Artificial Intelligence and Internet of Things in the development of Smart Sustainable Cities

Adoption of circular economies in the 4th Industrial Revolution

8th Green Standards Week, Zanzibar

International Telecoms Union (ITU)

Simon Peter Akugizibwe, ACIM, B.Sc. Tel Eng.

Revolution of Change (Paradigm Shift)

"The transition from a paradigm in crisis to a new one from which a new tradition of normal science can emerge is far from a cumulative process, one achieved by an articulation or extension of the old paradigm. Rather it is a reconstruction of the field from new fundamentals, a reconstruction that changes some of the field's most elementary theoretical generalizations as well as many of its paradigm methods and applications. During the transition period there will be a large but never complete overlap between the problems that can be solved by the old and by the new paradigm. But there will also be a decisive difference in the modes of solution. When the transition is complete, the profession will have changed its view of the field, its methods, and its goals."

Thomas S. Kuhn

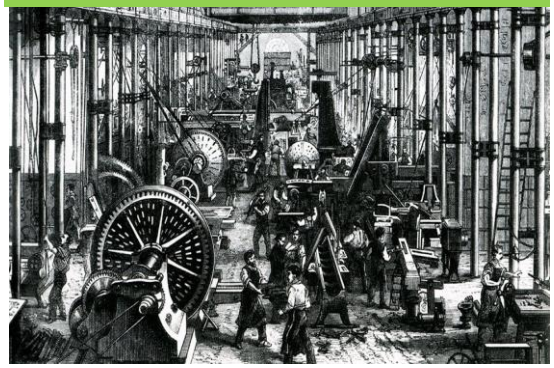
"The Structure of Scientific Revolutions (1962)"

Evolution of Industry and Economy

Industry 1.0

- 18th to 19th Century
- Water & Steam energy.
- Agricultural to Production.
- Raw materials search
- Rural urban migration
- Colonization
- Conflict
- World Population Estimate 1.8 Billion

Products & Trade



Industry 2.0

- 1870-1914
- Electricity & Fossil Fuels
- Mass production & assembly line.
- Inventions
- Fast urbanization & Infrastructure expansion
- Urbanization
- Conflict
- World Population: 4.4 Billion.

Products & Services & Mass marketing

Industry 3.0 Digital Revolution

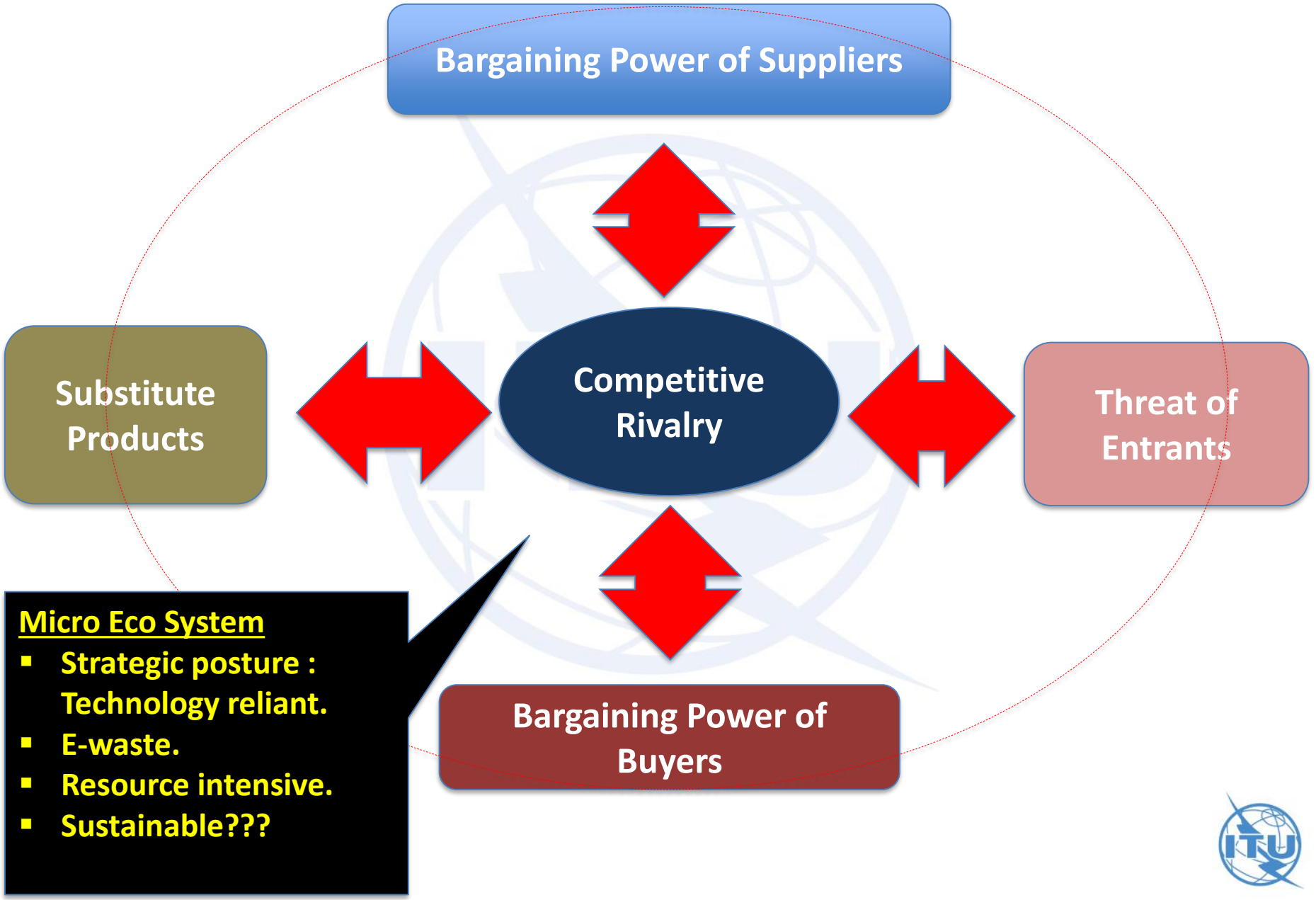
- 1960 – 20??
- Electricity, Fossil fuels, Renewable Energy, Nuclear and Geo thermal
- Internet
- Services to Intellectual Capital.
- Globalization
- Computing & Digitization
- World Population: 7.6 Billion

