A. Quinn
Department of Computer Science,
Makerere University, Uganda
jquinn@cit.mak.ac.ug

Kevin Leyton-Brown
Department of Computer Science,
University of British Columbia, Canada
kevinlb@cs.ubc.ca

Ernest Mwebaze
Department of Computer Science,
Makerere University, Uganda
emwebaze@cit.mak.ac.ug

Figure 4: Examples of healthy leaves (left) and those infected with cassava mosaic disease (right).
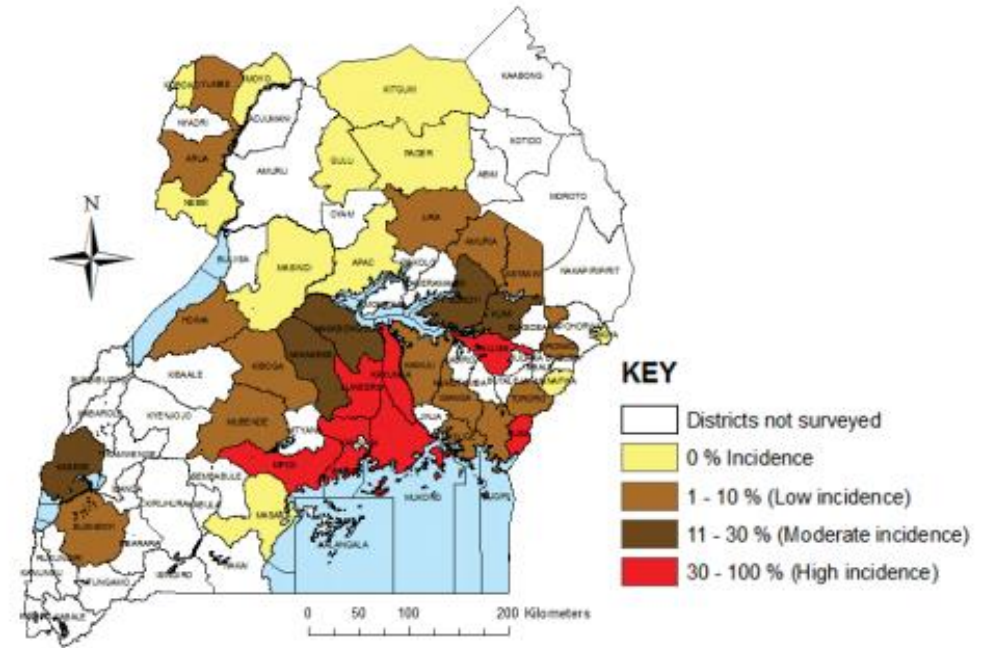
Figure 1: Incidence map of cassava brown streak disease in Uganda, 2009 (NACCRI).

Artificial Intelligence: The new technologies powering South African business
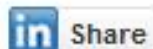
Artificial Intelligence: The new technologies powering South African business.

By next year, the number of businesses around the world using artificial intelligence (AI) in some aspect of their operations is expected to increase to 62 percent. Leading this trend are the South African organisations which are adopting smart technologies to not only make their procedures more efficient, but to adapt to the changing landscape of modern business.

Top 5 ways artificial intelligence can support your business

f Like   ✔ Tweet   in Share   8+1   Pin it
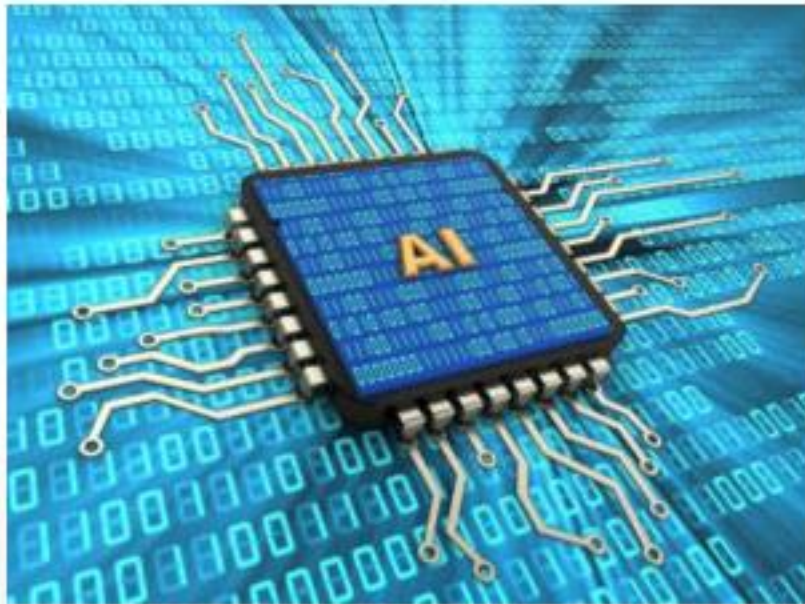
5 ways artificial intelligence can support your business

Artificial Intelligence (A.I.) has for decades been the subject of science fiction and fantasy films. But we've come a long way since 'Skynet'. Only a few months ago, Facebook deactivated a chatbot project, as the bots had developed their own language to communicate with each other, making them redundant to the human employees 'in charge'.

1) Facebook for Business

2) Intelligent Candidate Matching for Recruitment

3) Chatbots

4) Cognitive Technology for Asset Management

5) A.I. Writers

Here's how companies can benefit from machine learning

👍 **Like** 3   🐦 **Tweet**   in **Share**   G+   *Pin it*

Here's how companies can benefit from machine learning.

When a technology has its breakthrough, can often only be determined in hindsight. In the case of artificial intelligence (AI) and machine learning (ML), this is different. ML is that part of AI that describes rules and recognizes patterns from large amounts of data in order to predict future data. Both concepts are virtually omnipresent and at the top of most buzzword rankings.

Progress through machine learning

Artificial intelligence helps to satisfy the customer

If you can predict demand, you can plan more efficiently

New division of labor

Machine learning in education, medicine and development aid

Appendix II

AI in Africa - The Future

The AI Revolution could either

pull the "bottom billion" out of poverty and transform dysfunctional institutions

or

entrench injustice and increase inequality

The outcome will depend on how we manage the coming changes

Africa warned of Artificial intelligence impact on economies
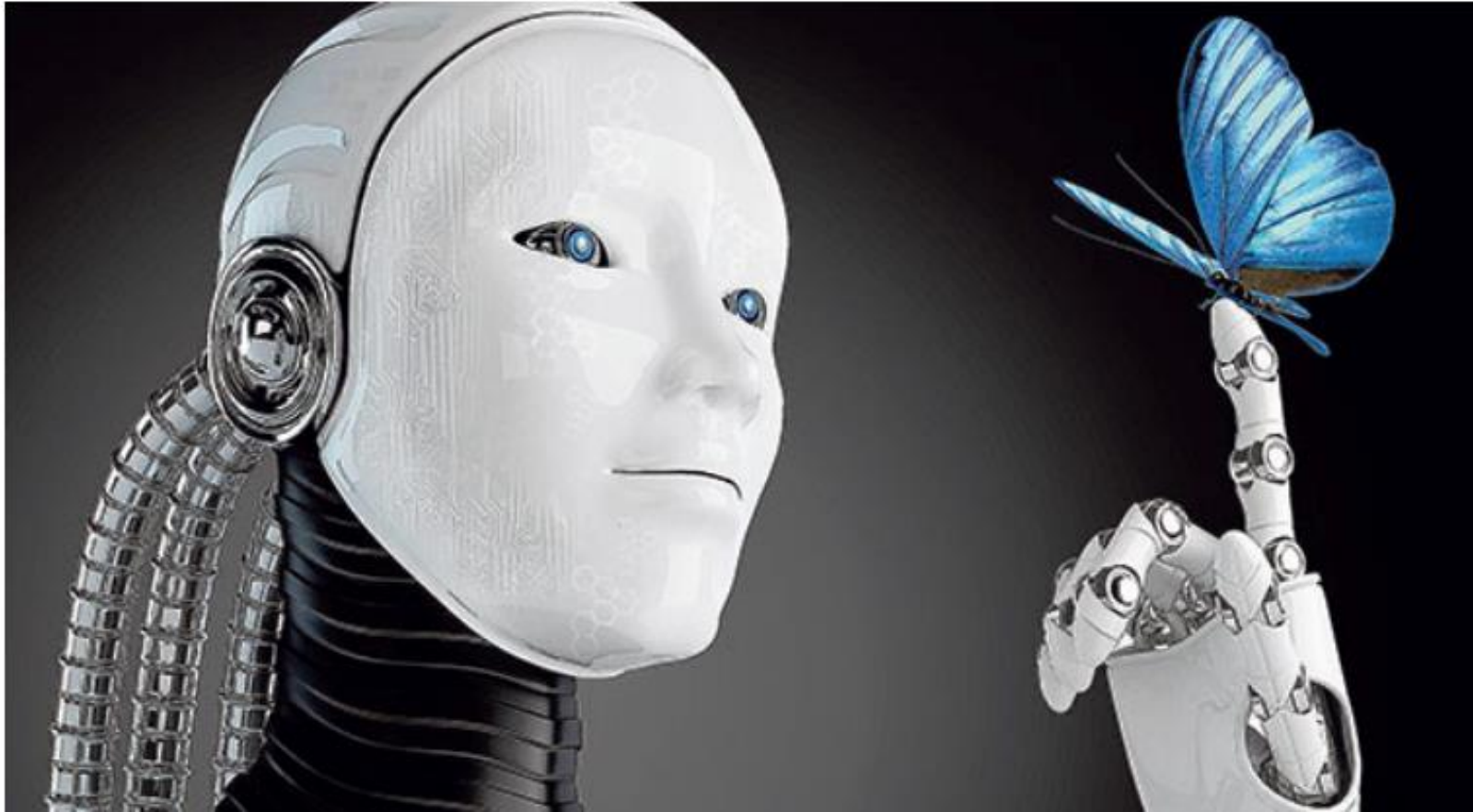
In Summary

