Systems Thinking for SDGs:

- ✓ Leaving no one behind
- ✓ Multistakeholder partnerships
- ✓ Inclusiveness and interdependence
- ✓ Interconnectedness & indivisibility

GIS is the nervous system for abstracting, perceiving, organizing, interpreting and anticipating events across space over time!

2021 GEOGEEK MAPP CHALLENGE | Mapping for a sustainable future

Realizing the Sustainable Development Goals (SDGs): The GIS Perspective

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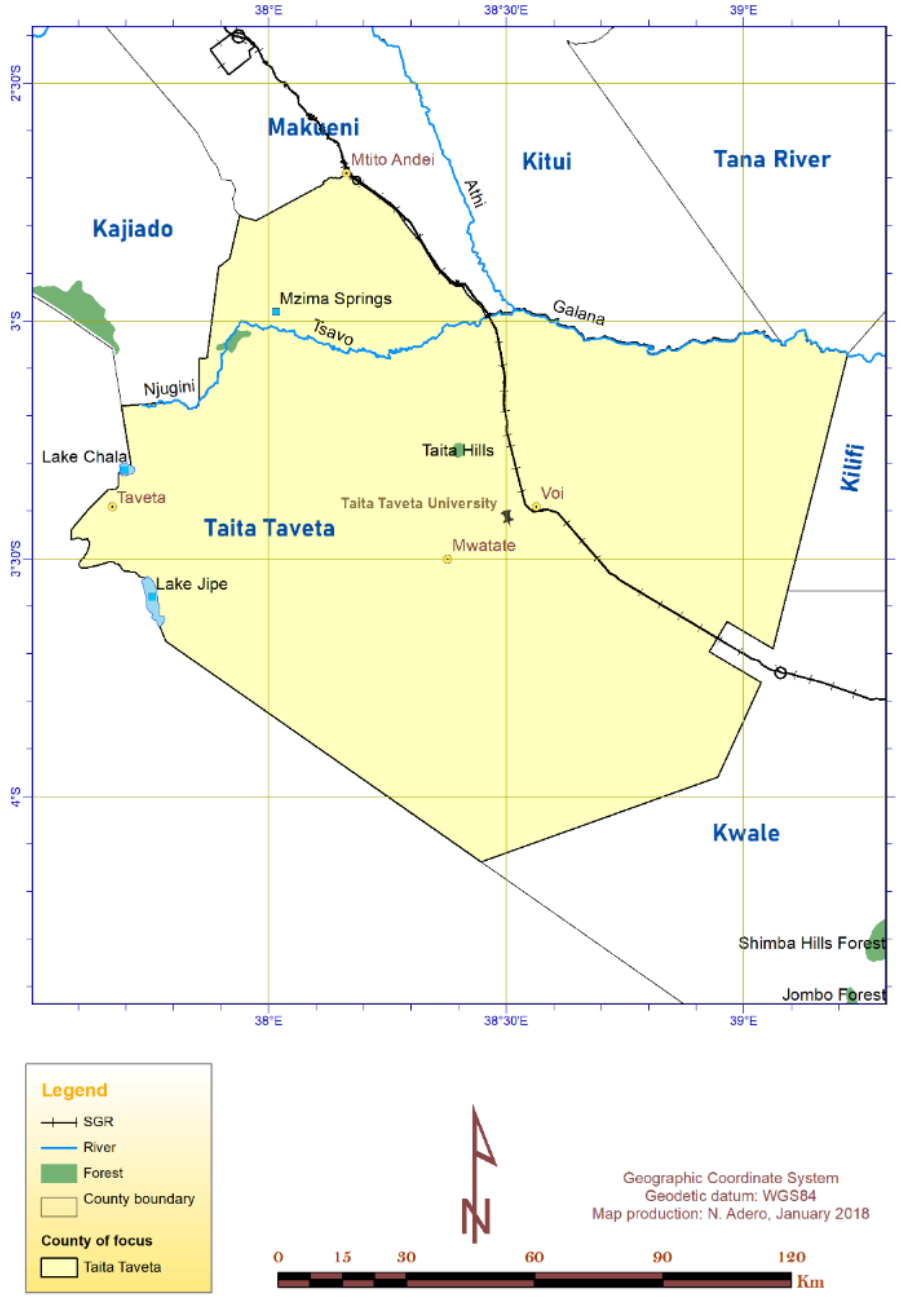
@hopadero

Date: 07 October, 2021
12:00 – 13:00 EAT

Empowering inclusive and sustainable transformation

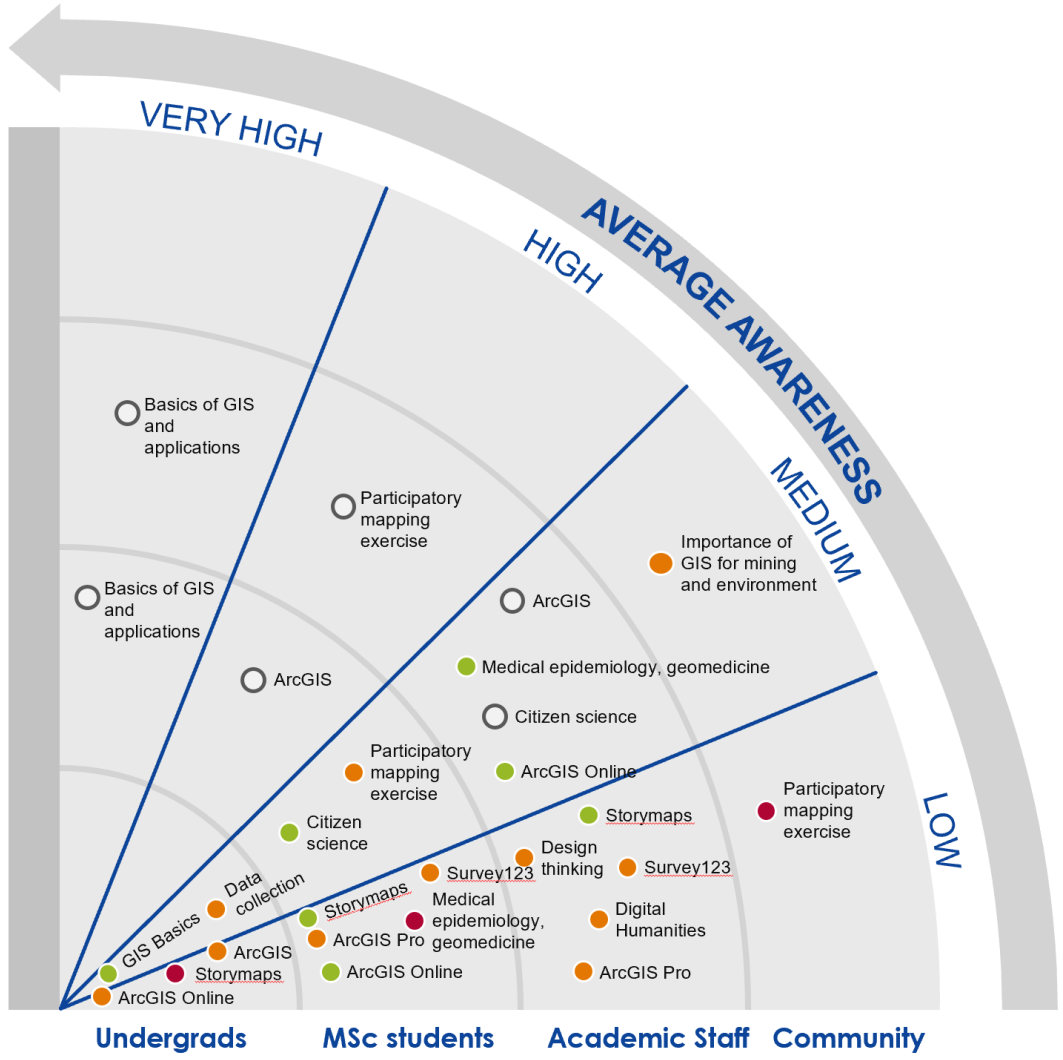
Where is Taita Taveta University?



Synthesis of GIS training needs from teaching and interaction experience

Adero (2019)

Mapping GIS by user training needs at TTU



- Low training need
- Basic training need
- High training need
- Extreme training need

LESSONS FROM HONG KONG, JUNE 2019

Background Highlights

Scale, location, trends and patterns

Sustainability is an old concept with roots traceable to the linkages between mining and forestry in the early 18th century as a need arose to avert a looming wood crisis due to silver mining in Freiberg (Silver City).

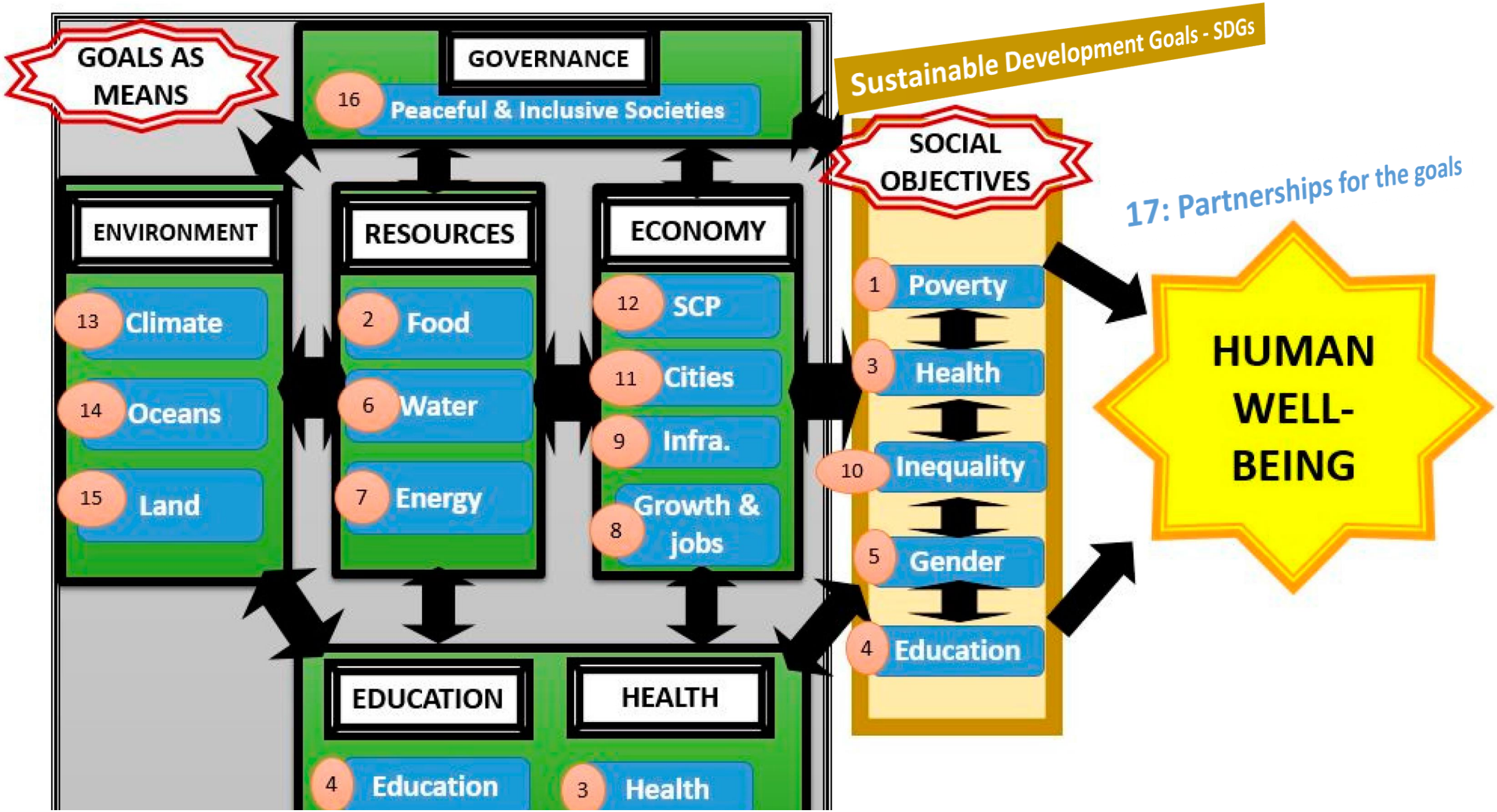
Key points:

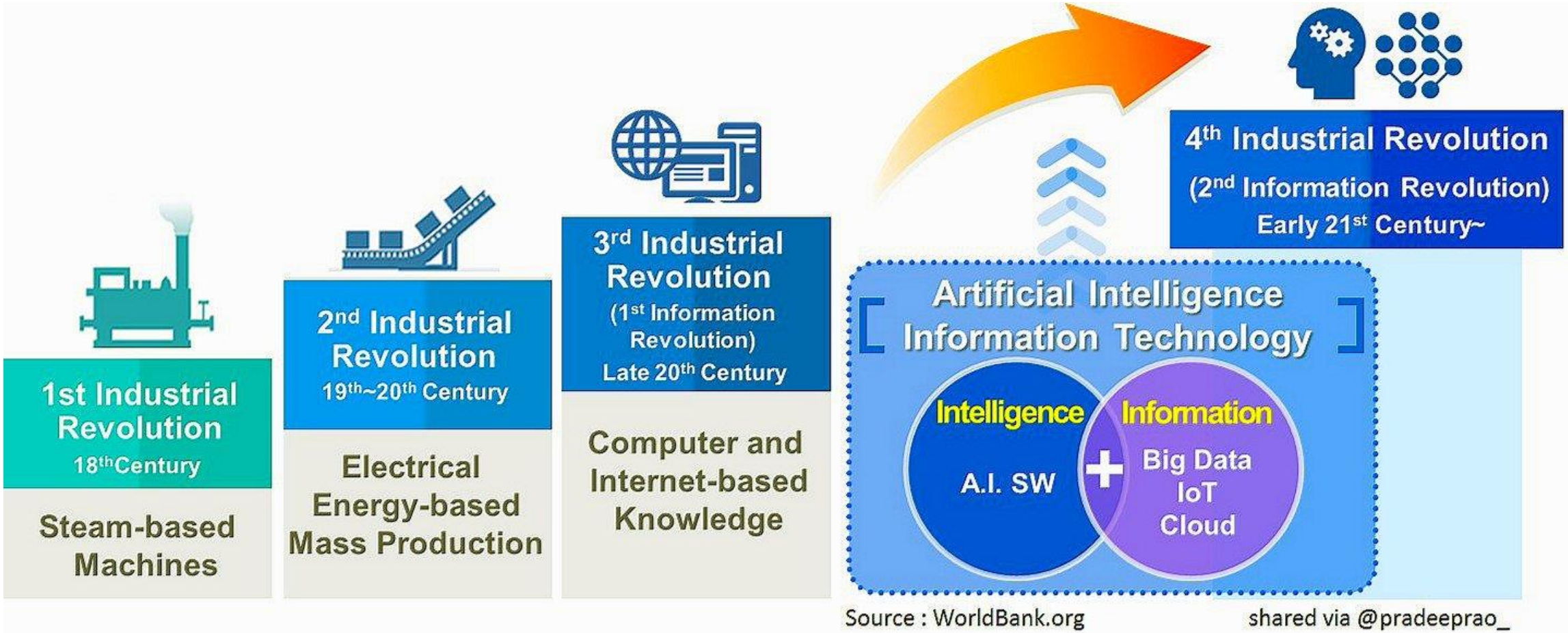
We are all one with the rest of nature

We live in an interconnected world

"Dividing an elephant in half doesn't produce two small elephants" – unintended consequences

Location-based intelligence is the heart of today's geodata-driven digital revolution


GOALS AS MEANS
GOVERNANCE
16 Peaceful & Inclusive Societies
Sustainable Development Goals - SDGs
SOCIAL OBJECTIVES
17: Partnerships for the goals
ENVIRONMENT
13 Climate
14 Oceans
15 Land
RESOURCES
2 Food
6 Water
7 Energy
ECONOMY
12 SCP
11 Cities
9 Infra.
8 Growth & jobs
1 Poverty
3 Health
10 Inequality
5 Gender
4 Education
HUMAN WELL-BEING
EDUCATION
4 Education
HEALTH
3 Health


1st Industrial Revolution
18thCentury
Steam-based Machines
2nd Industrial Revolution
19th~20th Century
Electrical Energy-based Mass Production
3rd Industrial Revolution
(1st Information Revolution)
Late 20th Century
Computer and Internet-based Knowledge
4th Industrial Revolution
(2nd Information Revolution)
Early 21st Century~
Artificial Intelligence
Information Technology
Intelligence
A.I. SW
Information
Big Data
IoT
Cloud
Source : WorldBank.org
shared via @pradeeprao_

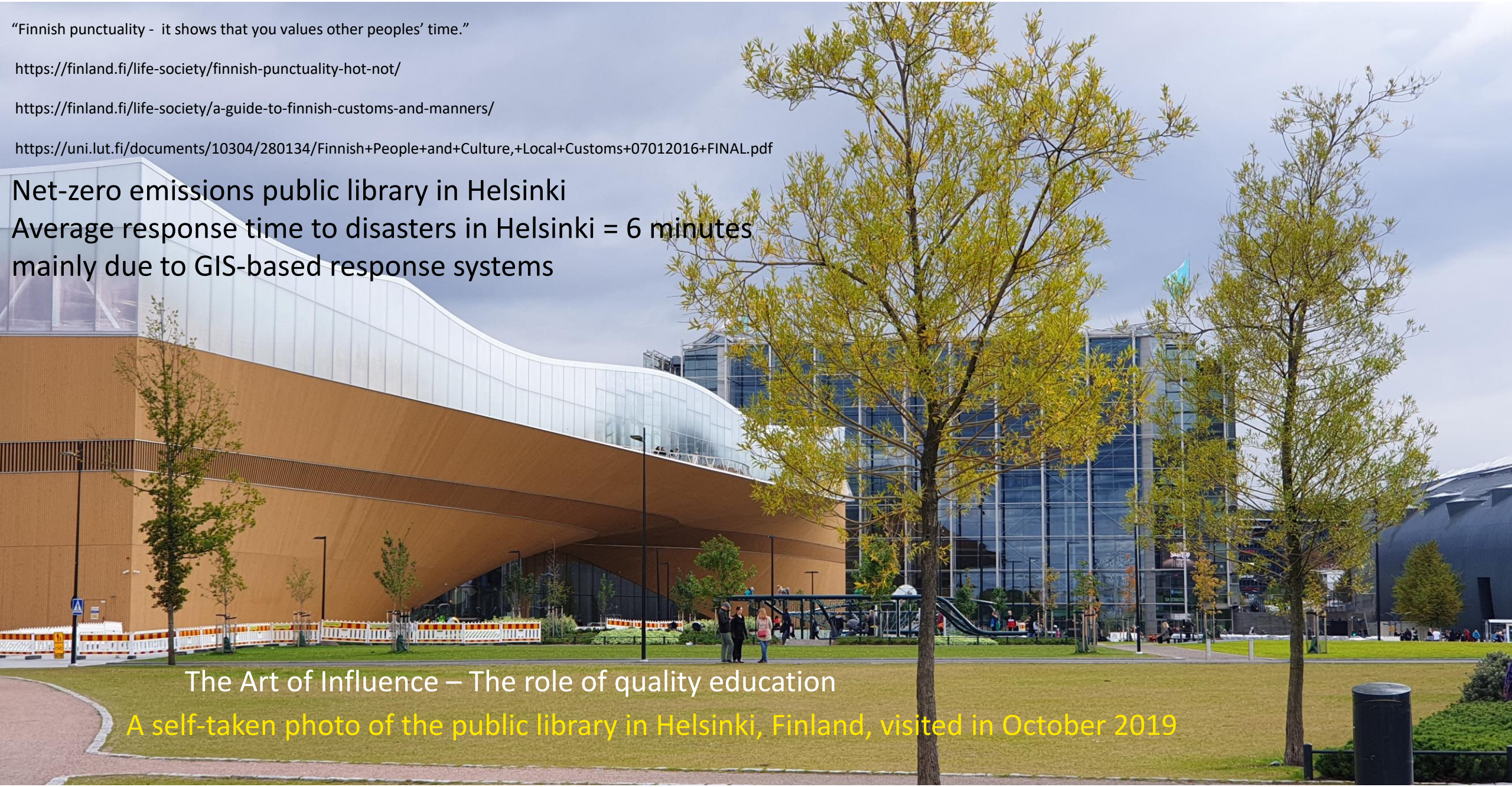
“Finnish punctuality - it shows that you values other peoples’ time.”

https://finland.fi/life-society/finnish-punctuality-hot-not/

https://finland.fi/life-society/a-guide-to-finnish-customs-and-manners/

https://uni.lut.fi/documents/10304/280134/Finnish+People+and+Culture,+Local+Customs+07012016+FINAL.pdf

Net-zero emissions public library in Helsinki
Average response time to disasters in Helsinki = 6 minutes
mainly due to GIS-based response systems



The Art of Influence – The role of quality education

A self-taken photo of the public library in Helsinki, Finland, visited in October 2019

World Population by Region

back to top ↑

#	Region	Population (2020)	Yearly Change	Net Change	Density (P/Km²)	Land Area (Km²)	Migrants (net)	Fert. Rate	Med. Age	Urban Pop %	World Share
1	Asia	**4,641,054,775**	0.86 %	39,683,577	150	31,033,131	-1,729,112	2.2	32	0 %	59.5 %
2	Africa	**1,340,598,147**	2.49 %	32,533,952	45	29,648,481	-463,024	4.4	20	0 %	17.2 %
3	Europe	**747,636,026**	0.06 %	453,275	34	22,134,900	1,361,011	1.6	43	0 %	9.6 %
4	Latin America and the Caribbean	**653,962,331**	0.9 %	5,841,374	32	20,139,378	-521,499	2	31	0 %	8.4 %
5	Northern America	**368,869,647**	0.62 %	2,268,683	20	18,651,660	1,196,400	1.8	39	0 %	4.7 %
6	Oceania	**42,677,813**	1.31 %	549,778	5	8,486,460	156,226	2.4	33	0 %	0.5 %

Worldometer Dec 24, 2020

Comparative Metrics on Africa

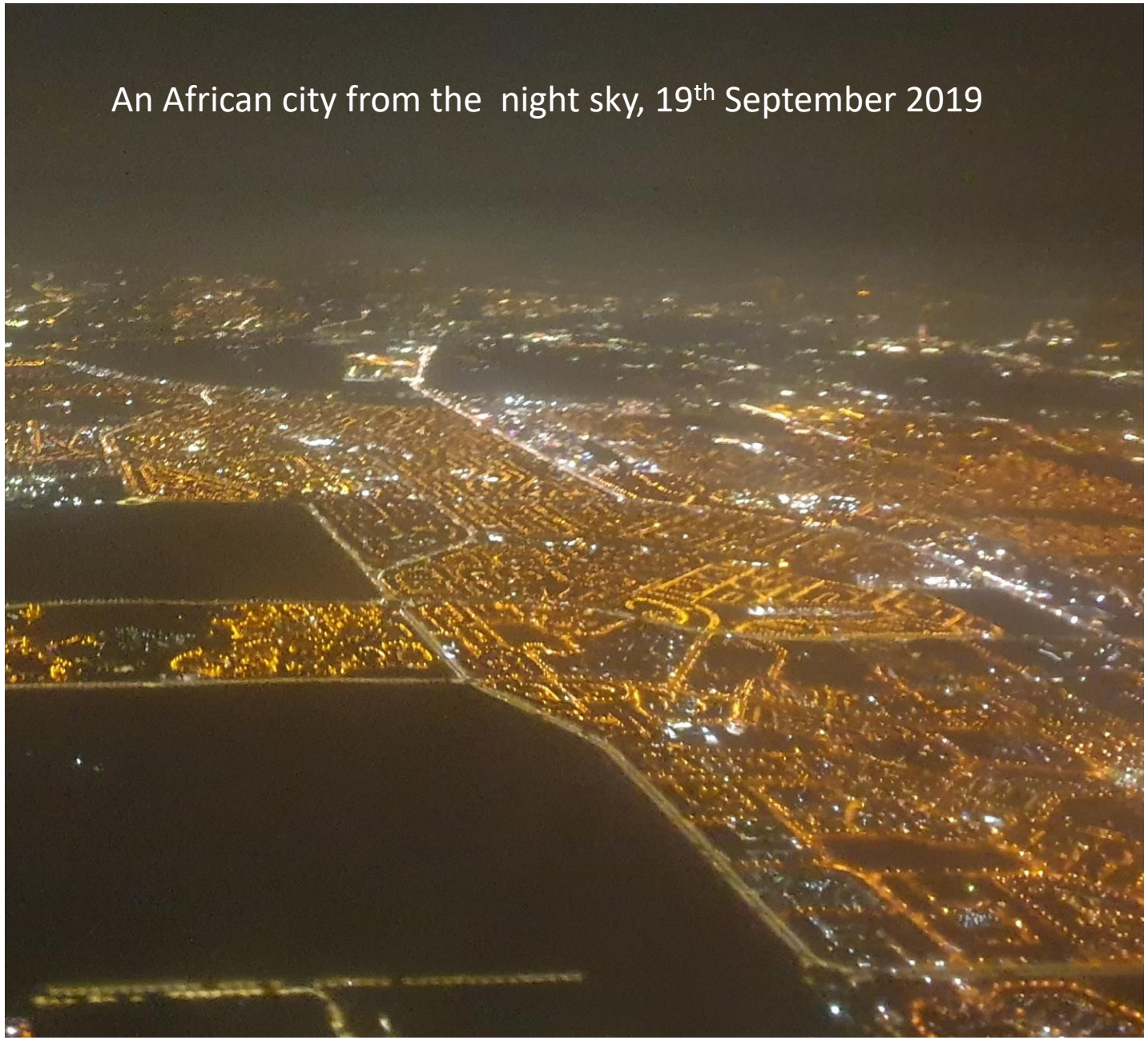
19.4 Median age in Africa, compare 38 in USA, 47 in Japan and Germany, Kenya 19.7