Value, Personalisation, Information and Innovation.

Macro Impact on Man & Society

Element	Positive	Negative
Social Economic	▪ Trade blocs and Custom unions ▪ Cashless economy ▪ Entrepreneurship & innovation	▪ Unequal distribution of wealth. ▪ Nationalization ▪ Trade barriers (Brexit) ▪ Resource shortages.
Focus Area	▪ Consumer power ▪ Globalization & diversity ▪ Diversity & Connectivity ▪ Cultural Fusion ▪ Social networking and media ▪ Education and Skills learning	▪ Lifestyle diseases ▪ Poverty, access to basic needs ▪ Unemployment & Crime ▪ Urban crowding & Slums. ▪ Illegal migration, Racial Conflict, Culture shock & Communication barriers
Technological	▪ Fintech & Ecommerce ▪ Robotics & robotics ▪ Internet & Smartphones ▪ Digital ▪ E-commerce & Fintech	▪ Social isolation. ▪ Exponential energy consumption. ▪ Breakdown in human relations. ▪ Internet addiction. ▪ Cyber crime
Enablers		
Environmental / Ethical	▪ Green movement ▪ Ethical consumption ▪ CSR & Philanthropy	▪ Pollution, Waste (E) & Global Warming ▪ Deforestation, desertification & Illegal mining ▪ Child labour & Exploitation & human trafficking. ▪ Cyber crime
Outcomes		

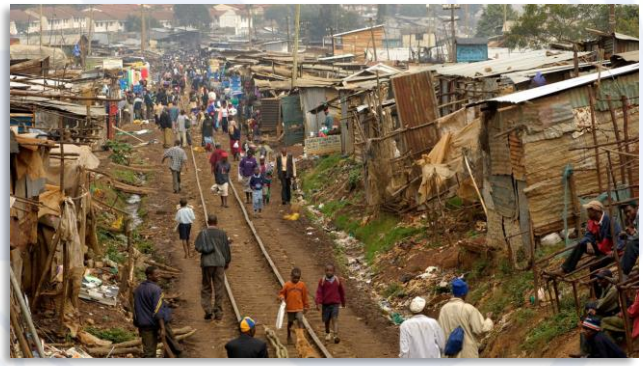
Micro Impact – Porter's 5 forces impacting Business Environment



Micro Eco System

- Strategic posture : Technology reliant.
- E-waste.
- Resource intensive.
- Sustainable???

Perspective



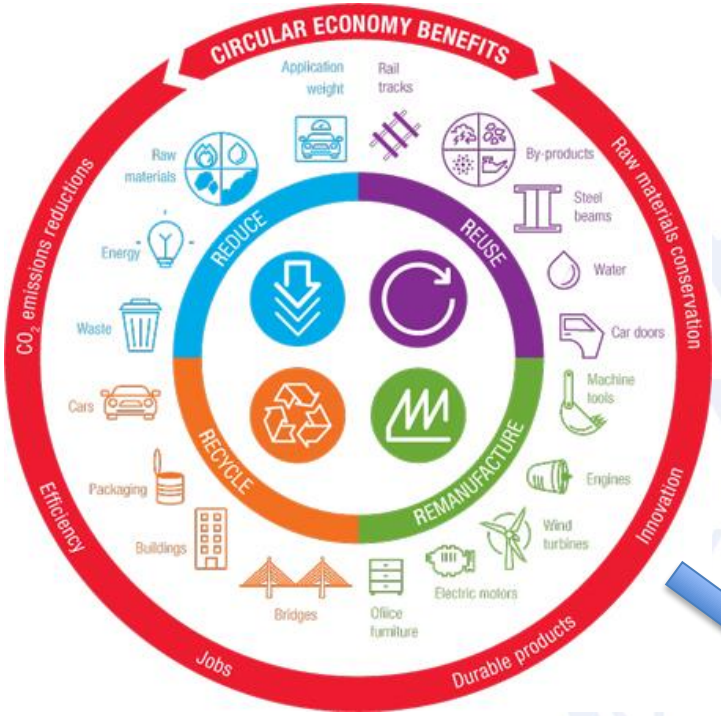
Switch from Linear to Circular Economy

Linear Economy

Circular Economy

Transformation

PARADIGM SHIFT in Business and Industry Modelling



People (Attractiveness)

- **Smart Cities**
- Smart Living
- Basic needs and necessities
- Health
- Safety
- Quality

Profit (Business Competitiveness)

- **Sustainable Growth**
- Fair Business practice
- **Effective Value Chains & Industry Sectors**

Planet (Society)

- **E-Waste Management**
- Recycling
- Environmental conservation
- **Re-usability**

ADDRESS THE TRIPLE BOTTOM LINE

People & Society

- People not merely statistics but Strategic Value Assets.
- Combined knowledge of people and society provide Intellectual Capital to develop solutions for sustainable co-existence.