•Economists say governments needed to create access to affordable IT infrastructure for their youth, to prepare them for a future where economies will be driven by artificial intelligence.

•While many believe robots will mainly affect demand for labour by the industrial and service sectors, other professions like accountancy, law and medicine will also be heavily affected.

•According to Dr Donald Kaberuka recent history suggests that it is not too late for Africa to adapt to the future.

Market Size Opportunity

TAM Total Available Market

SAM Serviceable Available Market

SOM Serviceable Obtainable Market

$40-100B by 2025

$1-5B by 2025

$0.5-2.5B by 2025

Assume SAM of 2.5% of TAM for Africa & other international opportunities

Assume SOM of 50% of SAM for Africa & other international opportunities

Worldwide Cognitive Systems and Artificial Intelligence Revenues Forecast to Surge Past $47 Billion in 2020, According to New IDC Spending Guide

We see a $100B market by 2025

Overall Market Size

2015	2020	2025
$1.8B	$40.3B	$100B

Artificial Intelligence Revenue, World Markets: 2016-2025

Source: Tractica

Artificial Intelligence Revenue by Region, World Markets: 2015-2024

- North America
- Western Europe
- Eastern Europe
- Asia Pacific
- Latin America
- Middle East
- Africa

Source: Tractica

@ConstellationR #AI #DigitalTransformation

Where is Africa?

IDC — Analyze the Future
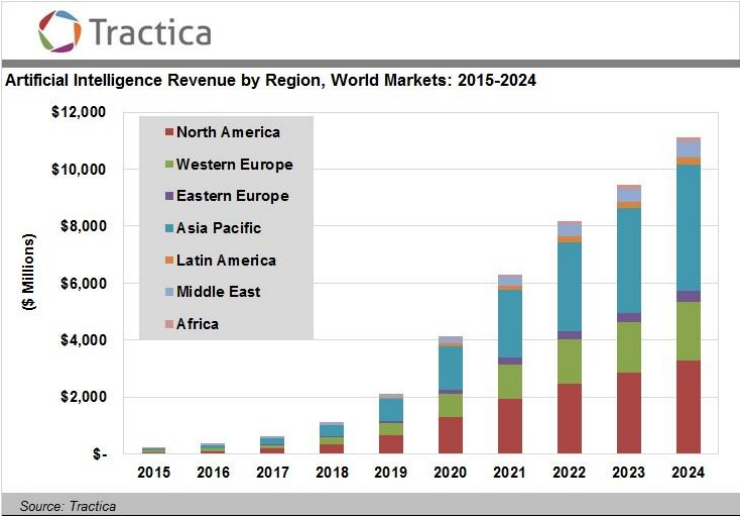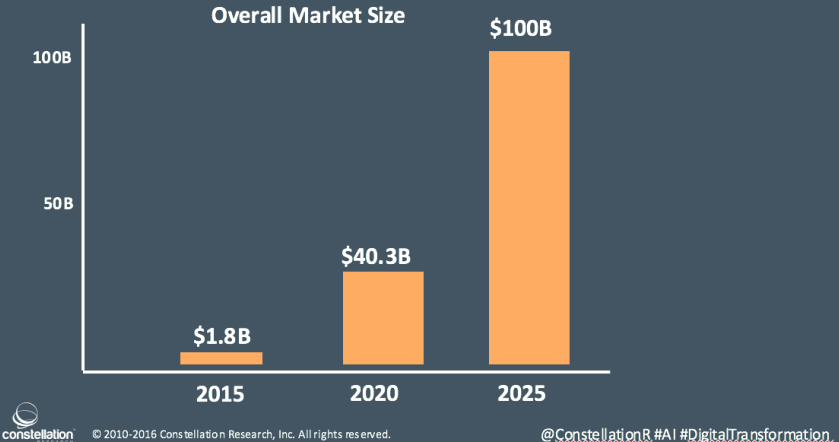
Top Region Based on 5 Year CAGR (2015 – 2020)

- 114.9%
- 63.9%
- 56.2%
- 54.5%
- 50.1%
- 34.3%

Legend: Japan · Asia/Pacific (ex. Japan) · Latin America · USA · Western Europe · Others
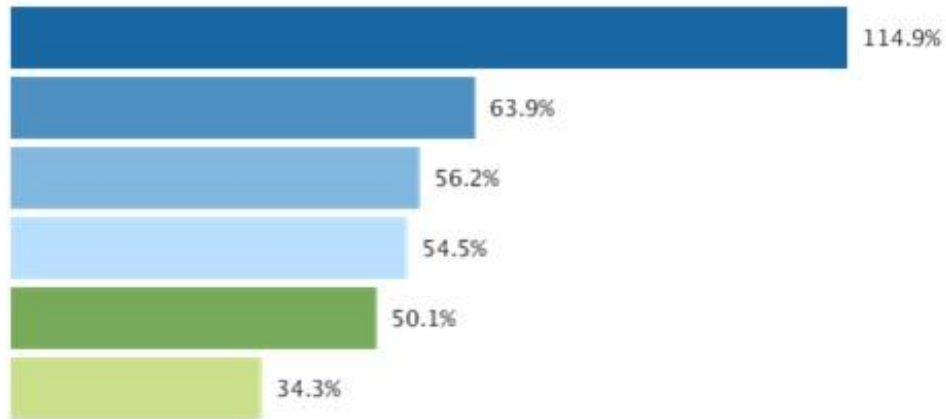
Source: IDC Worldwide Semiannual Cognitive Artificial Intelligence Systems Spending Guide

Chatbot Market Revenue
By Region, 2015 (US$ Mn)

2016 – 24 at a CAGR of 27.8%

52.7

Legend: North America · Asia Pacific · Europe · South America · Middle East and Africa
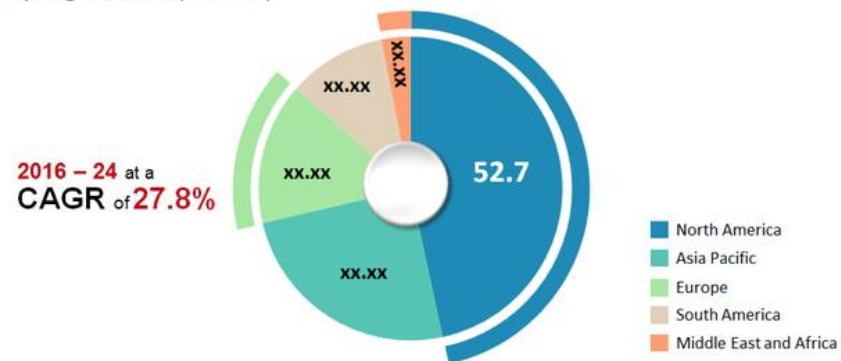
Source: TMR Analysis, November 2016