1.3 Billion Africa's population, compare 7.7 Billion world population

61/64 Africa's average male/female life expectancy in 2018, compare 70/74 global average, and 59 Kenya's average

43% Urban Africa, compare 55% global, 49% Asia, 81% L.A.C, 77% Europe, 82% N.A, Kenya 27%

Source: Statista 2019, Indexmundi 2019, Worldometer 2019, World Bank 2019.



We are at a critical juncture on an exciting journey of generational succession.

The Silent Generation:
World War
Born 1925 - 1945

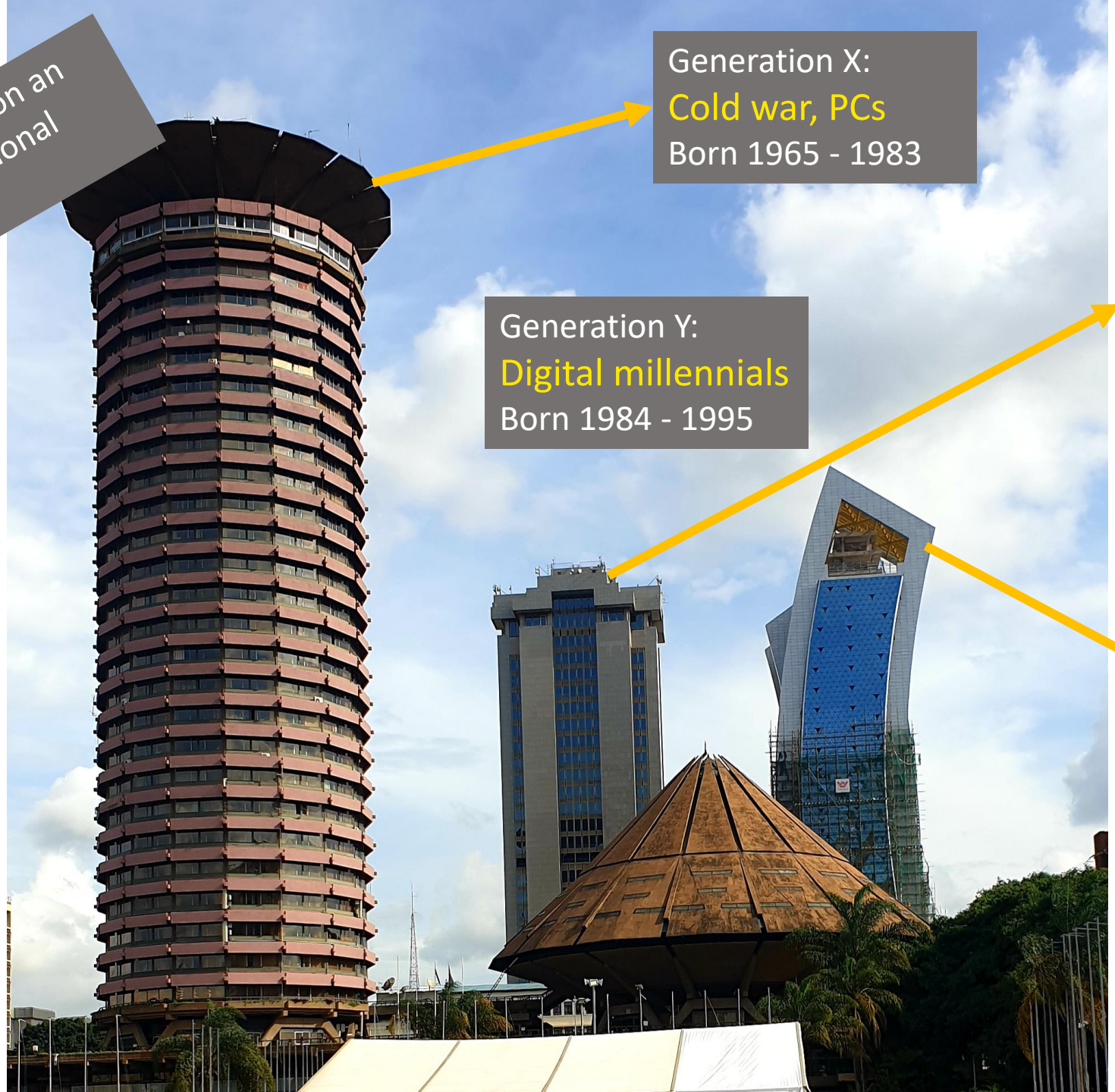
The Baby Boomers:
Space Age, post-war optimism
Born 1946 - 1964

Generation X:
Cold war, PCs
Born 1965 - 1983

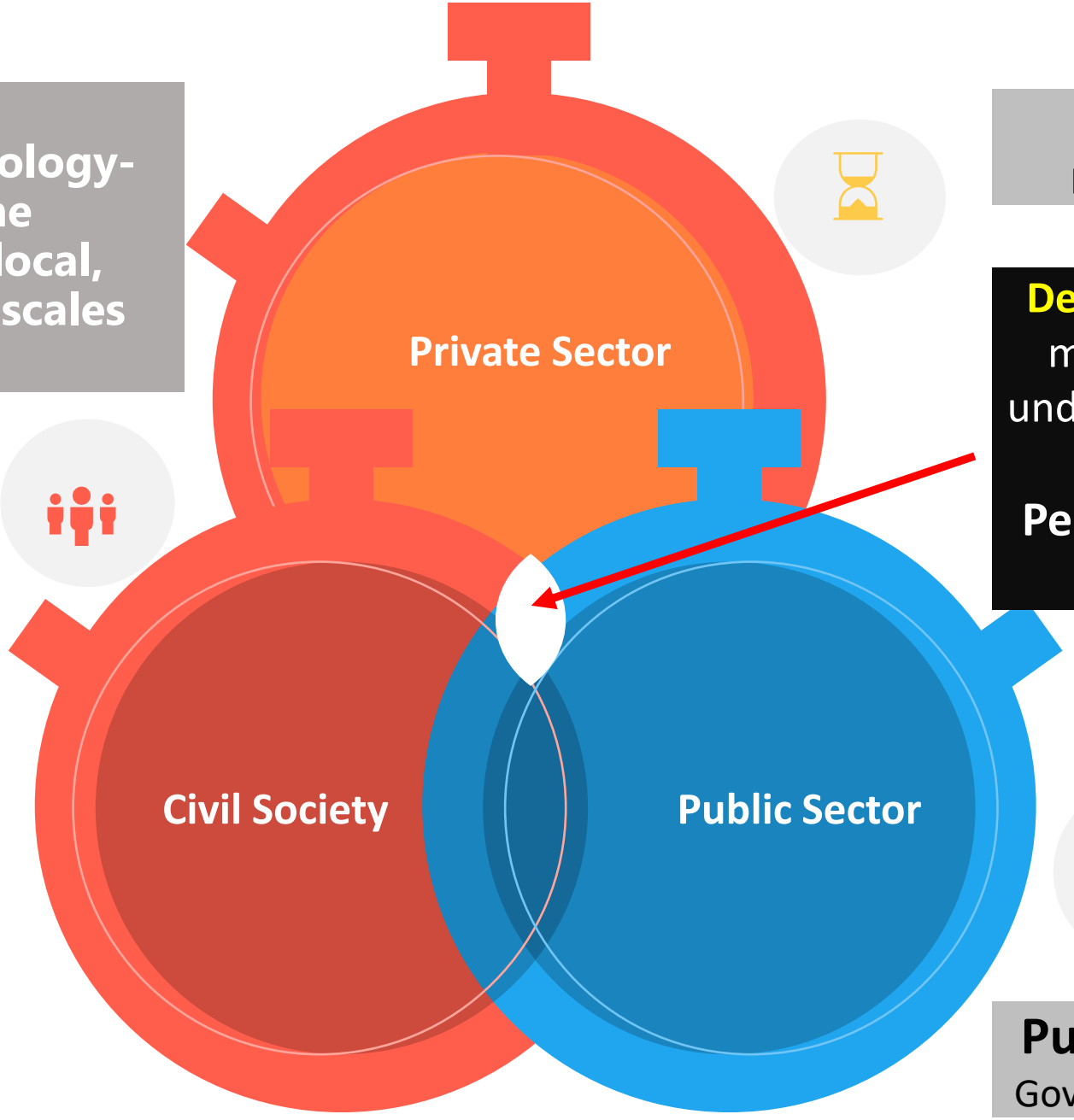
Generation Y:
Digital millennials
Born 1984 - 1995

Generation Z:
Netizens
Born 1996 - 2012

Generation Alpha:
AI
Born 2013 - 2025



Knowledge and technology-led influence unites the spheres of impact on local, regional & planetary scales



Private Sector:
Business, Commerce, Market

Democratisation of decision-making resources | Shared understanding & governance | 5Ps of SDGs:
People, Planet, Prosperity, Peace, Partnerships