Sustainable Co-existence

Smarty City Solutions

Create an environment to allow People to Co-exist with Quality of Life and Superior Living experiences

Transition from Conventional City to Smart City

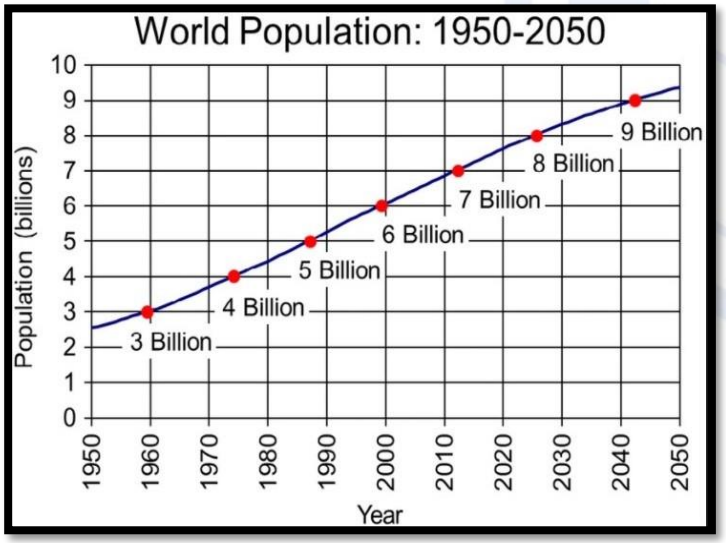
"A smart City: uses ICT in an integrated collaborated and sustainable approach across all vertical segments to cater to the needs of citizens , organizations and other important stakeholders, while maximizing its triple bottom line."

Jo Linstad

Global Director SSC (Ericsson)

Convention city ICT challenges

- **Internet of People (IoP) not fully integrated to ICT ecosystem (Non IoT).**
- **Vertical sectors not fully integrated.**
- **Fragmented Business Value Chains lacking API integration.**
- **Bureaucratic skepticism to change among some stakeholders.**



Scalable solution?

Transition, Control & Cost?

INDUSTRY 4.0 ECO SYSTEM

"We cannot solve our problems with the same thinking we used when we created them." - Albert Einstein

4th INDUSTRIAL REVOLUTION

"Technologies at the heart of the 4th INDUSTRIAL REVOLUTION are connected in many ways, in the way they extend digital capabilities , in the way the scale, emerge and embed themselves in our lives, in their combinatorial power and in their potential and their power to concentrate privilege and challenging existing governance systems"

Klaus Schwab

Founder and Executive Chairman World Economic Forum

"Shaping the Fourth Industrial Revolution"

Core Technological Concepts

1. AI
2. IOT

Core Focus

3. Quantum & Cloud computing
4. Block chain and distributed ledgers
5. Advanced materials
6. Robotics
7. Additive manufacturing and multidimensional (3D) printing
8. Neural technologies
9. Biotechnologies
10. Virtual and augmented realities
11. Geo Engineering
12. Space Technologies
13. Energy capture, storage and transmission.

Expert Opinion: ***"The confluence of data with massive storage and cognitive power will transform industry and society at every level , creating opportunities that were once unimaginable from health and education to agriculture , manufacturing and services "***

Satya Nadella (CE0-Microsoft)

Foreword -"Shaping the Fourth Industrial Revolution"

CYBER PHYSICAL SYSTEMS

AI (Data Science)

"Artificial intelligence is software or a computer program with a mechanism to learn. It then uses that knowledge to make a decision in a new situation, as humans do. The researchers building this software try to write code that can read images, text, video or audio, and learn something from it. Once the machine has learned, that knowledge can be put to use elsewhere."

Lasse Rouhiainen

"Artificial Intelligence, 101 Things you must know about our future"

Fast growing applications

- **Static image recognition, classification and tagging.**
- **Algorithmic trading strategy performance improvements.**
- **Efficient scalable processing of patient data.**
- **Predictive maintenance**
- **Object detection and classification**
- **Content distribution on Social media**
- **Cyber security protection**
- **Chat Bots**