Tractica

Artificial Intelligence Revenue by Region, World Markets: 2015-2024

($ Millions)

Legend: North America · Western Europe · Eastern Europe · Asia Pacific · Latin America · Middle East · Africa
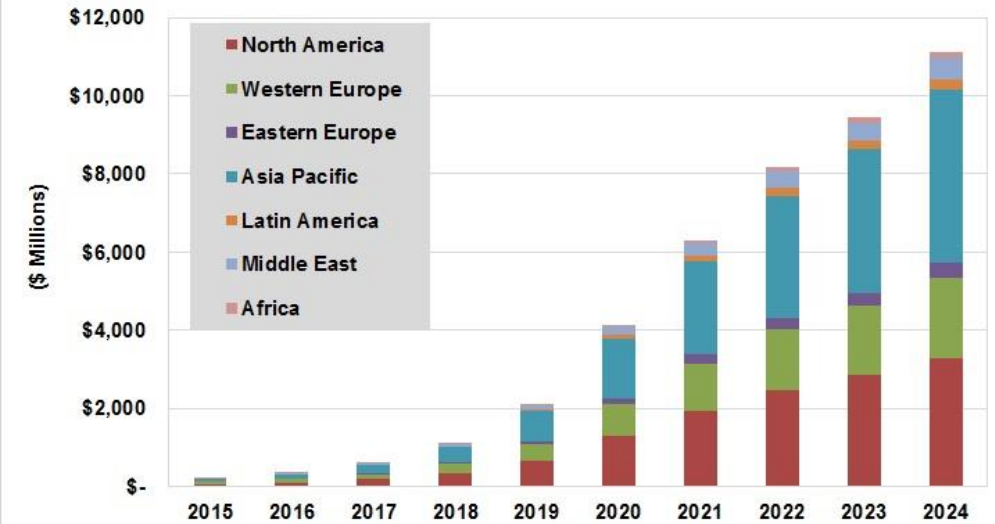
Source: Tractica

Annual growth rates by 2035 of gross value added (a close approximation of GDP), comparing baseline growth by 2035 to an artificial intelligence scenario where AI has been absorbed into the economy.

Legend: BASELINE · AI STEADY STATE

Country	Baseline	AI Steady State
UNITED STATES	2.6	4.6
FINLAND	2.1	4.1
UNITED KINGDOM	2.5	3.9
SWEDEN	1.7	3.6
NETHERLANDS	1.6	3.2
GERMANY	1.4	3.0
AUSTRIA	1.4	3.0
FRANCE	1.7	2.9
JAPAN	0.8	2.7
BELGIUM	1.6	2.7
SPAIN	1.7	2.5
ITALY	1.0	1.8
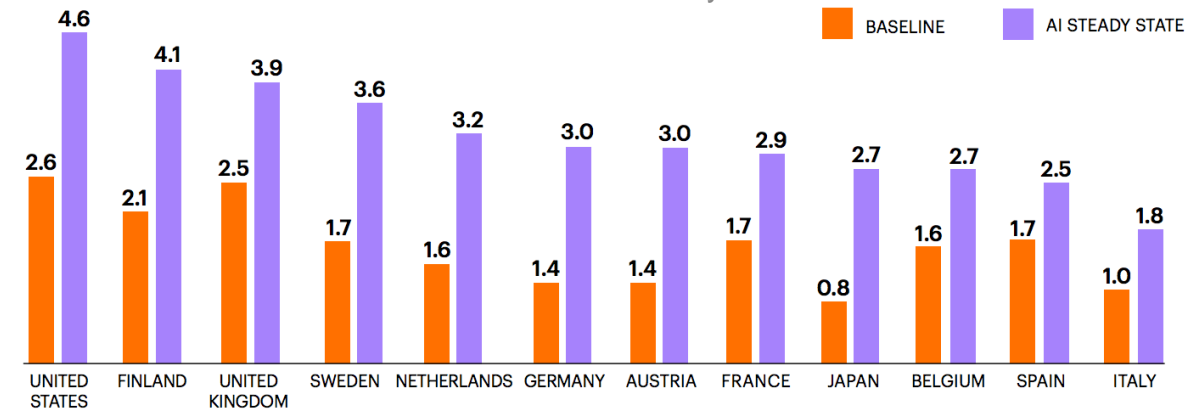
Real gross value added (GVA) (%, growth)

Source: Accenture and Frontier Economics

AI Use Cases & Opportunity size

ARTIFICIAL INTELLIGENCE—USE CASES AND OPPORTUNITY SIZE (2025E)

SECTOR	OPPORTUNITY SIZE	USE CASES
Agriculture	$20 billion total addressable market	• Optimizing seed planting, fertilization, irrigation, spraying and harvesting • Sorting fruits and vegetables to reduce labor costs • Identifying sick livestock based on changes in audio data
Finance (U.S.)	$34-43 billion annual cost savings and new revenue	• Identifying and executing trades in the latency period before consolidated data hits markets • Scrubbing and packaging satellite images that can be used to inform economic/market forecasts (e.g., images of oil inventory, retail traffic) • Identifying credit risk and executing limit reduction/closures on accounts that could go delinquent • Email monitoring for compliance
Healthcare	$54 billion annual cost savings	• Reducing failed drug discovery • Improving care algorithms by connecting historically disparate data sets • Decreasing procedural costs
Retail	$54 billion annual cost savings and $41 billion annual new revenue	• Enabling image-based product searches • Enhancing recommendation engine capabilities by leveraging large data sets on sales, inventory and customer preferences • Improving online search and customer support • Predicting product demand and optimizing pricing
Energy	$140 billion cumulative cost savings	• Streamlining project identification and planning by fusing geological and production data • Improving equipment reliability and reducing redundancies required at the well site • Reducing maintenance-related downtime in downstream industries

Source: Goldman Sachs: Profiles in Innovation, November, 2016.

Artificial Intelligence Revenue, Top 10 Use Cases, World Markets: 2025
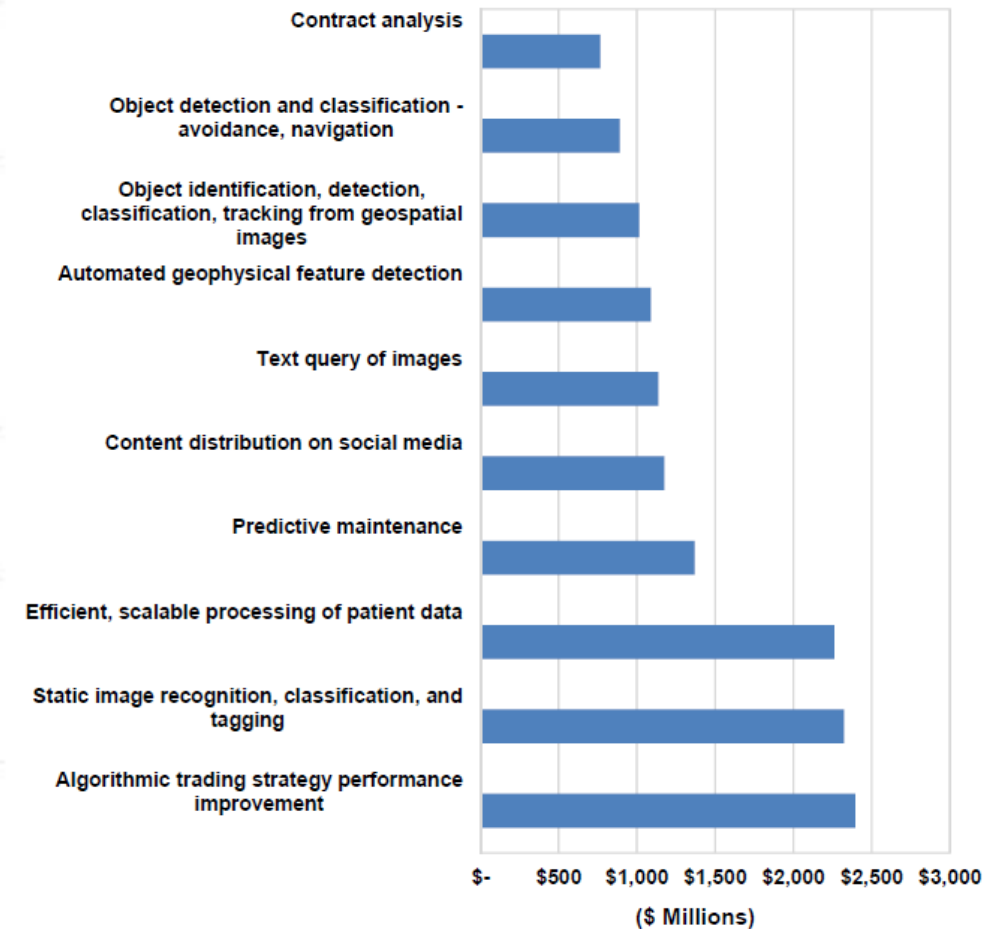
(Source: Tractica)