Decade of delivery

Vision 2030:
Social, Economic, Political Pillars

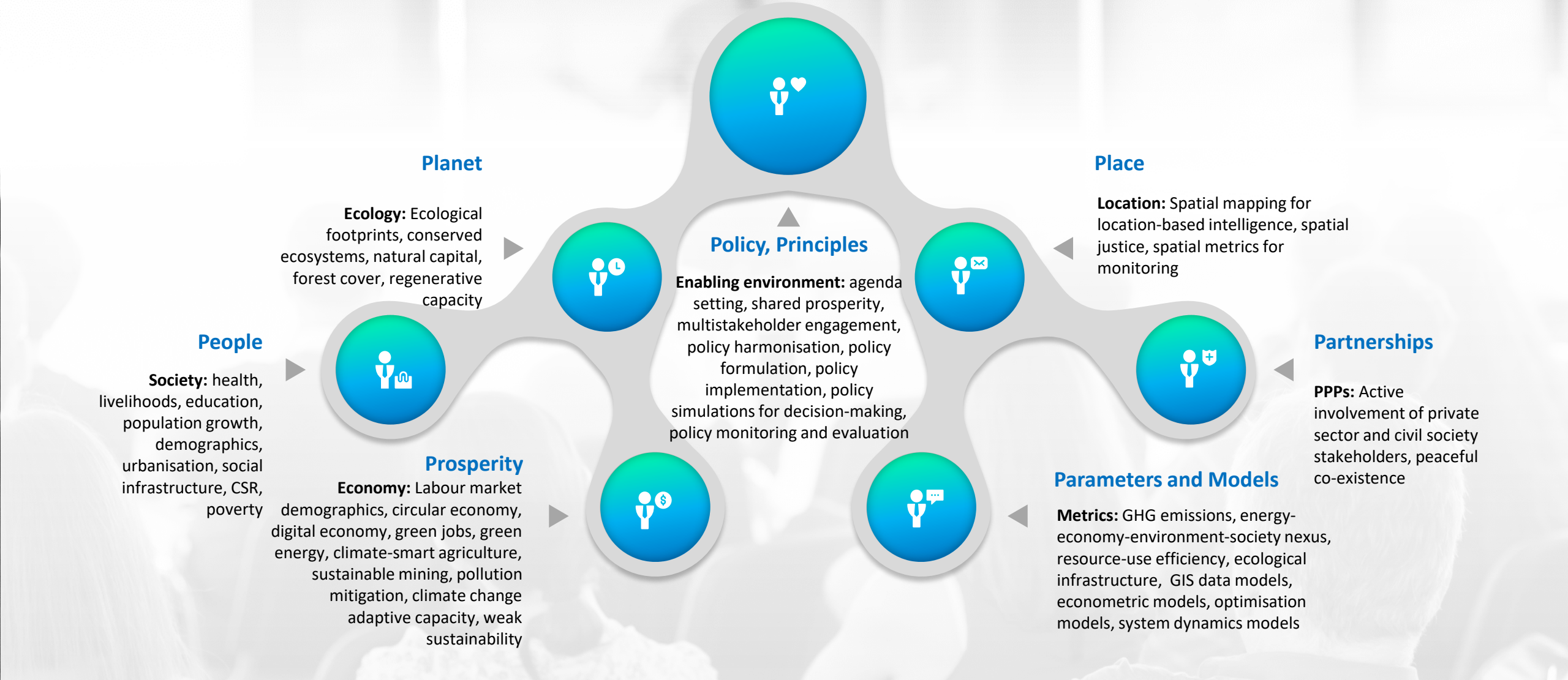
Civil Society:
Voluntary communities and social groups or movements: NGOs, FBOs, CBOs, trade unions, academic institutions, professional bodies, foundations and charities, humanitarian bodies, non-profits

Public Sector:
Government, State

Source: Constructed by Adero, 2019

GIS and Systems Thinking for Sustainability: 7Ps

A synthesis by Nashon Adero based on participation in 20 mining and natural resource management conferences across the world (2017 – 2020)



Planet

Ecology: Ecological footprints, conserved ecosystems, natural capital, forest cover, regenerative capacity

People

Society: health, livelihoods, education, population growth, demographics, urbanisation, social infrastructure, CSR, poverty

Prosperity

Economy: Labour market demographics, circular economy, digital economy, green jobs, green energy, climate-smart agriculture, sustainable mining, pollution mitigation, climate change adaptive capacity, weak sustainability

Policy, Principles

Enabling environment: agenda setting, shared prosperity, multistakeholder engagement, policy harmonisation, policy formulation, policy implementation, policy simulations for decision-making, policy monitoring and evaluation

Place

Location: Spatial mapping for location-based intelligence, spatial justice, spatial metrics for monitoring

Partnerships

PPPs: Active involvement of private sector and civil society stakeholders, peaceful co-existence

Parameters and Models

Metrics: GHG emissions, energy-economy-environment-society nexus, resource-use efficiency, ecological infrastructure, GIS data models, econometric models, optimisation models, system dynamics models

Geography and health

Good health and well-being – **SDG 3**

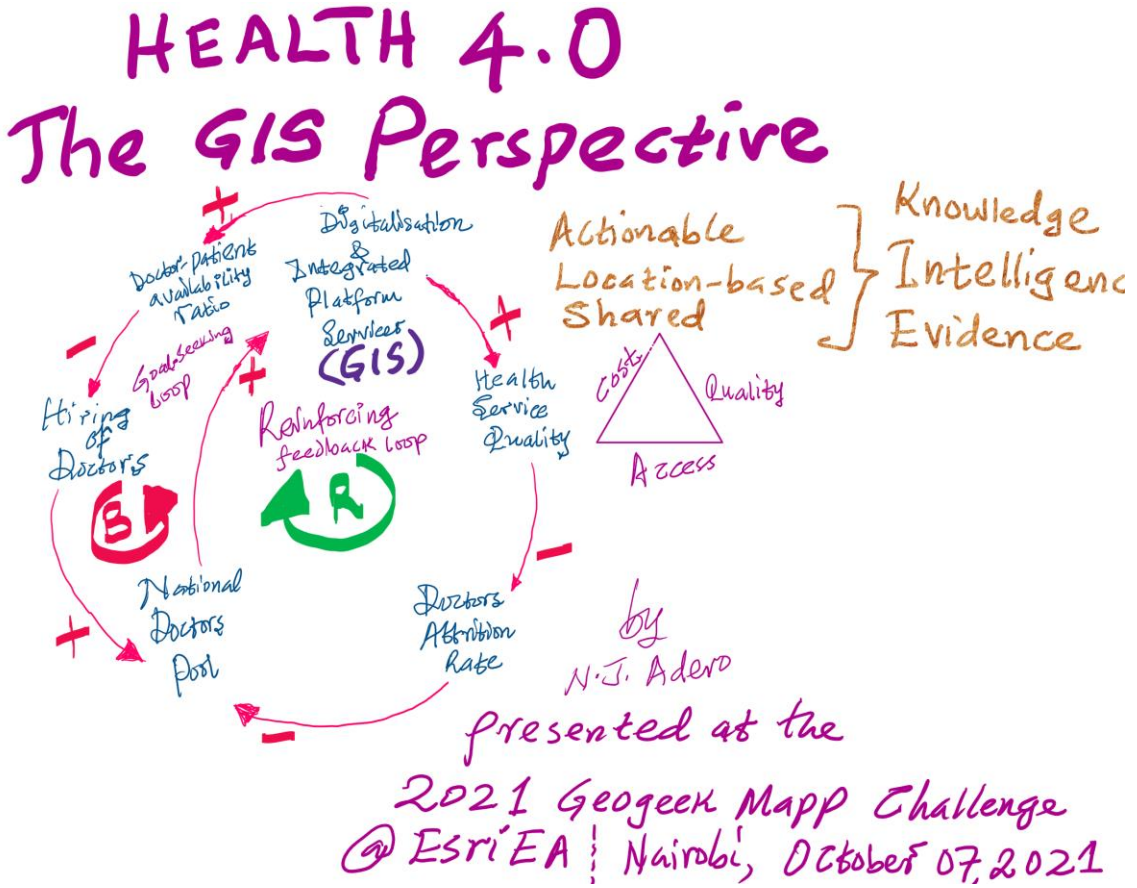
Geomedicine = geography + health: where you live determines your health through the water, air, resources, etc. you consume and the social circles you interact with!

Dr John Snow's map of the 19th century for cholera research confirmed the critical place of mapping in health

Biogeography – Alexander von Humboldt used maps to study abstract aspects at the intersection of geography and biology

Dynamic modelling for health sector planning leveraged by GIS

- SDG 3



Way forward in eHealth

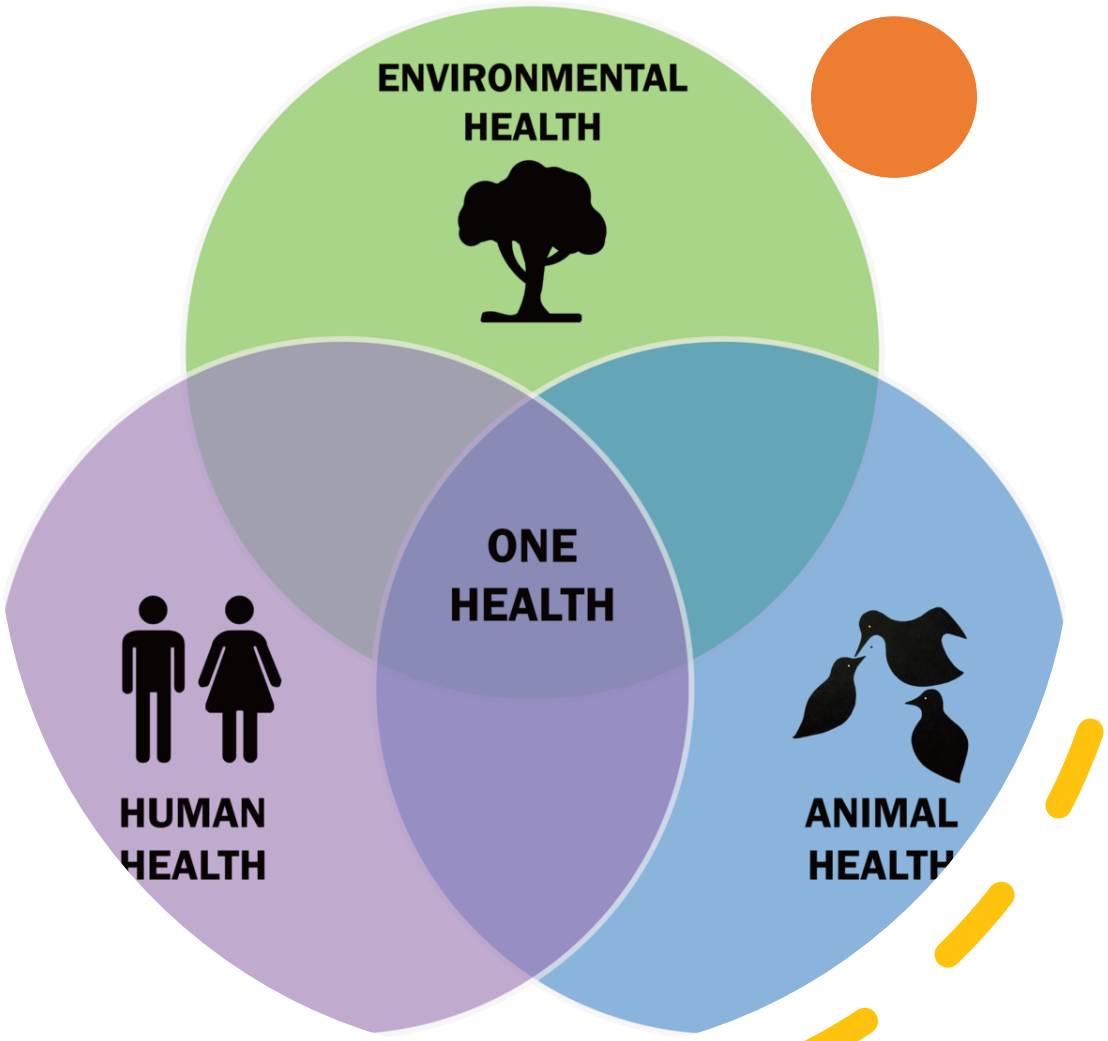
Delivery of medicine and other health-related supplies using satellite **navigation** and **positioning** technologies → Potential in unmanned aerial vehicles (**UAVs**) → Mapping for equitable policy decisions