Expert Opinion

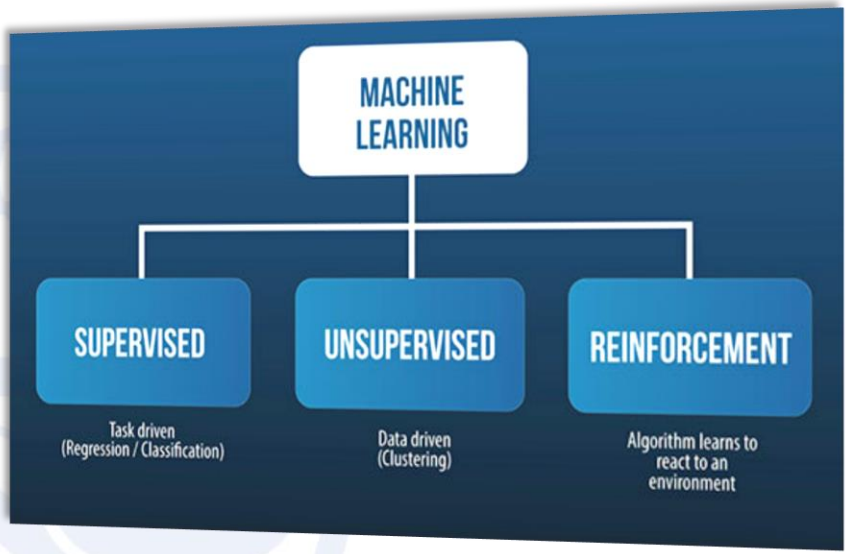
"Intelligence is the ability to adapt to change"

Stephen Hawking

Fundamentals of AI

1. Deep & machine learning at the core

2. Modes of machine learning



3. Cognitive and sensory abilities

4. Interpretation of data

AI Impact on creative thinking & Innovation

Creative Process

1. Preparation & Analysis
2. Investigation
3. Transformation
4. Incubation
5. Illumination
6. Verification
7. Implementation

People & Convention Computing

- Time consuming.
- Relative high margin of error.
- Involves right, left & subconscious combined brain manpower.
- Timeouts in thought process.
- Conventional computing is pre-programmed.

VS

AI

- Instant through Quantum computing + Big Data Analytics.
- Low margin of error.
- Integrates both left , right and subconscious deep learning.
- Unsupervised, cognitive and reinforced analysis.

AI can adopt to existing creative processes like Force field analysis, Mind mapping, Brainstorming, TRIZ, Rapid Prototyping and create its on paradigm of creativity.

Impact & Benefits of AI

Benefits

- **Perform difficult, hazardous, dangerous and boring tasks.**
- Speed of implementation.
- Improve social interactions (culture & language translation).
- Competitive advantage in innovation for Businesses.
- Ethical development.
- Address shortage of knowledge workers
- Top priority for Large Tech firms.
- Collaboration between private and public sectors.
- **Counter – Terrorism and Pre crime detection**

IoT

"Put more technically, the IoT is the interconnection of uniquely identifiable embedded computing devices. That means any device can be connected – not just computers , but various sensors and monitors, too"

Michael Miller (2015)

"The Internet of Things, How Smart TVs, Smart Homes and Smart cities are changing the world."

Connectivity of IoT could be over Mobile Broadband, Fixed Line, WIFI and Proprietary Technologies

<u>Expert Opinion</u> "Urban centers are incredible test beds for the INTERNET OF EVERYTHING, the increasing connections between all of us and digitization. Some of our most promising innovation is being fueled by cities working to create a better future for their citizens"

John Chambers (Former Chairman and CEO Cisco Systems)

Foreword - "Smart Cities, Digital Nations. How digital urban infrastructure an deliver a better life in tomorrow's crowded world."

Devices supported by IoT

- Home electronics: Smart TVs & Media servers.
- Home appliances: Fridge, Oven, Laundry, Garage door and Gate.
- Smartphones and Smart wearables
- Security and surveillance
- Automotives (Cars, Bikes & etc)
- Aircraft and Drones
- Monitoring implants heart and pacemakers
- Biochip implants – human and animals (wild life inclusive).
- Infrastructure
  - Utility grids
  - Telecommunications
  - Waste management
- Cloud systems
- City to City
- Nation to Nation
- Global

Fundamentals of IOT

- **A device is not smart unless interconnected with other network of devices** becoming something greater than any given individual device by itself. The whole is greater than the sum of its parts.

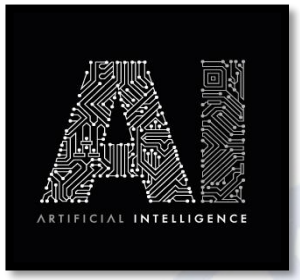
- Devices communicating together act in unison with form of **AMBIENT INTELLIGENCE** in background while automatically serving people's needs without requiring intervention.

- **Smart IoT devices** incorporate data collection, sensor monitoring, measuring and reporting environmental elements e.g. temperature, pressure, humidity, weather, climate, seismic activity, radiation , light, motion, proximity & etc forming large amounts of Big Data.

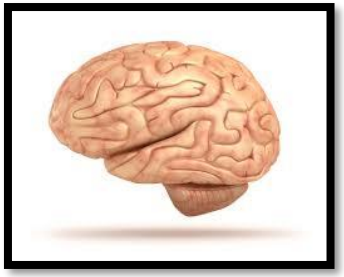
- Big data, the analysis of disparate pieces of information not originally designed to be looked at together is transmitted and actions implemented in control system pattern with self correction cycles becoming **SMARTER WITH MULTIPLE ITERATIONS.**

Relationship between AI & IOT – Neural Network

Data Storage, Analysis, creative thinking & Decision



BRAIN

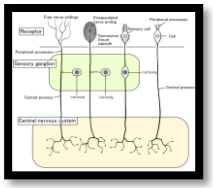


Data Communication + Activities

Motor & Nerve Network

<u>Data Harvesting</u> Monitoring, Measuring and Reporting

Sensory cells



Environmental + External Stimuli

Conventional City Eco -System

City

Sectors

Not fully integrated!!!!!