AFRICA'S RAPID URBANIZATION CAN BE A DRIVER OF INDUSTRIALIZATION

AFDB PRESIDENT ADESINA COMMITS $250,000 WORLD FOOD PRIZE MONEY TO SUPPORT YOUNG AFRICAN FARMERS

ARTIFICIAL INTELLIGENCE IS SOUTH AFRICA READY?

Accenture

EMERGING AI TECHNOLOGIES

AI TECHNOLOGIES

ILLUSTRATIVE SOLUTIONS

Sense
- Computer Vision
- Audio Processing

Comprehend
- Natural Language Processing
- Knowledge representaion

Act
- Machine Learning
- Expert Systems

- Virtual Agents
- Identity Analytics
- Congnitive Robotics
- Speech Analytics
- Recommendation Systems
- Data Visualisation
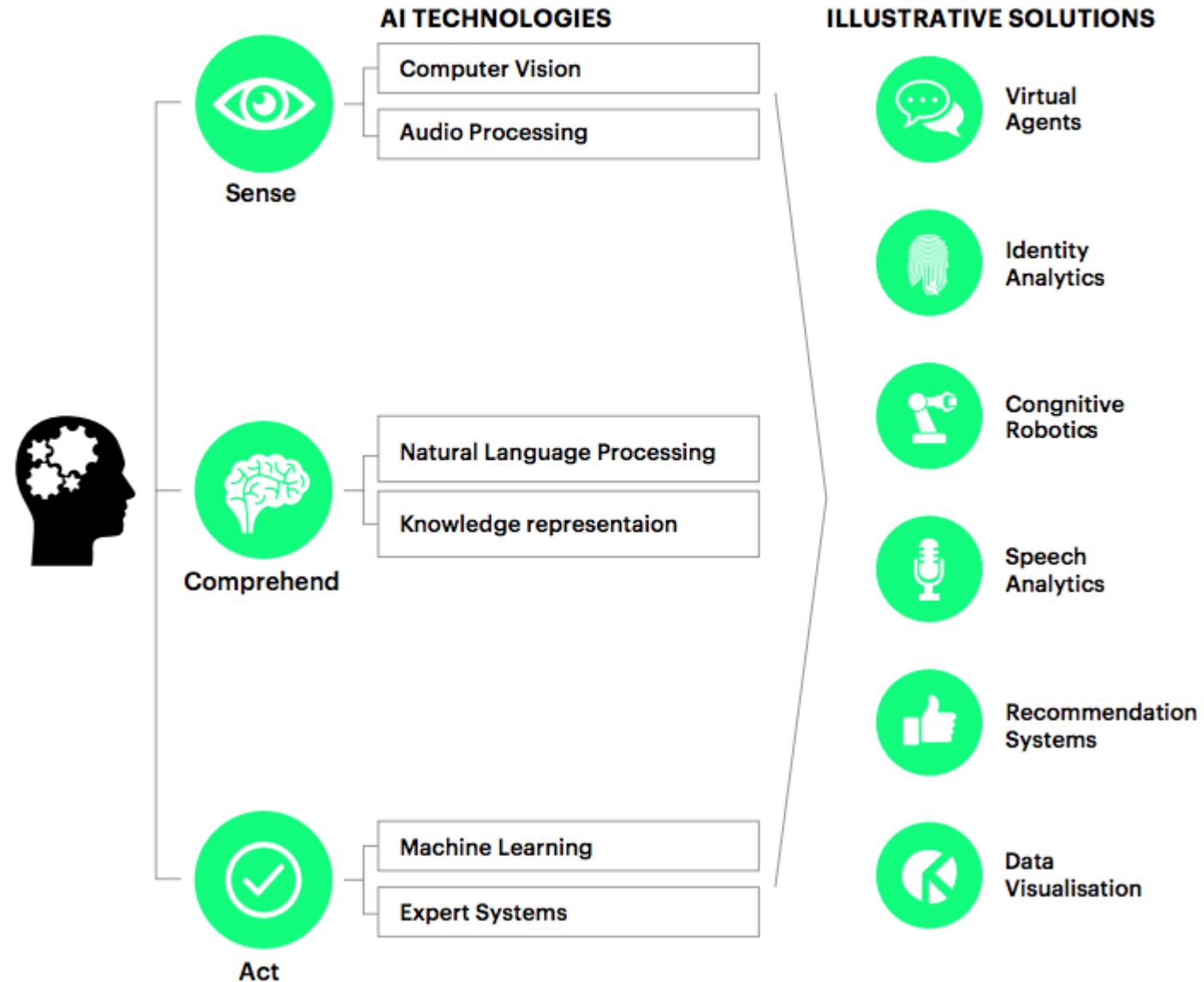
WHY DO WE NEED AI?

1. Most consumers and enterprise clients **will select products and services based on a company's AI**, instead of that company's traditional brand.

2. Most **interfaces** will not have a screen and will be **integrated into daily tasks**.

3. **An adaptive workforce**

4. **Ecosystem power plays**

5. AI as the **new UI**

In fact, most executives agree that AI will revolutionise the way they gain information from and interact with customers. In South Africa, some 78% of South African executives say they **need to boost their organisation's competitiveness by innovating through investments in AI technologies**, notably embedded AI solutions and computer vision. But the reality, though, is that only about a third of these organisations are planning significant AI investments over the next three years.

WHAT'S HOLDING SOUTH AFRICA BACK?

With the recent convergence of technologies, economies are entering a new era in which AI has **the potential to overcome the physical limitations of capital and labor and open up new sources of value and growth**.

AI can be seen as a new factor of production that can help address future labour shortages and a chronic productivity deficit in South Africa.

To estimate the true potential of the impact that AI can make, we developed an economic model built upon three main channels through which value is generated.

3 main channels through which value is generated

1. **Intelligent automation**, which differs from all previous forms of automation in that AI machines can learn and improve over time, rather than degrade.
2. **Augmenting** existing labour and capital, which means that people can be far more productive when supported by machines, and machines themselves can learn and improve their own performance without human supervision.
3. **Innovation diffusion**, which refers to how innovation begets further innovation—for example, by stimulating new ideas and business models among adjacent businesses and industries in a spill-over effect.