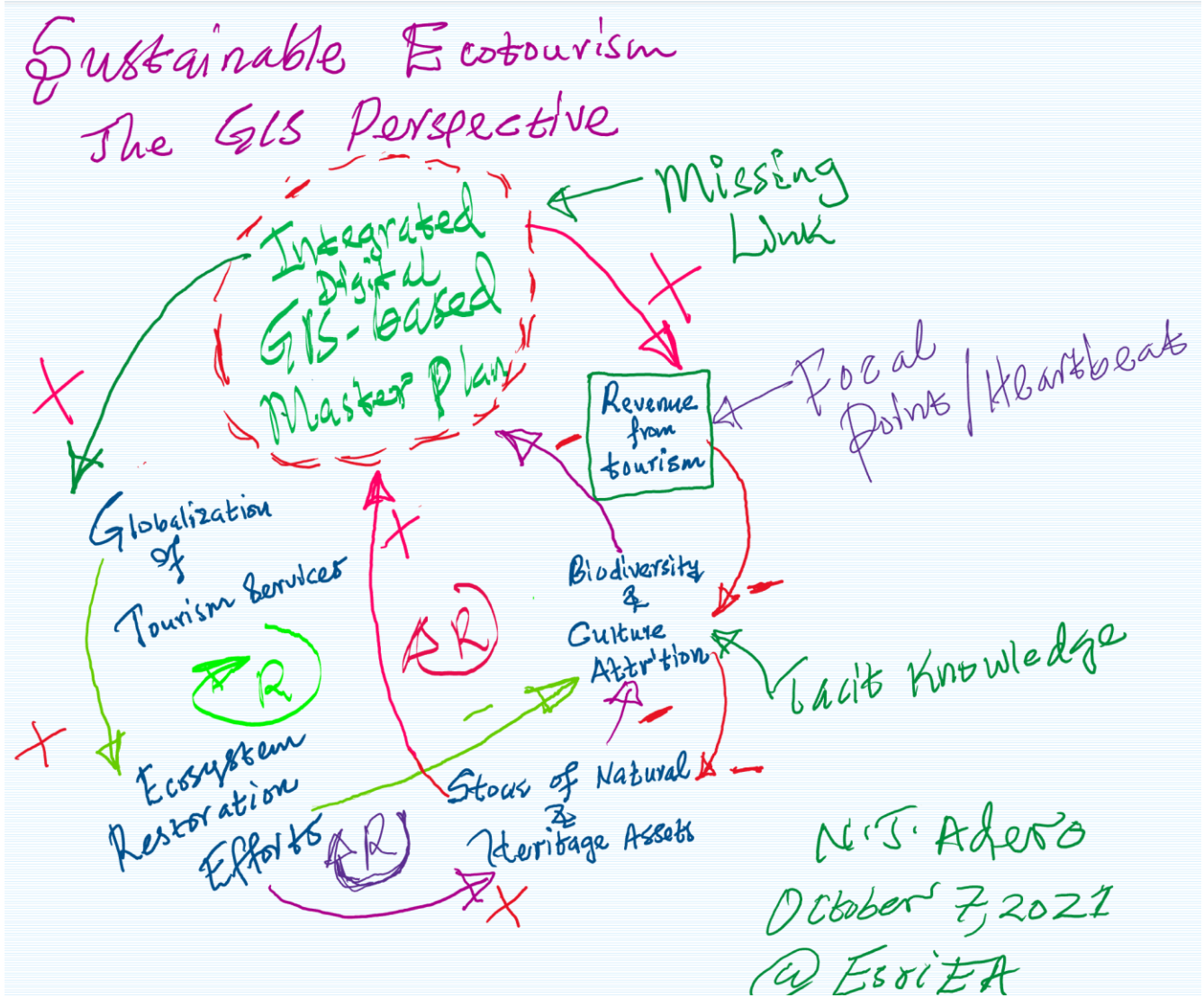
↓

Improving clinical diagnostics using **FAIR** standards and integrated health informatics anchored on databases with GIS-mapped environmental variables → Application of AI, ML, robotics and telemonitoring for measuring and evaluating health outcomes → Social inclusion in awareness raising using **mapped** and **shared visual** evidence

↓

Predictive public health management based on spatio-temporal models

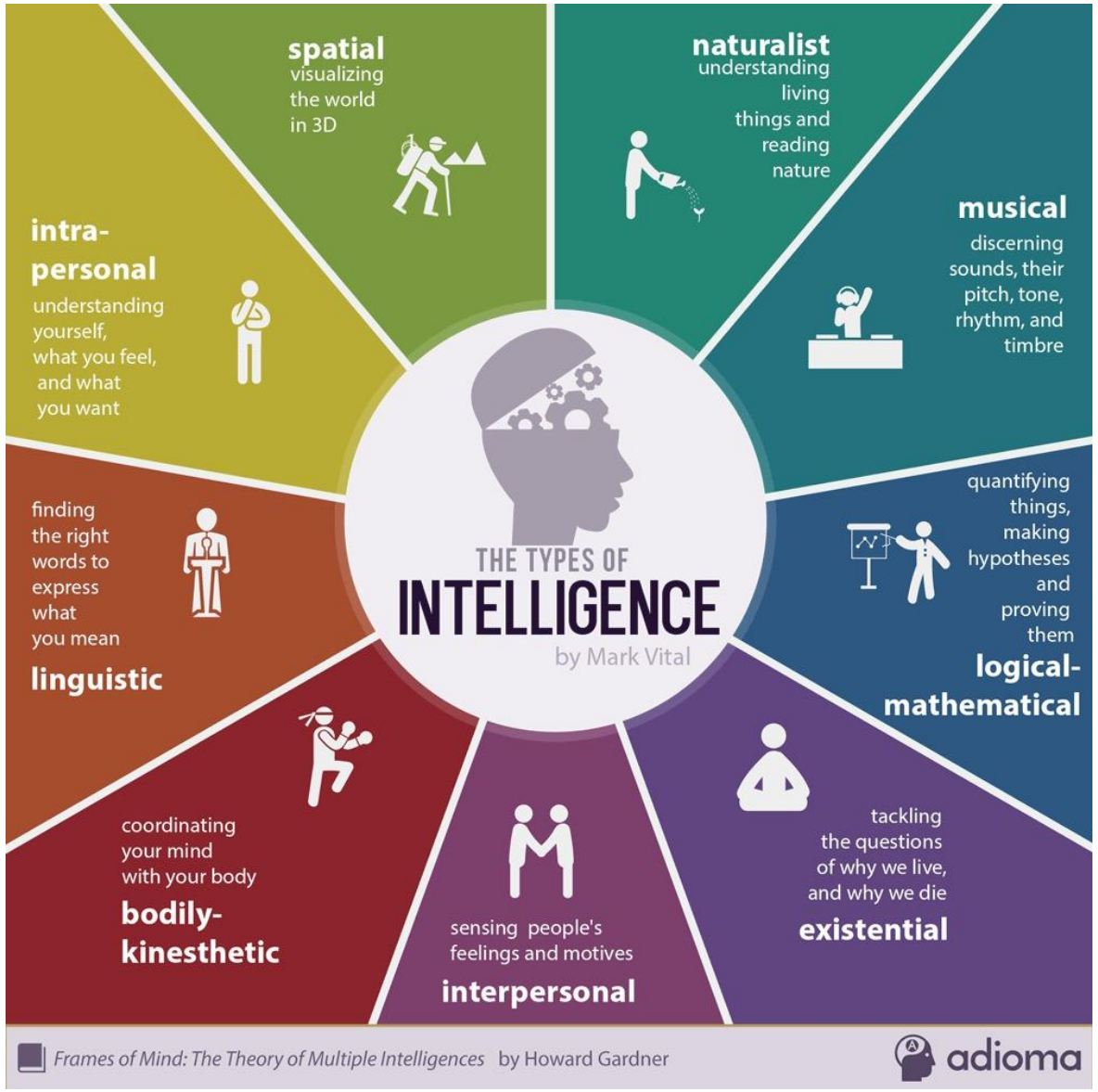




Dynamic modelling for Sustainable ecotourism leveraged by GIS

- SDG 8
- SDG 15

Education 4.0: Contextual Intelligence



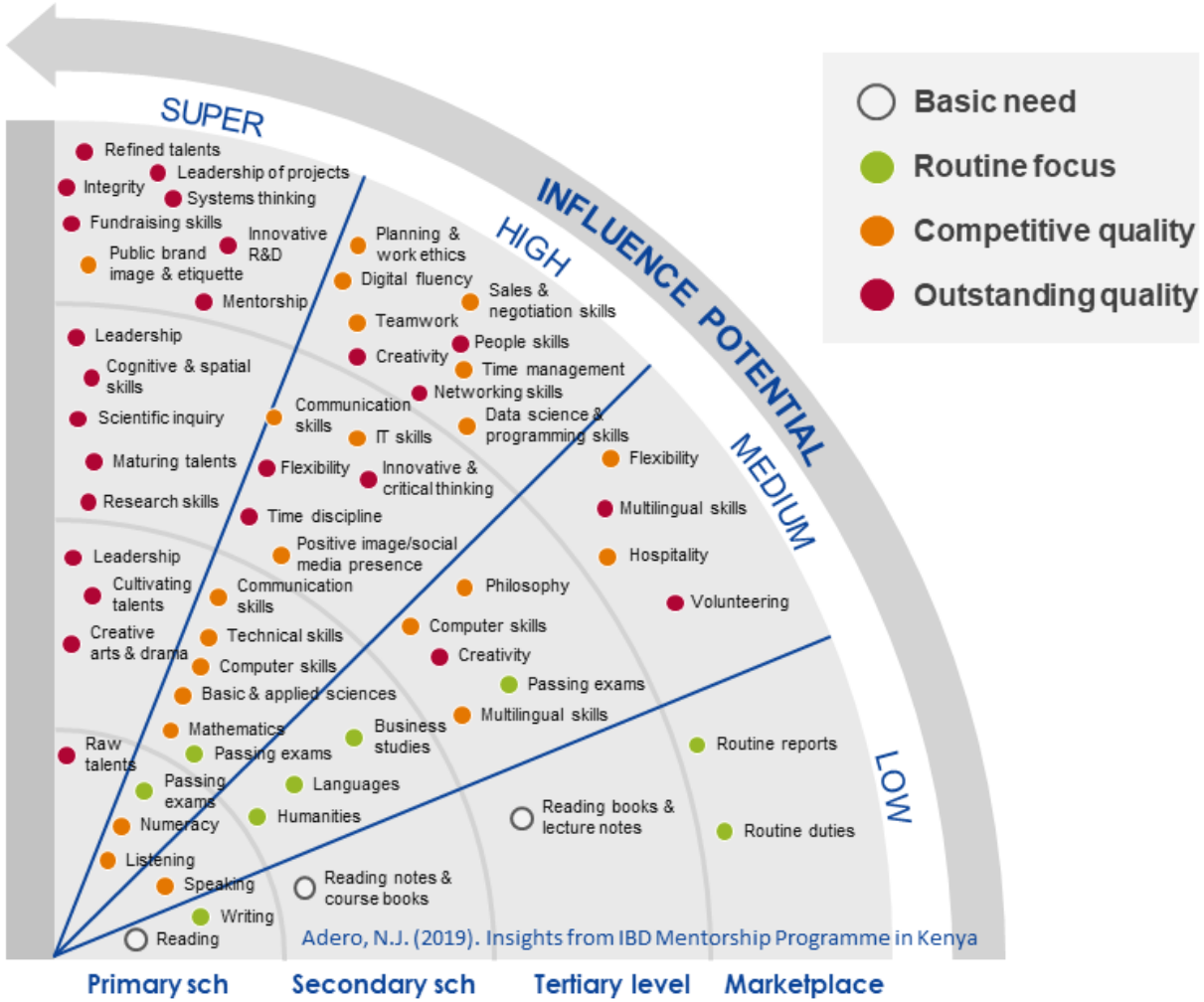
The Future of Work

The **Future of Work** requires a radical shift in Kenya's education and skills development paradigm.

65%

Primary school pupils who will be engaged in jobs which still don't exist yet! (Davison, 2012)

The Curve of Influence vs. the Crux of Formal Education



Are you equipping yourself with the competencies needed to face the future: ***digital fluency, lifelong learning, automation, artificial intelligence, machine learning, big data,*** etc.?