Services: Leadership, Accounting, HR, Customer Services, Legal, Marketing, Research, Directory

Smart City Eco System + AI & IOT enhancements

Needs & Priorities

- Citizens, Visitors + Relatves
- Business + Start ups
- Academia
- Public & Private institutions
- Research

Sustainable Co-existence

Integrated SSC Experience

Sustainable Value

- Safe and Social unification
- Environmentally conscious
- Economically Sustainable

Management Systems

- Integrated Vertical Sectors
- Operation Center
- Service & Info services
- Asset & Devices
- Connectivity
- ICT Infrastructure

Critical

AI + IOT

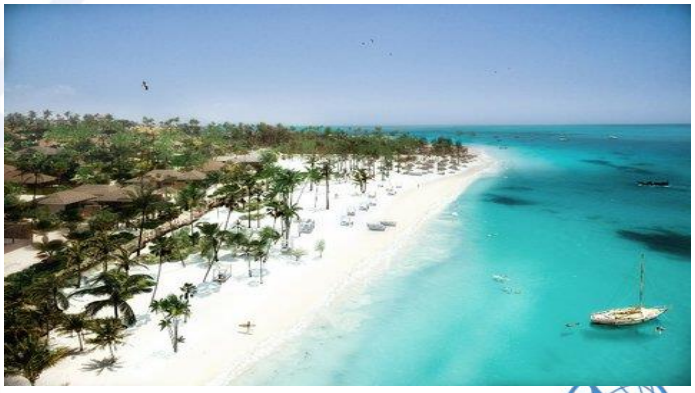
Role of Telecoms in growing ICT Eco System (Africa)

- Most Viable Solution (MVS) for Africa.
- Mobile Broadband Network expansion (3G, 4G, 5G).
- Network signal re-farming (Spectral efficiency).
- Internet penetration drives (Pricing & Promotions).
- Market development (Retail & Distribution).
- New product development and innovation.
- Device OEM strategic partnerships.
- Digital transformation strategy.
- 3rd party strategic partnerships with forward progressive enterprises.
- Aggregation of Fintech entities (E-commerce).
- Digital transformation across the 7S Mckinsey framework include critical 8th S, Speed to market.
- Public private sector partnerships.
- Regulatory synergy & policy contributions.
- Consumer education and customer experience.
- ICT CSR & Philanthropy.
- Personnel Upskilling.

Smart Cities Uses Case – Case Study Zanzibar
Customer Experience Journey

- Capital City: Zanzibar City
- Languages: English, Arabic, Kiswahili
- Religion: Islam and Christianity
- Area: 2,461 square Kms
- Pop: 1.3million
- GDP: 823m USD
- Main Industry: Tourism
- Global Wealth Ranking: 25 poorest (Aggregated with Tanzania)