ECONOMIC IMPACT OF AI IN SOUTH AFRICA

Real Gross Value Add by 2035 (%, growth)

4,5

3,5

☐ Economic Growth Forecast without AI

☐ Economic Growth Forecast with AI
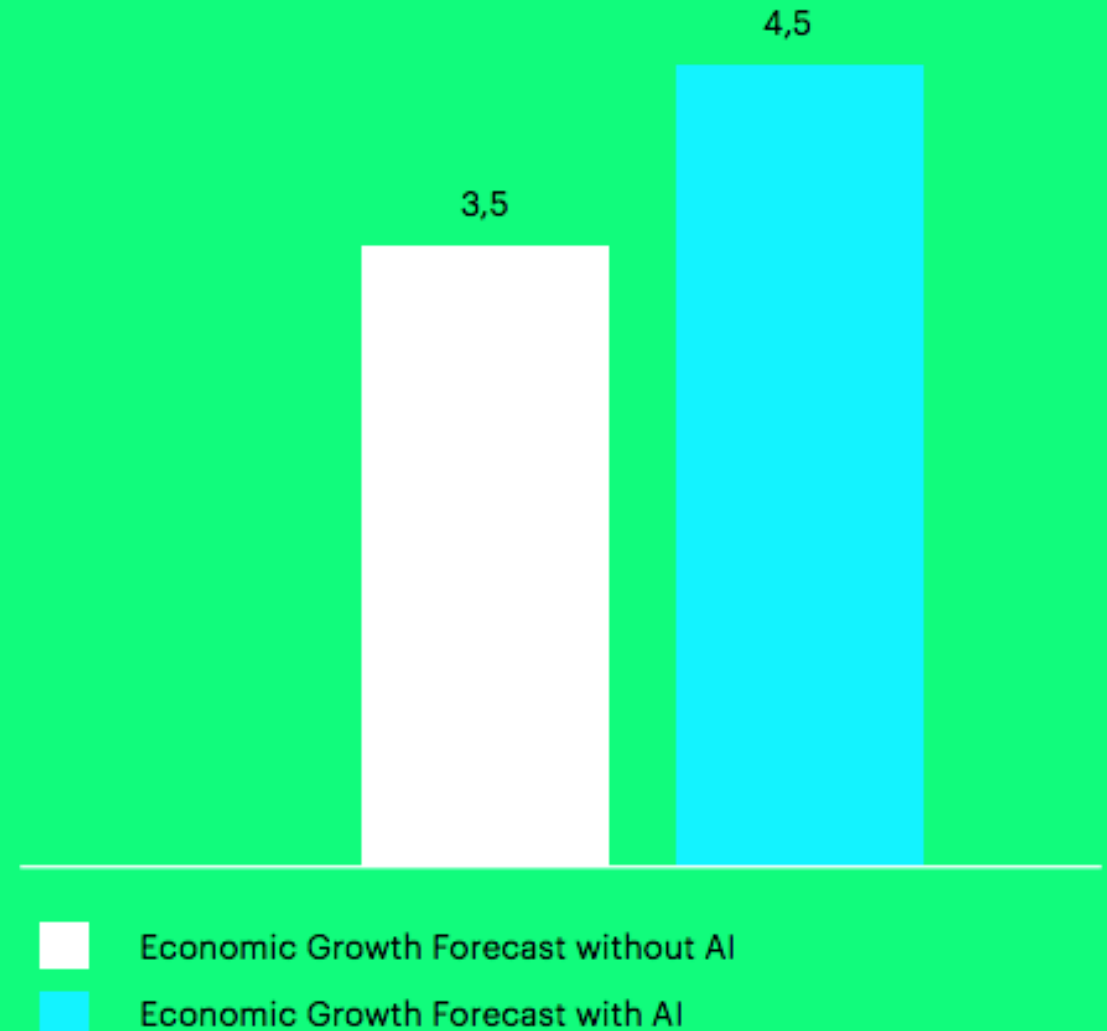
FORGING A PATH TO AN AI FUTURE

WHAT MUST SOUTH AFRICA DO NOW?

South Africa needs to fundamentally shift its thinking about AI and strategically plan to create a vibrant ecosystem where AI flourishes.

A first step in this direction for South Africa is to create a **comprehensive long-term vision of the role of AI in the country's economic development.**

E.g., China has laid out clear targets for AI development in phases, initially by 2020 and going forward by 2030.

1. CREATE A VIBRANT ECOSYSTEM

Universities

Startups

Large companies

Policymakers

Multi-stakeholder partnerships

2. TURN AI INVESTMENT INTO AI-DRIVEN GROWTH

3. PRACTICE RESPONSIBLE AI

2. TURN AI INVESTMENT INTO AI-DRIVEN GROWTH

3. PRACTICE RESPONSIBLE AI

The most significant challenges to the adoption of AI are no different in South Africa than anywhere else. They are about <u>preparing stakeholders thoroughly for the major intellectual, technological, political, ethical and social questions</u> that will arise as AI becomes more deeply integrated into our lives.

THE ARTIFICIAL INTELLIGENT QUOTIENT (AIQ) FOR INVENTION AND COLLABORATION

Less than 20 percent of analysed companies are strong on both — we call them "collaborative inventors"

AIQ FOR INVENTION (0 – 100)

INVENTOR
14% OF COMPANIES
1. Use AI to transform core business
2. Develop AI in-house, benefit from owning AI-critical resources
3. Only collaborate to source talent

COLLABORATIVE INVENTOR
17% OF COMPANIES
1. Use AI to transform core business
2. Develop AI in-house, benefit from owning AI-critical resources
3. Collaborate to share resources and to co-create AI

OBSERVER
56% OF COMPANIES
1. Do not fully see transformational or incremental value of AI
2. See limited benefits in owning AI-critical resources
3. Relatively small initiatives, wait and see approach

COLLABORATOR
13% OF COMPANIES
1. Use AI to drive incremental value across business
2. Collaborate to adopt AI solutions and services, relatively small in-house inventions
3. Unable to own AI-critical resources or limited benefits from their ownership

AIQ FOR COLLABORATION   0 — 100

NEXT STEPS FOR POLICY MAKERS AND BUSINESS LEADERS

1. DESIGN

- **Take the lead.** Attaining value from AI demands recognition and action from leadership. To create an AI roadmap focussed on growing the business, leaders need a sufficient grasp on AI. This means AI must be made tangible to the C-Suite. They must spend time with real AI machines, and visit AI labs where experts can be probed, ideas can be tested and prototypes can be developed.

- **Create an open AI culture.** Corporate culture must adapt to the presence of its new AI employees. It will demand trust, openness and transparency. It must address not only interactions but employees' concerns over the impact of AI on job security, wages and privacy. Indeed, AI can be used to proactively improve workplace culture.

- **Adopt a holistic AI approach.** Keeping abreast of technology can expose business opportunities, as does staying current with ever-changing customer dynamics. By reducing the distance between business-unit leaders and IT, businesses will be more able to identify and pick lower-hanging fruits. Introducing change management will also reduce the organisational emotional divide between those that fear AI and those that embrace it.

- **Leverage the Ecosystem.** Explore the AI platforms preferred by customers and forge strategic partnerships. Also consider the value of sharing and enhancing business intelligence through collaboration with other companies and organisations to target higher value return.

- **Take the crowd into the cloud.** Cloud technologies have provided an opportunity to scale rapidly with lower computing costs and without the confines of internal IT structures. The next step in innovation will be to combine the crowd-sourced data in the cloud with AI capabilities to create new and disruptive business opportunities.

2. EXECUTE

- **Reinvent HR into HAIR (Human and AI resources).** As AI becomes part of the workforce, HR leadership will play a much bigger role in business strategy and innovation, as well as accumulate a greater technical understanding of AI technologies and how these will shape the future of work. The HR function will need to incorporate AI technologies in all aspects of its work, from hiring to retirement.

- **Converge data for intelligence.** The true value of AI will not be found in, say, an algorithm or a neural network itself. Rather it will be found in the way data intelligence transforms the business. The performance of AI will depend on the quality and amount of data available. It will also depend on the ability to converge and make sense of data from sources such as Internet of Things (IoT) sensors and social networks. In addition to focusing on data security, regulations and governance, chief data officers must construct an integrated, end-to-end data supply chain to maximise the value derived from enterprise data. This will also increase the impact of, and value derived from, AI.

- **Learn with machines.** AI will transform not only what people learn, but also how they learn. To fully exploit the potential of AI, human and machine intelligence must be tightly interwoven. With AI taking over mundane and low-value-added tasks, a skills gap will open between young professionals and older workers, favouring workers with experience and placing emphasis on human abilities such as judgment, communication, and creative thinking, which will all complement AI technologies.