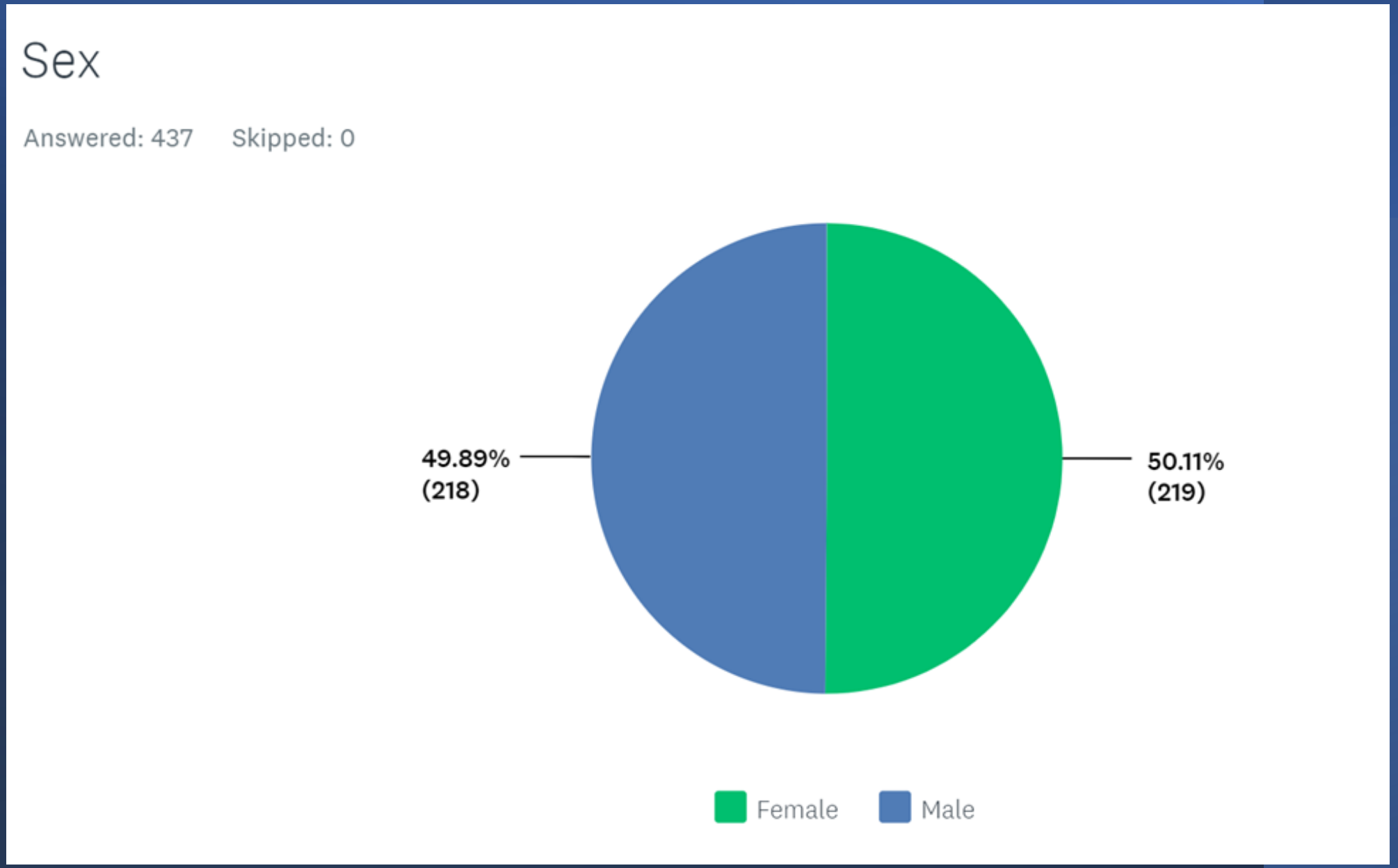
GLOBALISATION AND TRANSFERABLE SKILLS

Seeing #results, worrying about the #reason, mismanaging the #resource, and neglecting the #source?

The challenge progressive #education must address in the post-pandemic era of #DigitalTransformation

Digital Literacy	→	Digital Fluency
Data Literacy	→	Data Fluency
Local Awareness	→	Global Awareness
Raw Talents	→	Mentored & Refined Talents
Formal Education	→	Lifelong Skills Development

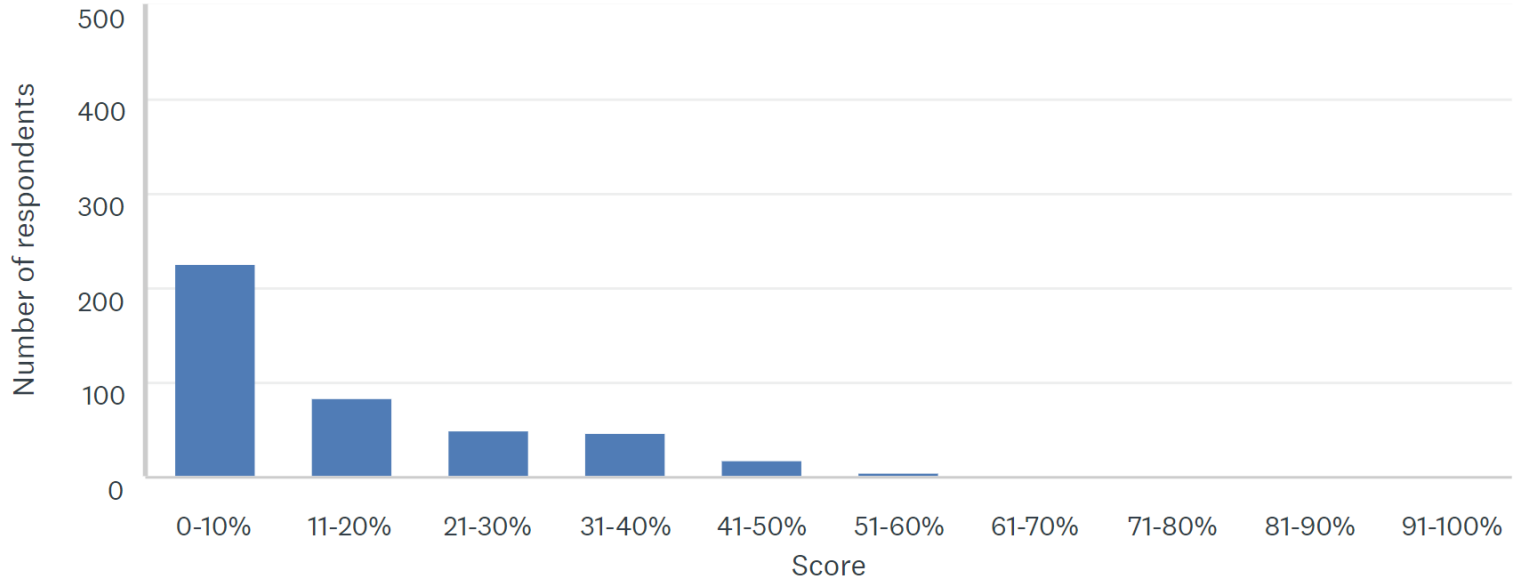
Gender parity in responses



Source:
Adero (2021). Nationwide youth (18-35) skills and unemployment survey under the ACCESS University of Ideas Competition for African Lecturers, March – April 2021

AVERAGE SCORE

16% • 16/96 PTS



STATISTICS

Lowest Score	Median	Highest Score
1%	13%	82%

Mean: 16%

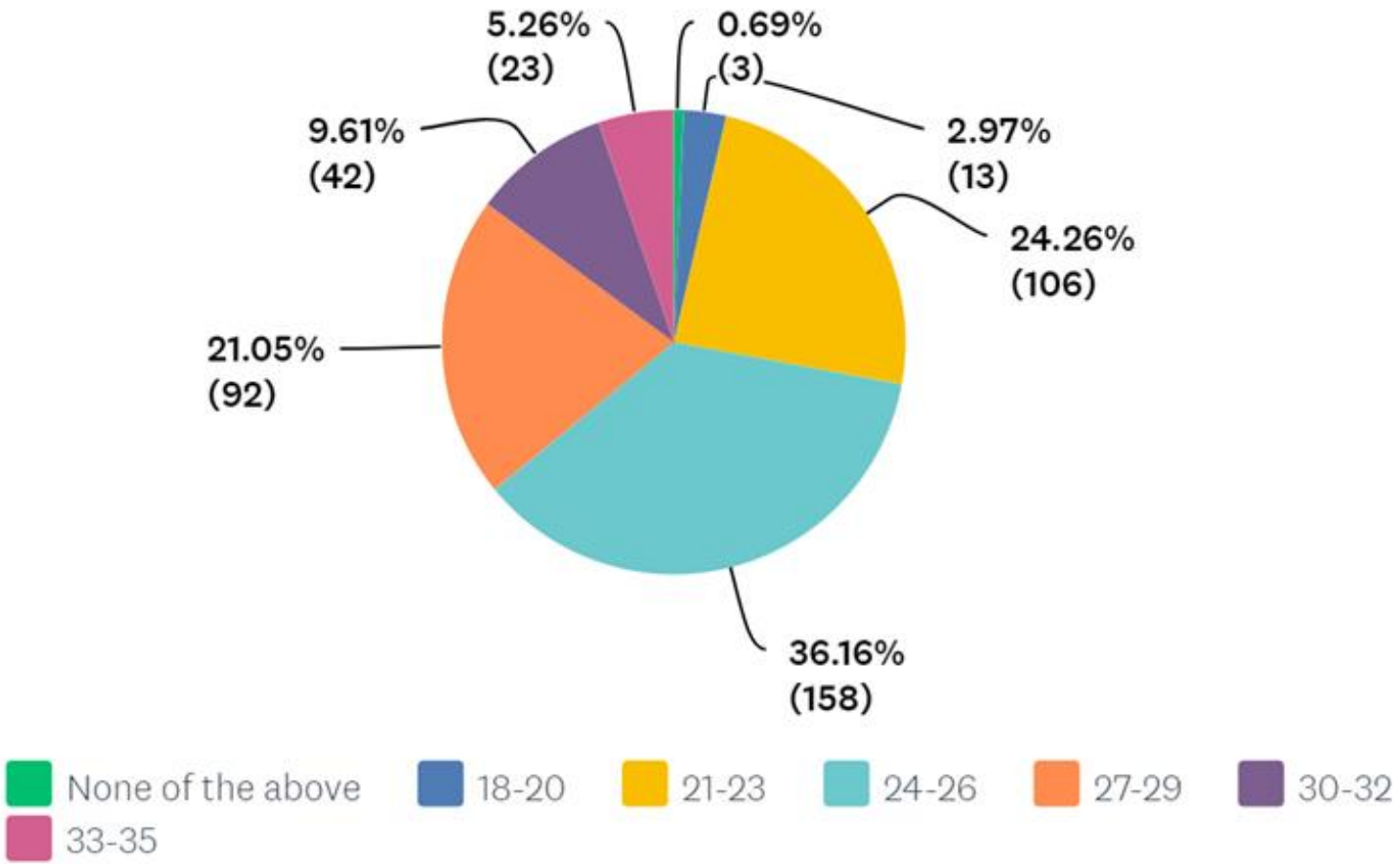
Standard Deviation: 15%

Work-ready digital skills based on 63 questions with 96 points

Source:
Adero (2021). Nationwide youth (18-35) skills and unemployment survey, March – April 2021

Age bracket (select)