Solution
Deploy AI + Cloud Computing Repository + E2E Island IoT entities



Smart Adaptive advertising - Customised Digital experience

Tourism Drive

Internet

VR + 3D augmented Reality

Virtual Apps

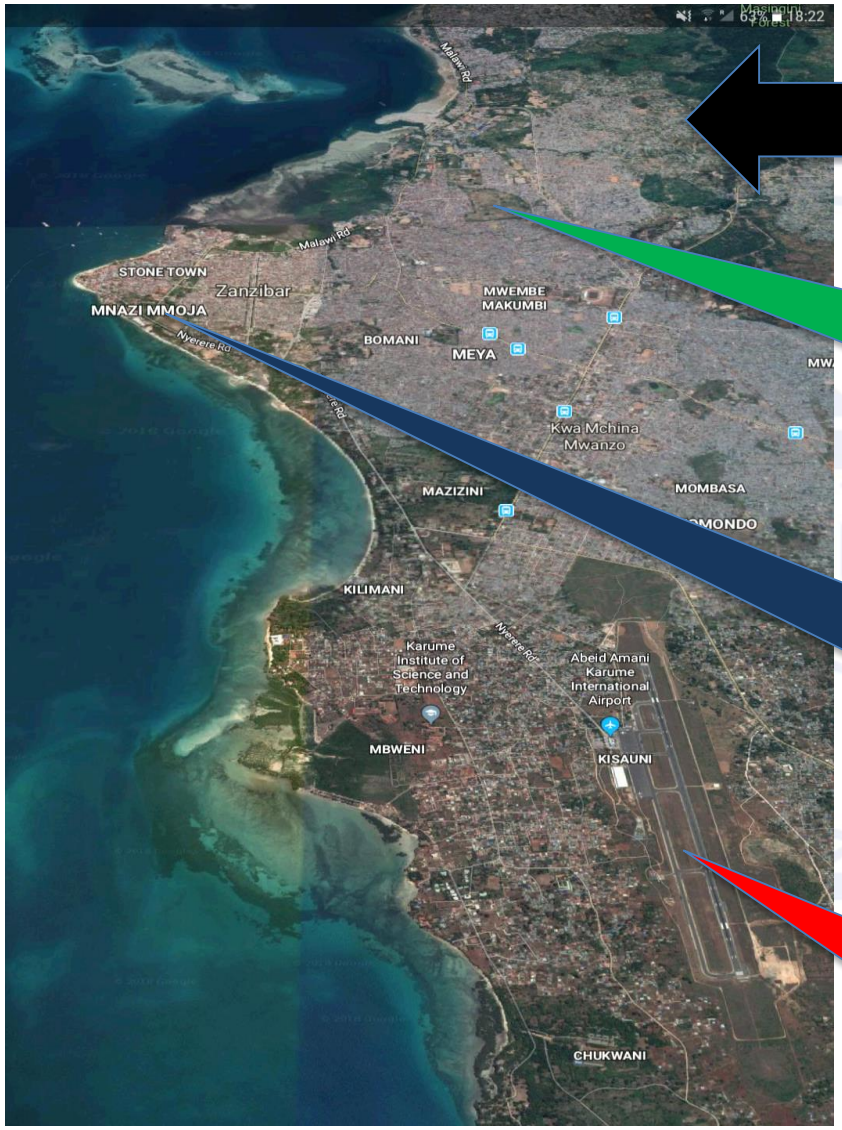
Online persona profiling

AI + IoT Eco System

- Language translation (Text & Audio)
- Cultural Interpretation & Self reference criteria
- Smart managerial economics
- Travel Itinerary + Health implications.
- Virtual Video + Audio drone experiential
- Micro segmentation & cognitive profiling.
- Seasonality alignment

Smart Travel + Experience

Self driving car with auto travel translation + Cashless Payment

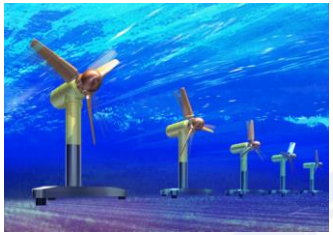


- Travel route optimisation
- Smart traffic management
- Auto Car or Shuttle rental

- Site seeing – Stone town
- Auto hotel check in
- Auto Room ambient optimisation
- Food & Menu options aligned to cultural sensitivity + medical status.

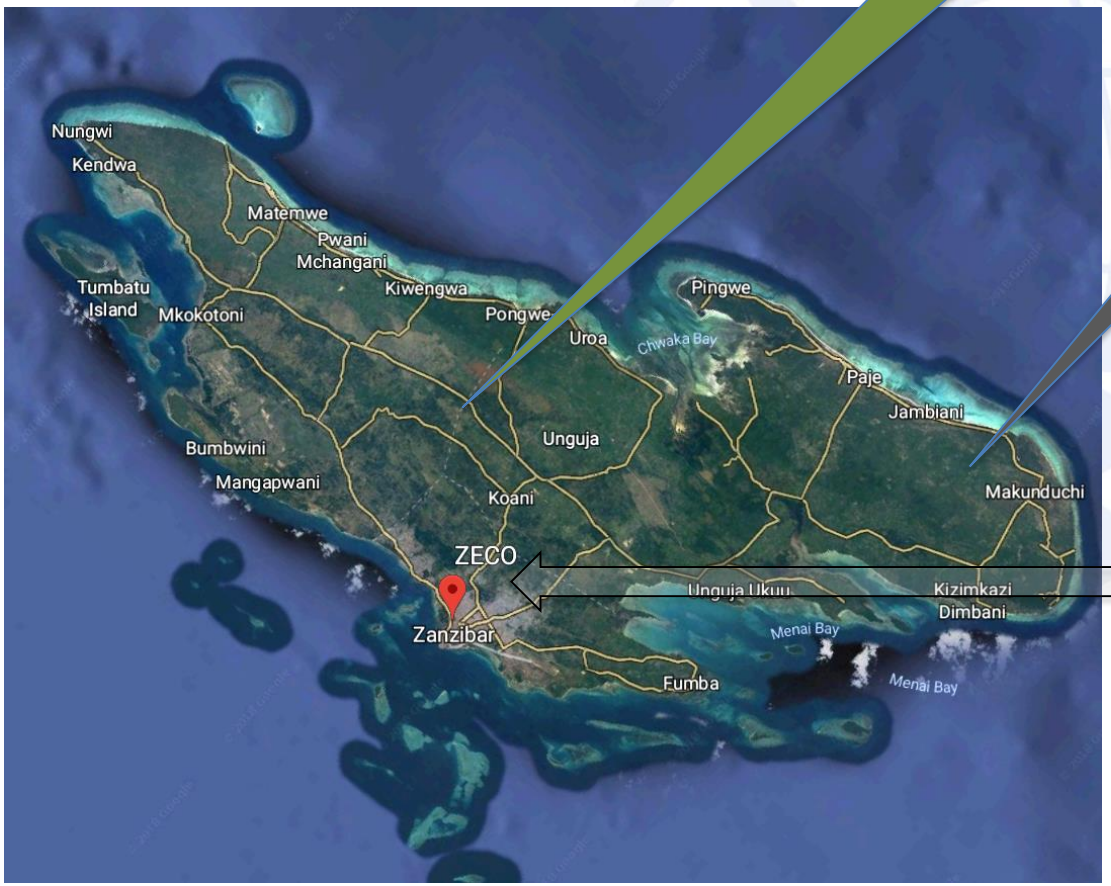
- Online biometric yellow fever authentication
- Auto passport checkout.
- Customised welcome airport arrival
- Auto Car / Shuttle rental