- **Take a step beyond automation.** With recent strides in AI, companies need to take a step beyond automation to harness the intelligence of dynamic, self-learning and self-governing machines. This means enabling AI-powered machines to self-diagnose technical failures, autonomously order replacement parts and anticipate maintenance needs.

3. MONITOR

- **Measure your return on algorithms.** CFOs will need a new toolbox of financial metrics to properly assess the "Return on AI." Unlike traditional assets that depreciate over time, AI assets, with their self-learning technologies, gain value as time passes. But because of the learning nature of AI, benefits will stem from yet-to-be determined sources. This complexity may deter AI investment decisions, underlining the need for new thinking and new terminology for capital expenditure and valuation models.

- **Analyse and Audit** — the performance of AI against key value-driven metrics, with respect to algorithmic accountability, bias and cybersecurity.

MCKINSEY GLOBAL INSTITUTE

ARTIFICIAL INTELLIGENCE
THE NEXT DIGITAL FRONTIER?

1. Artificial intelligence is getting ready for business, but
are businesses ready for AI?

2. Artificial intelligence promises to boost profits and
transform industries

3. Businesses, developers, and governments need to act
now to realize AI's full potential

ARTIFICIAL INTELLIGENCE

The next digital frontier?

The current AI wave is poised to finally break through

Investment in AI is growing at a high rate, but adoption in 2017 remains low

In 2016, companies invested

$26B to $39B

in artificial intelligence

TECH GIANTS
$20B to $30B

STARTUPS
$6B to $9B

3x External investment growth since 2013

20% of AI-aware firms say they are **adopters**

- 3+ technologies
- 2 technologies
- 1 technology

41% of firms say they are **uncertain about the benefits** of AI

10%

3%

7%

40% Contemplators

31% Partial adopters

10% Experimenters
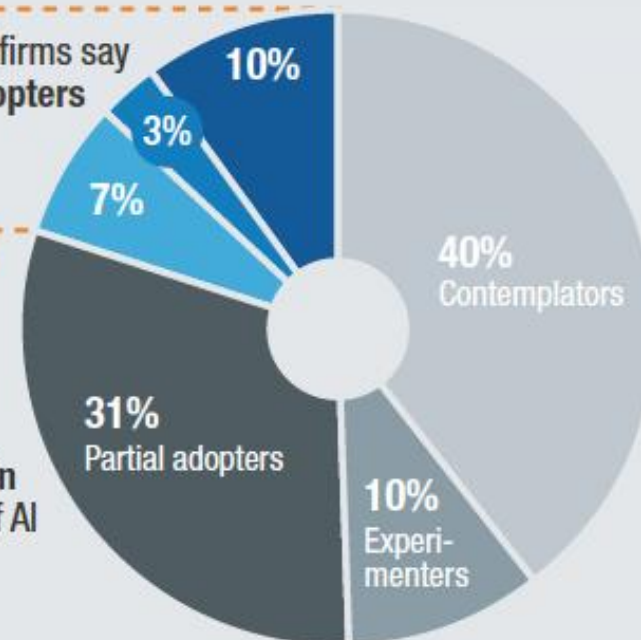
How companies are adopting AI

AI adoption is greatest in sectors that are already **strong digital adopters**

High AI adoption	• High tech / telecom • Automotive / assembly • Financial services
Medium AI adoption	• Retail • Media / entertainment • CPG
Low AI adoption	• Education • Health care • Travel / tourism

Assets

Usage

Labor

Digital maturity
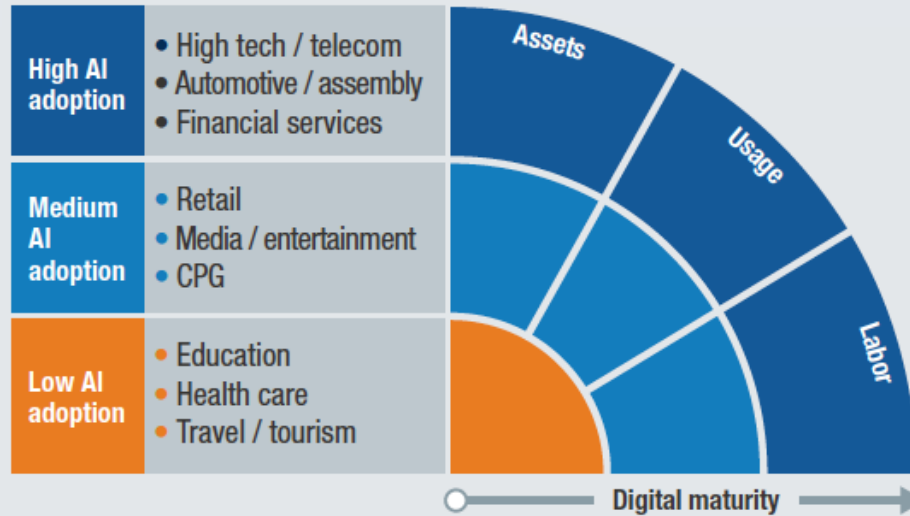
Six characteristics of early AI adopters

- Digitally mature
- Larger businesses
- Adopt AI in core activities
- Adopt multiple technologies
- Focus on growth over savings
- C-level support for AI
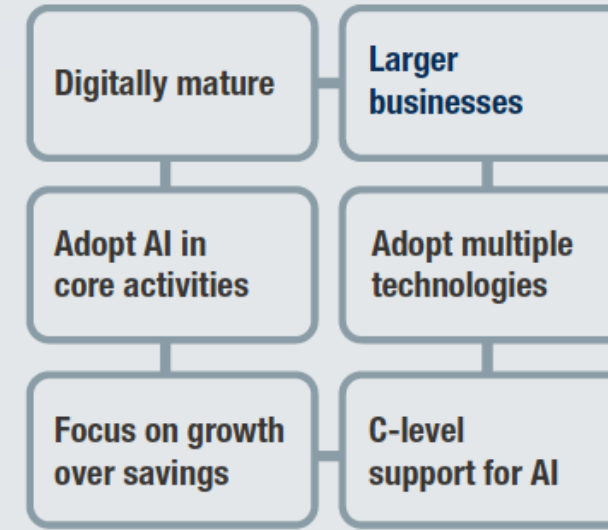
Four areas across the value chain where AI can create value

PROJECT: Smarter R&D and forecasting

PRODUCE: Optimized production and maintenance

PROMOTE: Targeted sales and marketing

PROVIDE: Enhanced user experience

Five elements of successful AI transformations

Use cases / sources of value

Data ecosystems

Techniques and tools

Workflow integration

Open culture and organization
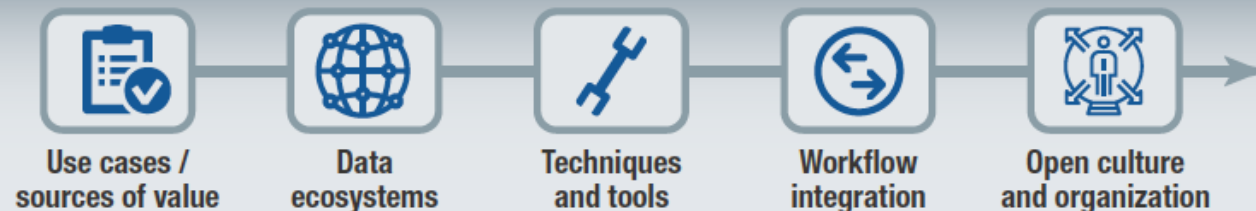
Machine learning received the most investment, although boundaries between technologies are not clear-cut

External investment in AI-focused companies by technology category, 2016[1]
$ billion