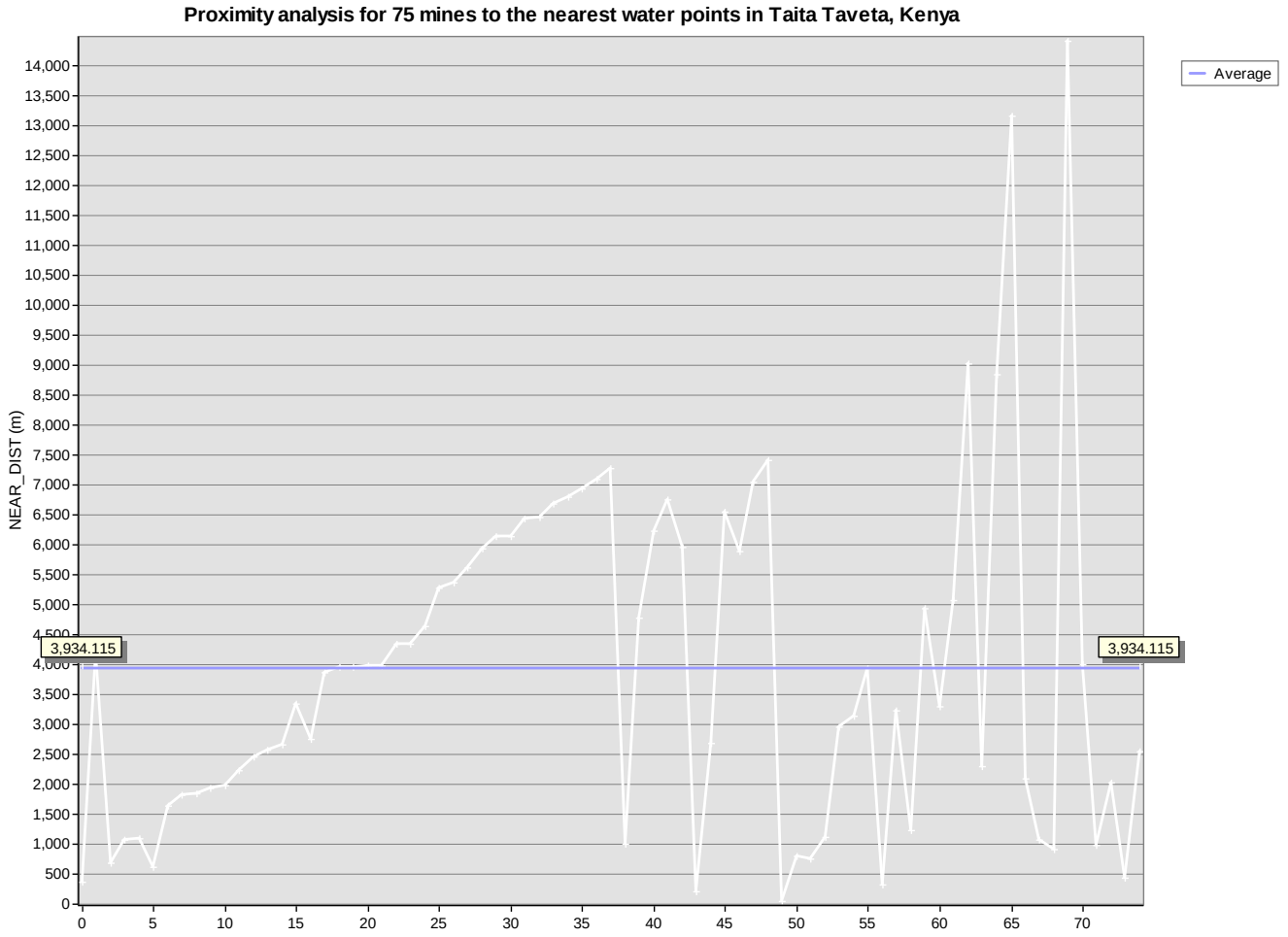
Answered: 437 Skipped: 0



Mainly youths in their 20's

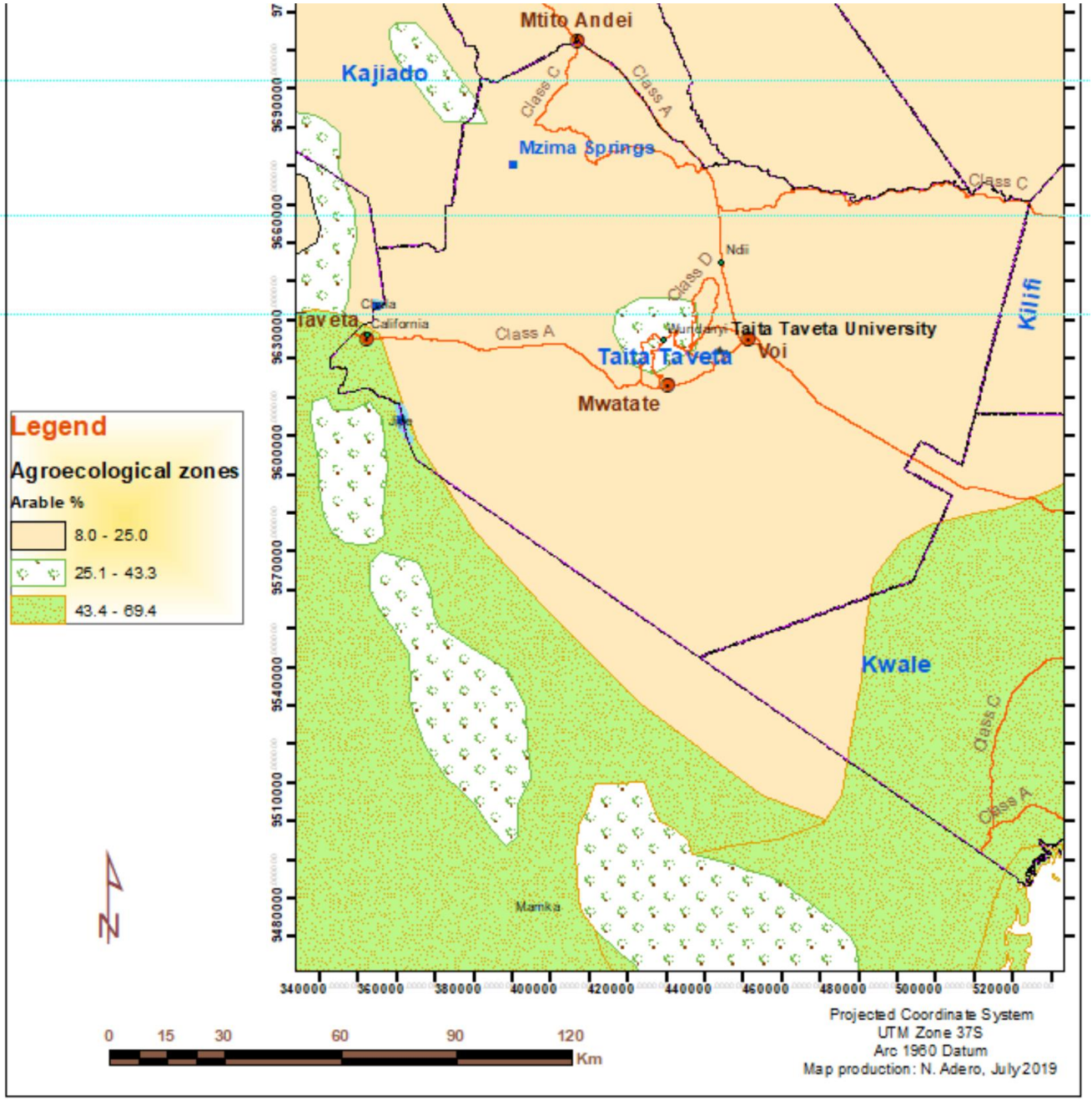
Source:
Adero (2021). Nationwide youth (18-35) skills and unemployment survey, March – April 2021

Central tendency - mean



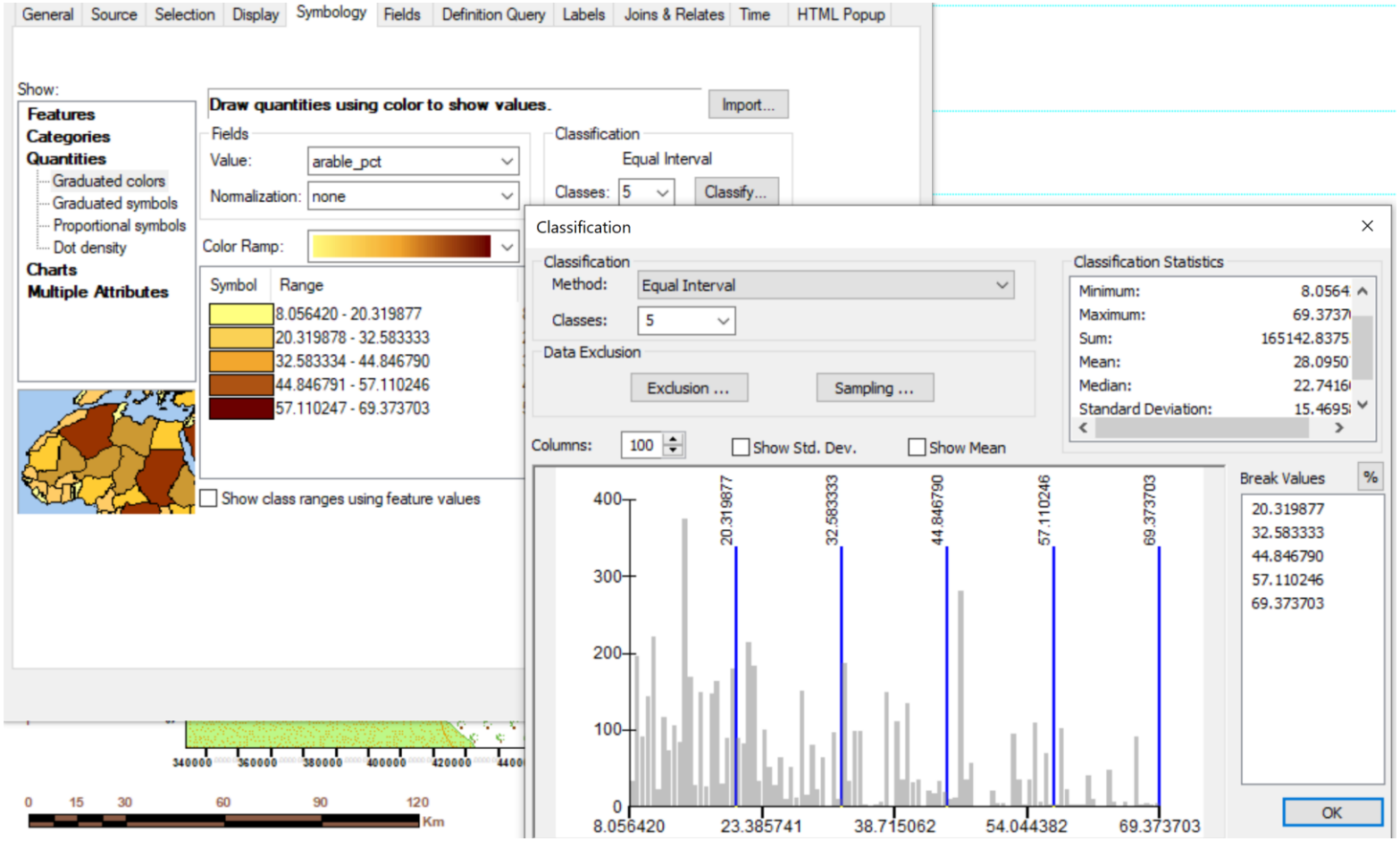
Working with real data

- Arable percentages varying from approximately 8% to 70%
- Non-uniform distribution
- Classification intervals – to become clearer by plotting a histogram
- Why Natural Breaks (Jenks)?



Equal intervals

- Arable percentages varying from approximately 8% to 70%
- Non-uniform distribution
- Classification intervals – to become clearer by plotting a histogram
- Why Natural Breaks (Jenks)?



Natural breaks (Jenks)