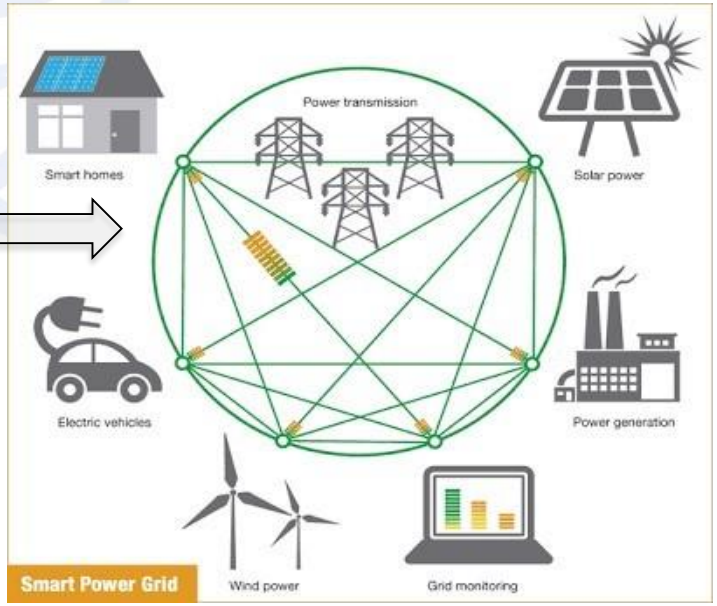
ZECO Smart Power Grid: Renewable Energy + Optimisation



Low Power Consumption

High Power Consumption





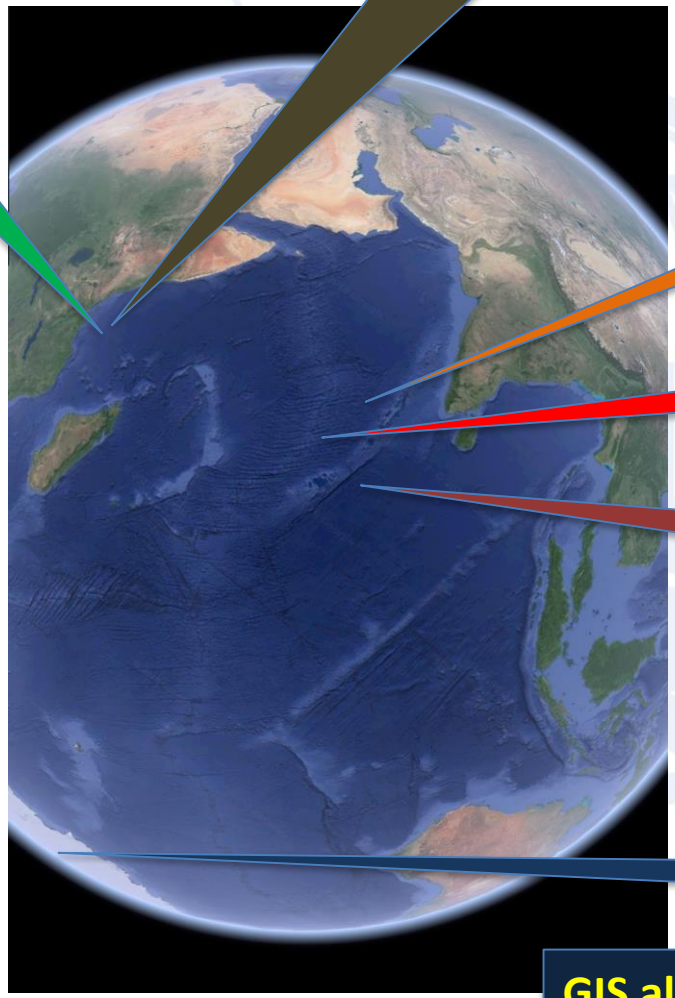
Disaster Prevention

Early Evacuation Safety

Zanzibar

Tsunami threats

Geo Satellite alignment to AI cloud



Radiation + EMF detection

Continental Plate Seismic Activity detection.

Polar Ice Cap flooding threats.

Geo Stationary Satellite

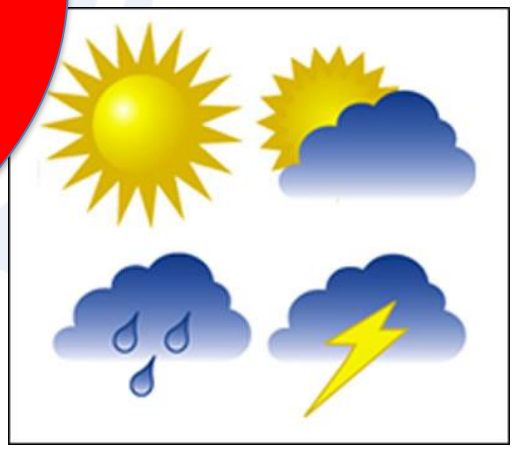
GIS aligned to AI Predictive analytics + Leading indicators for Early Warning Systems

Smart Agriculture

Global forecasts & demand Pricing

Hi-tech farming

AI + IOT
Agro
Processing
Value Chain



Local farmer

Predictive weather patterns

Smart Health

Muhimbili Hospital on TZ mainland (Inaccessible for Critical Situations)

Zanzibar Hospital Locations

- Dr Mehta's hospital
- Afya Medical Center
- Mnazi mmoja
- Al rahma
- Kidongo Chikendu
- Ali Amour
- Hospital Ya Wazazi