Natural language
0.6–0.9

Autonomous
vehicles
0.3–0.5

Machine learning
Multiuse and nonspecific applications
5.0–7.0

Computer vision
2.5–3.5

Smart
robotics
0.3–0.5

Virtual
agents
0.1–0.2
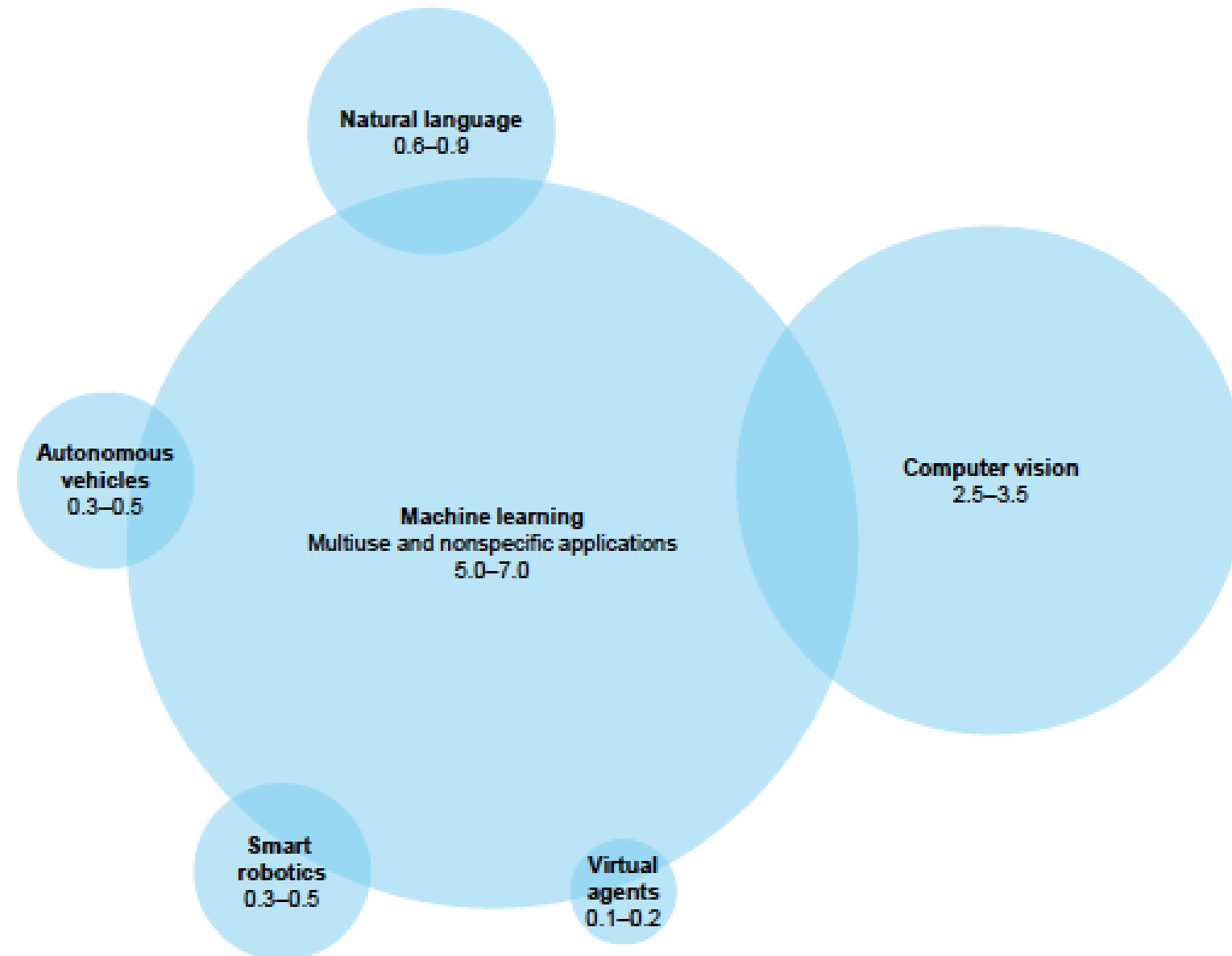
AI adoption is occurring faster in more digitized sectors and across the value chain

AI Index — Relatively low ▢▢▢▢▢ Relatively high

	Overall AI index	MGI Digitization Index[1]	Assets			Usage						Labor	
			Depth of AI technologies	AI spend	Supporting digital assets	Product development	Operations	Supply chain and distribution	Customer experience	Financial and general management	Workforce management	Exposure to AI in workforce	AI resources per worker
High tech and telecommunications													
Automotive and assembly													
Financial services													
Resources and utilities													
Media and entertainment													
Consumer packaged goods													
Transportation and logistics													
Retail													
Education													
Professional services													
Health care													
Building materials and construction													
Travel and tourism													

Sectors leading in AI adoption today also intend to grow their investment the most

Future AI demand trajectory[1]
Average estimated % change in AI spending, next 3 years, weighted by firm size[2]

Leading sectors

Financial services

High tech and telecommunications

Transportation and logistics

Health care

Travel and tourism

Automotive and assembly

Professional services

Energy and resources

Retail

Consumer packaged goods

Media and entertainment

Education

Construction

Falling behind

Current AI adoption
% of firms adopting one or more AI technology at scale
or in a core part of their business, weighted by firm size[2]

While few occupations are fully automatable, 60 percent of all occupations have at least 30 percent technically automatable activities

Automation potential based on demonstrated technology of occupation titles in the United States (cumulative)[1]

Example occupations

Share of roles (%)
100% = 820 roles

Example occupations	Technical automation potential (%)	Share of roles (%)
Sewing machine operators, graders and sorters of agricultural products	100	1
	>90	8
	>80	18
Stock clerks, travel agents, watch repairers	>70	26
	>60	34
Chemical technicians, nursing assistants, Web developers	>50	42
	>40	51
	>30	62
Fashion designers, chief executives, statisticians	>20	73
	>10	91
Psychiatrists, legislators	>0	100

<5% of occupations consist of activities that are 100% automatable

In about 60% of occupations, at least 30% of activities are automatable
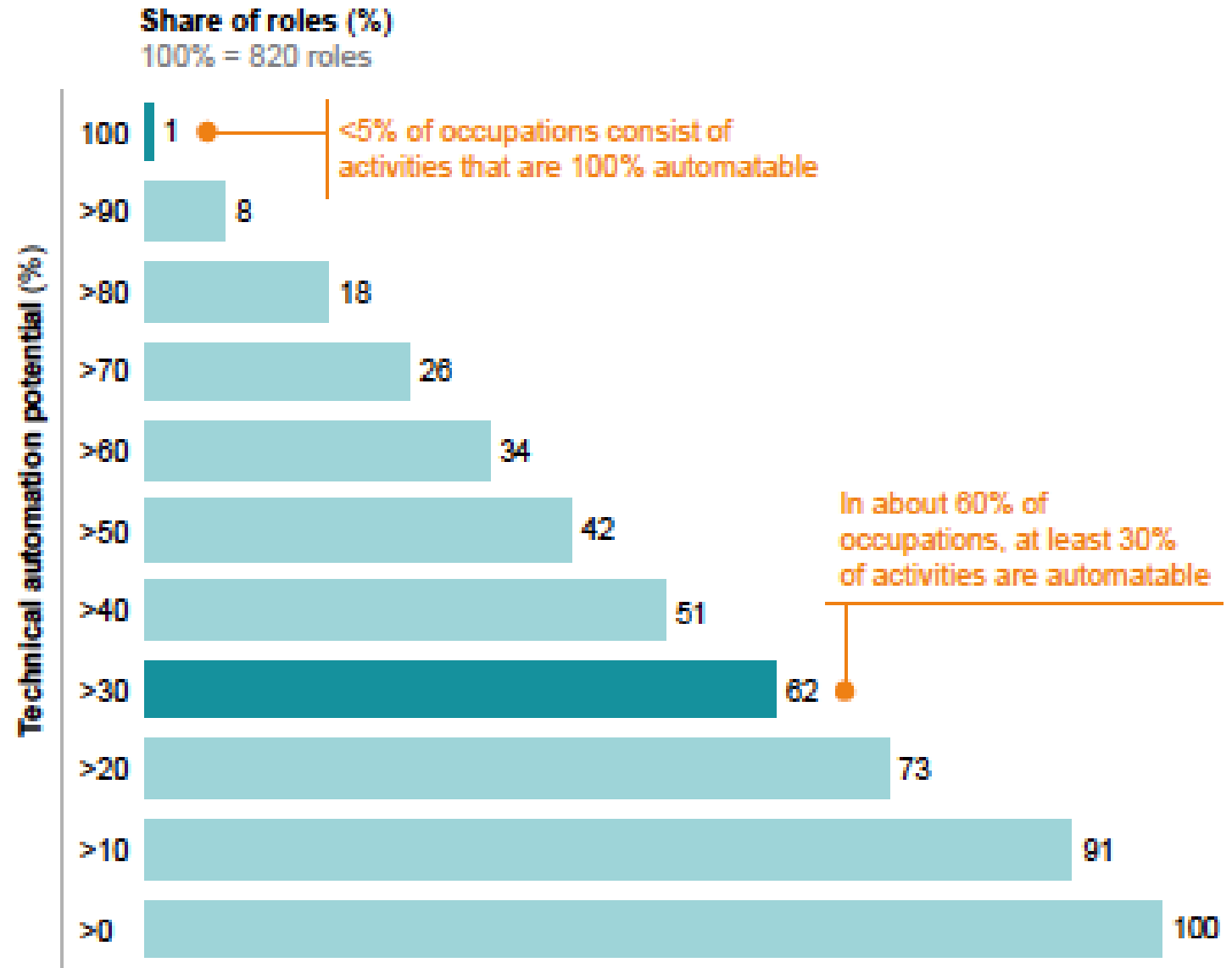
ARTIFICIAL INTELLIGENCE AND LIFE IN 2030

ONE HUNDRED YEAR STUDY ON ARTIFICIAL INTELLIGENCE | REPORT OF THE 2015 STUDY PANEL | SEPTEMBER 2016

The overarching purpose of the One Hundred Year Study's periodic expert review is to provide a collected and connected set of reflections about AI and its influences as the field advances.

PREFACE

The One Hundred Year Study on Artificial Intelligence, launched in the fall of 2014, is a long-term investigation of the field of Artificial Intelligence (AI) and its influences on people, their communities, and society. It considers the science, engineering, and deployment of AI-enabled computing systems. As its core activity, the Standing Committee that oversees the One Hundred Year Study forms a Study Panel every five years to assess the current state of AI. The Study

AI and Life in the Future

Many have already grown accustomed to touching and talking to their smart phones. People's future relationships with machines will become ever **more nuanced, fluid, and personalized**.

Society is now at a **crucial juncture** in determining how to deploy AI-based technologies in ways that promote rather than hinder democratic values such as freedom, equality, and transparency.

The field of AI is shifting toward building intelligent systems that can **collaborate effectively** with people, including creative ways to develop interactive and scalable ways for people to teach robots.

Longer term, AI may be thought of as a radically different mechanism for **wealth creation** in which everyone should be entitled to a portion of the world's AI-produced treasures.

Misunderstandings about what AI is and is not could fuel opposition to technologies with the potential to benefit everyone. **Poorly informed regulation** that stifles innovation would be a tragic mistake.

AI and Life in the Future

Intelligence lies on a multi-dimensional spectrum. According to this view, the difference between an arithmetic calculator and a human brain is not one of kind, but of scale, speed, degree of autonomy, and generality.

AI technologies already pervade our lives. As they become a central force in society, the field is shifting from simply building systems that are intelligent to building intelligent systems that are human-aware and trustworthy.

A growing body of research is devoted to the idea that a wide array of devices can be interconnected to collect and share their sensory information. Such devices can include appliances, vehicles, buildings, cameras, and other things.

Human intelligence has no match in the biological and artificial worlds for sheer versatility, with the abilities "to reason, achieve goals, understand and generate language... create art and music, and even write histories."

Natural Language Processing is a very active area of machine perception. Research is now shifting towards developing systems that are able to interact with people through dialog, not just react to stylized requests.

AI and Life in the Future

EDUCATION

Though quality education will always require active engagement by human teachers, AI promises to enhance education at all levels, especially by providing personalization at scale.

It can be argued that AI is the secret sauce that has enabled instructors, particularly in higher education, to multiply the size of their classrooms by a few orders of magnitude—class sizes of a few tens of thousands are not uncommon.

The current absence of sophisticated use of AI technologies in schools, colleges, and universities may be explained by the lack of financial resources as well as the lack of data establishing the technologies' effectiveness.

While formal education will not disappear, MOOCs and other forms of online education will become part of learning at all levels, from K-12 through university, in a blended classroom experience.

LOW-RESOURCE COMMUNITIES

With targeted incentives and funding priorities, AI technologies could help address the needs of low-resource communities. Budding efforts are promising.

PUBLIC SAFETY AND SECURITY

One of the more successful uses of AI analytics is in detecting white collar crime, such as credit card fraud. Cybersecurity (including spam) is a widely shared concern, and machine learning is making an impact.

Predictive policing tools raise the specter of innocent people being unjustifiably targeted. But well-deployed AI prediction tools have the potential to actually remove or reduce human bias.

AI and Life in the Future

AI will likely replace tasks rather than jobs in the near term, and will also create new kinds of jobs. But the new jobs that will emerge are harder to imagine in advance than the existing jobs that will likely be lost.

As labor becomes a less important factor in production as compared to owning intellectual capital, a majority of citizens may find the value of their labor insufficient to pay for a socially acceptable standard of living.

AI will increasingly enable entertainment that is more interactive, personalized, and engaging. Research should be directed toward understanding how to leverage these attributes for individuals' and society's benefit.

More sophisticated tools and apps will become available to make it even easier to produce high-quality content, for example, to compose music or to choreograph dance using an avatar.

Impact on People

- The 4th Industrial Revolution **will change not only <u>what we do</u> but also <u>who we are</u>**. It will affect our identity and all the issues associated with it:
our sense of privacy, our notions of ownership, our consumption patterns, the time we devote to work and leisure, and how we develop our careers, cultivate our skills, meet people, and nurture relationships. It is already changing our health and leading to a "quantified" self, and sooner than we think it may lead to human augmentation.
The list is endless because it is bound only by our imagination.

- Question: Could the ***inexorable integration of technology in our lives diminish some of our quintessential human capacities?***

    E.g., such as compassion and cooperation.
    Our relationship with our smartphones is a case in point.
        Constant connection may <u>deprive us of one of life's most important assets</u>:
        the time to pause, reflect, and engage in meaningful conversation.

Impact on People

- One of the greatest individual challenges posed by new information technologies is **privacy**. *We instinctively understand why it is so essential, yet the tracking and sharing of information about us is a crucial part of the new connectivity.*

  - Debates about fundamental issues such as the <u>impact on our inner lives </u>of the loss of control over our data will only intensify in the years ahead.

- Similarly, the ***revolutions occurring in biotechnology and AI***, which are <u>redefining what it means to be human</u> by **pushing back the current thresholds of** **life span**, **health**, **cognition**, **and** **capabilities**, will <u>compel us to *redefine our moral and ethical boundaries*</u>.

Shaping the future

- *Neither technology nor the disruption* that comes with it <u>is an exogenous force over which humans have no control</u>. All of us are responsible for guiding its evolution, in the *decisions we make on a daily basis as citizens, consumers, and investors.* We should thus **grasp the opportunity and power we have to shape the Fourth Industrial Revolution and** **direct it toward a future that reflects our common objectives and values**.

- To do this, however, we must <u>develop a comprehensive and globally shared view</u> of how technology is affecting our lives and reshaping our economic, social, cultural, and human environments. There has never been a time of <u>greater promise</u>, or one of <u>greater potential peril</u>. **Today's decision-makers, however, are too often trapped in traditional, linear thinking, or too absorbed by the multiple crises demanding their attention, to think strategically about the forces of disruption and innovation shaping our future**.

Shaping the future

- It all comes down to people and values. We need to shape a future that works for all of us by *putting people first and empowering them*.

- In its most pessimistic, dehumanized form, the Fourth Industrial Revolution may indeed have the potential to "robotize" humanity and thus to deprive us of our heart and soul.

- **But as a complement to the best parts of human nature—creativity, empathy, stewardship— it can also lift humanity into a new collective and moral consciousness *based on a shared sense of destiny*. It is incumbent on us all to make sure the latter prevails.**