Patient Location Remote

Specialist doctor In India with Remote Monitoring + Medical Remedy

Smart Security & Surveillance

- Surveillance drones and cameras
- Proximity sensors
- Rapid remote security response
- RFID tags for guests
- Facial recognition
- Biometric alert systems
- Laser and thermal sensors

Smart Virtual Assistance – Leadership & Policy Makers















AI Virtual Assistant

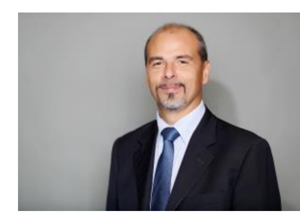
- Program Scheduling and planning
- Policy verification and Validation
- Research & aided decision making
- Event management & Virtual presence
- Productivity evaluation
- Work life balance & family



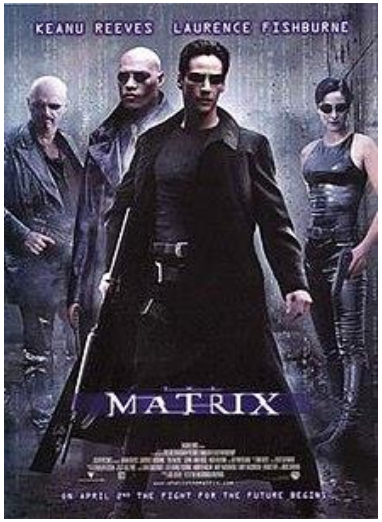


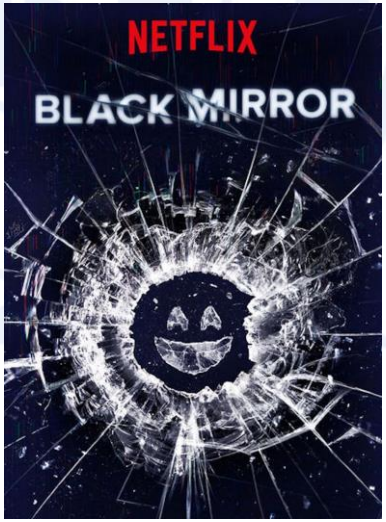




Fear and Perception of AI, IOT, SSC & Industry 4.0





Technology Taking Over: Media Driven!!!!!

Challenges & Solutions in Building AI, IoT and SSCs

Challenge	Proposed Solution
Job loss	Re-skilling in new fields of AI & Data Science
Infrastructure	Public Private partnerships with Telcos as MVS
Big Brother Watching	New regulatory rules for AI & IoT + Privacy Protection
Standardization	Refer to next slide
Investment Cost	Phased approach of roll out

Standardization of SSCs

- ITU-T SG20:IoT & its applications including smart cities & communities (SC&C)
- ISO/IEC JTC 1: Identify the ICT-specific standardisation requirements based on an understanding of the particular needs of Smart Cities.
- ISO 37120 Sustainable development & resilience of communities - Indicators for city services & quality of life.
- SO/TR 37150: Smart community infrastructures - Review of existing activities relevant to metrics.
- ISO 37101 Sustainable development & resilience of communities - Management systems - General principles & requirements.
- ISO 37102 Sustainable development & resilience of communities – Vocabulary
- ISO/TR 37121 Inventory & review of existing indicators on sustainable development & resilience in cities
- ISO/TS 37151 Smart community infrastructure metrics - General principles & requirements
- ISO/TR 37152 Smart community infrastructures -- Common framework for development & operation

“The best way to predict the future is to design it”

R. Buckminster Fuller

THANK YOU FOR LISTENING

Additional Information

Bio

Member

- UMS
- ICTAU
- CIM
- NACOBA
- USAT

Positions

- Head of Products (Marketing): Airtel Uganda
- Executive Producer & Head of Strategy Oversight: Wandulu Productions (Media House)
- Co-Founder & CEO: HUB360° - Start Up Think Tank
- Co-Founder and Marketing Head: HISMAK – Power and Renewable energy
- TV Co-Host – Upcoming show "Marketing Connect" by Uganda Marketers Society (UMS).

Experience:

- 10 years' experience in NPD of Internet, VAS, Enterprise, Devices & Digital solutions.
- Ventured into digital media production, content development, scriptwriting, executive production

Qualifications

- B.Sc. Tel. Engineering – University of Dar-es-Salaam Tanzania
- CIM Professional Diploma Marketing - Digital Strategy Level 6
- CIM Professional Certificate in Marketing – CIM Level 4
- Masters in International Business Administration: Paris ESLSCA Business School (ongoing)
- PGD in Management – Paris ESLSCA Business school (ongoing)

My guiding philosophy : "As i grow older, am less inclined to worry about the lost days of my youth as compared to the untapped potential of my brain's thought processes".

Contacts

- **Name:** Simon Peter Akugizibwe
- **Country:** Uganda
- **Email:** smgpeters@gmail.com
  simon.Akugizibwe@ug.airtel.com
- **Contact:** +256752604966
  +256754006706
- **Address:** P.O. BOX 119, Kyambogo, Kampala.
- **Twitter:** @smgpeter
- **Facebook:** https://www.facebook.com/akugizibwe.peter
- **Skype:** simonpeterak
- **LinkedIn:** https://www.linkedin.com/in/smgpeters/