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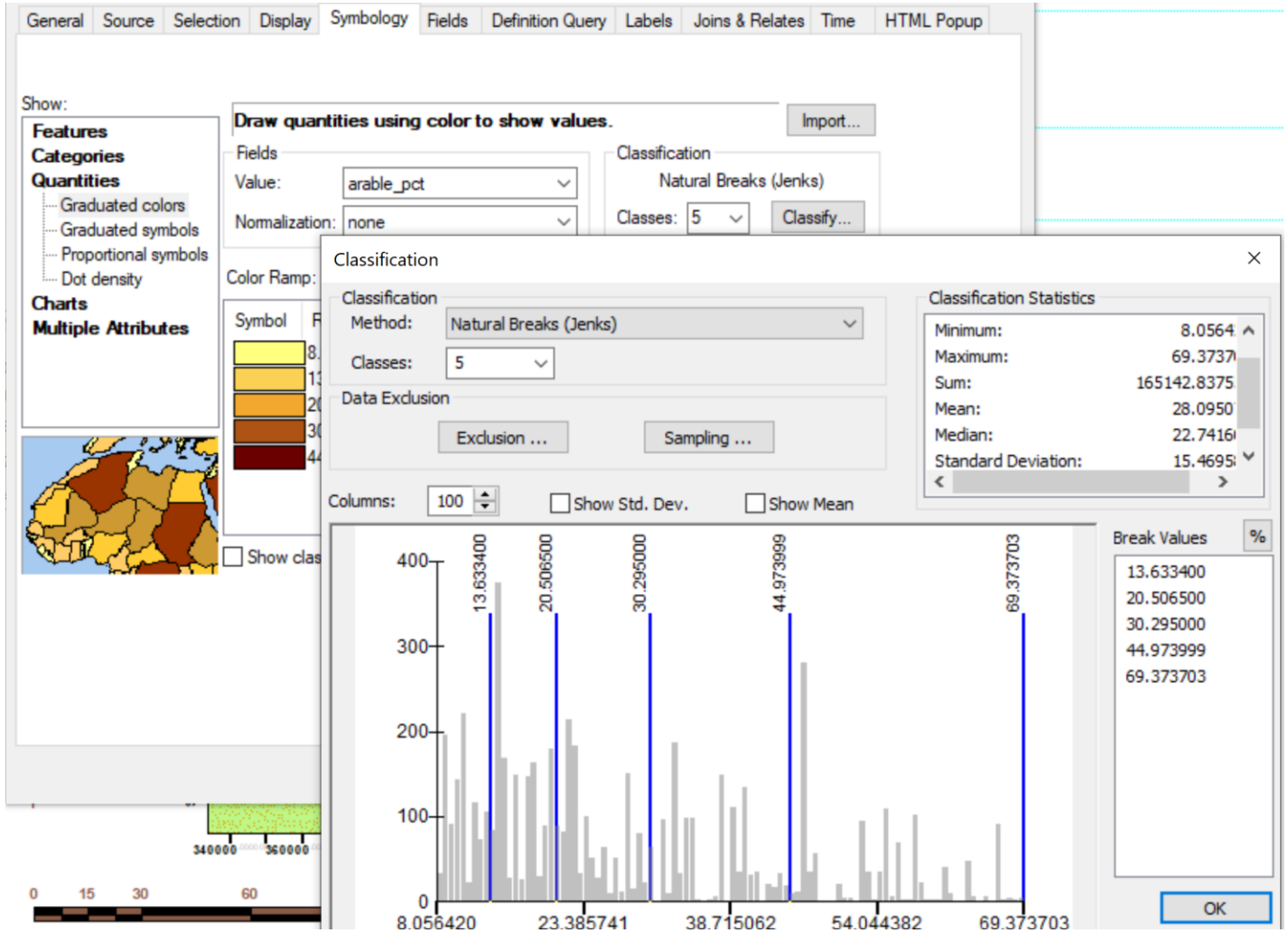


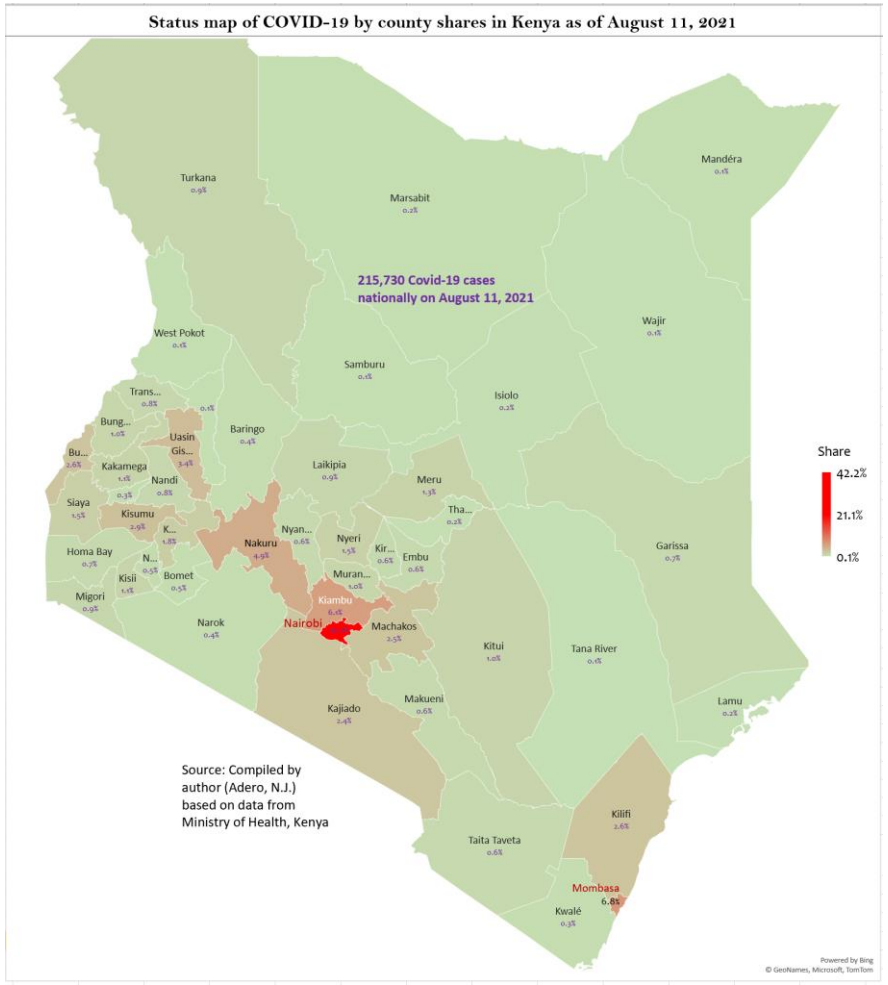
GIS – Visualisation ensures inclusivity

- GIS provides sound facilities for multistakeholder participation using visual maps as opposed to numbers/statistics alone

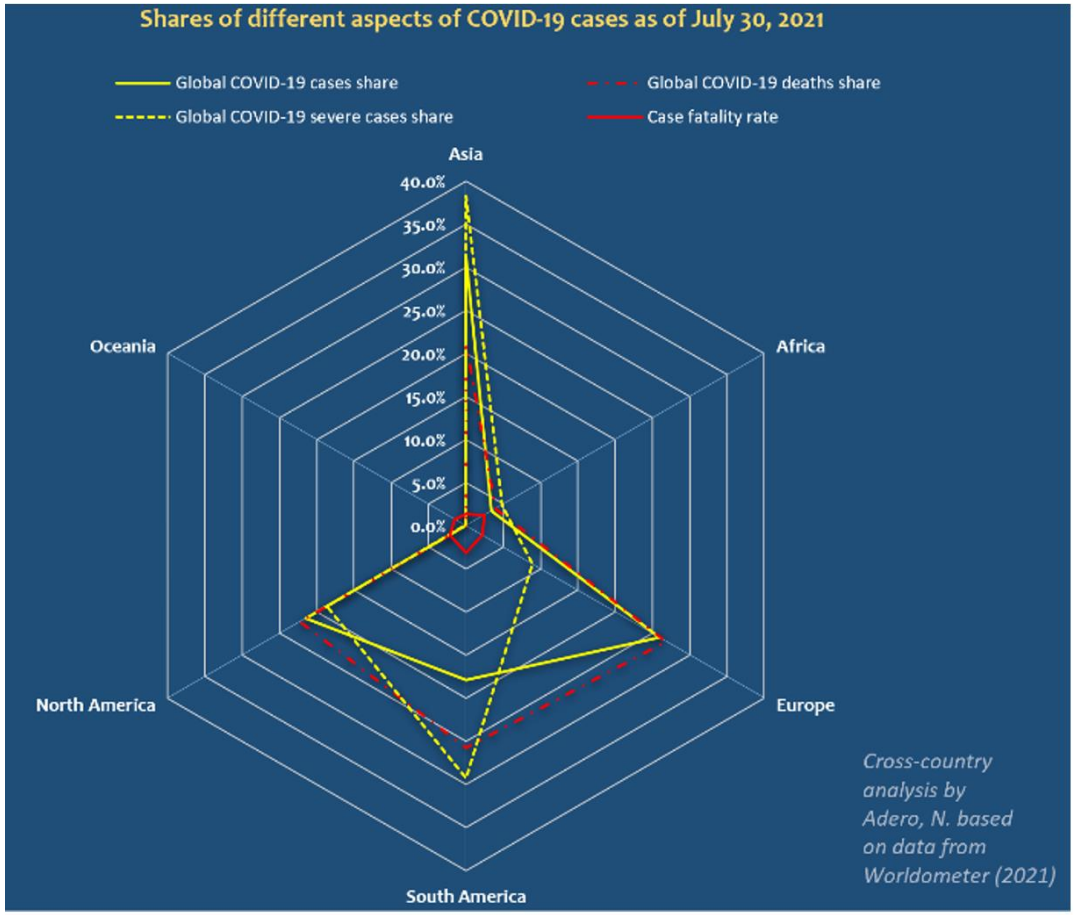
- Shared visual evidence with location makes robust decision support systems

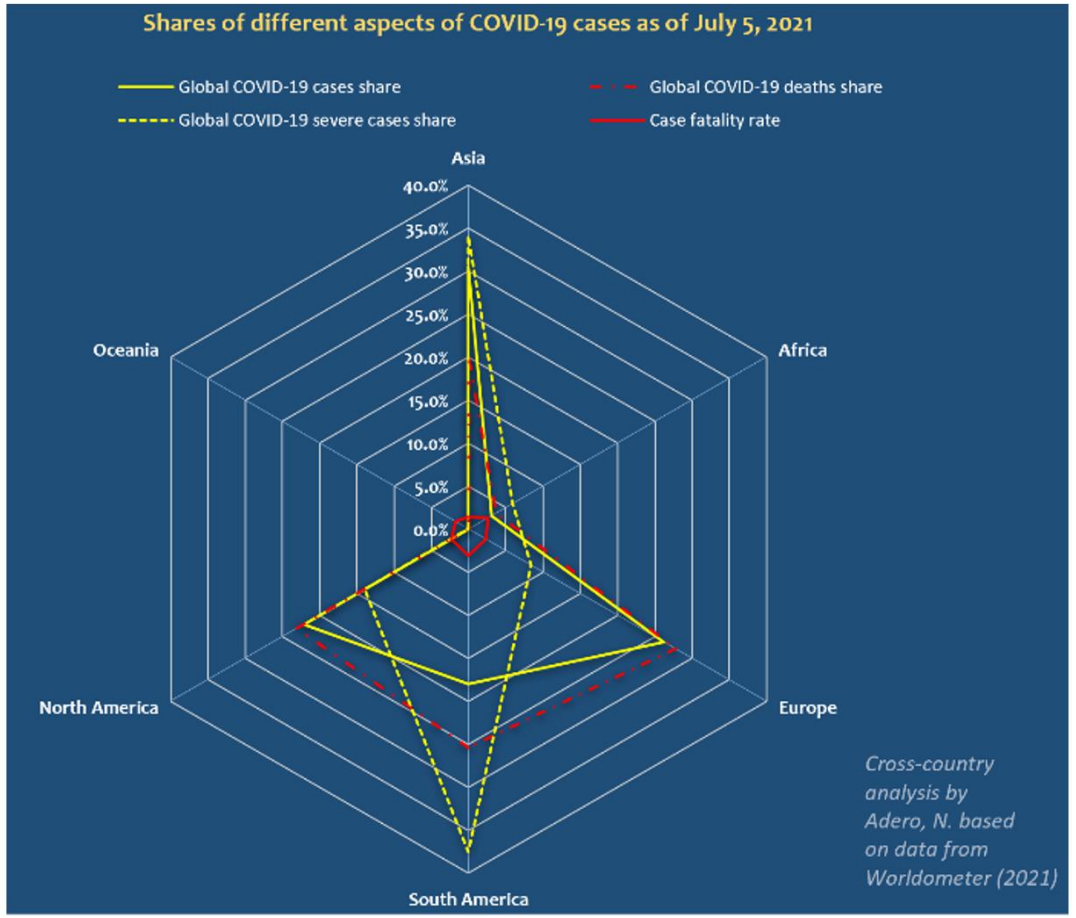
- Compare the following figures in terms of ease of understanding and effectiveness of communication across **diverse stakeholder profiles**

Visualisation at spatial scales using maps



Radar plots


Shares of different aspects of COVID-19 cases as of July 30, 2021
Global COVID-19 cases share
Global COVID-19 deaths share
Global COVID-19 severe cases share
Case fatality rate
Asia
Africa
Europe
South America
North America
Oceania
40.0%
35.0%
30.0%
25.0%
20.0%
15.0%
10.0%
5.0%
0.0%
Cross-country analysis by Adero, N. based on data from Worldometer (2021)


Shares of different aspects of COVID-19 cases as of July 5, 2021
Global COVID-19 cases share
Global COVID-19 deaths share
Global COVID-19 severe cases share
Case fatality rate
Asia
Africa
Europe
South America
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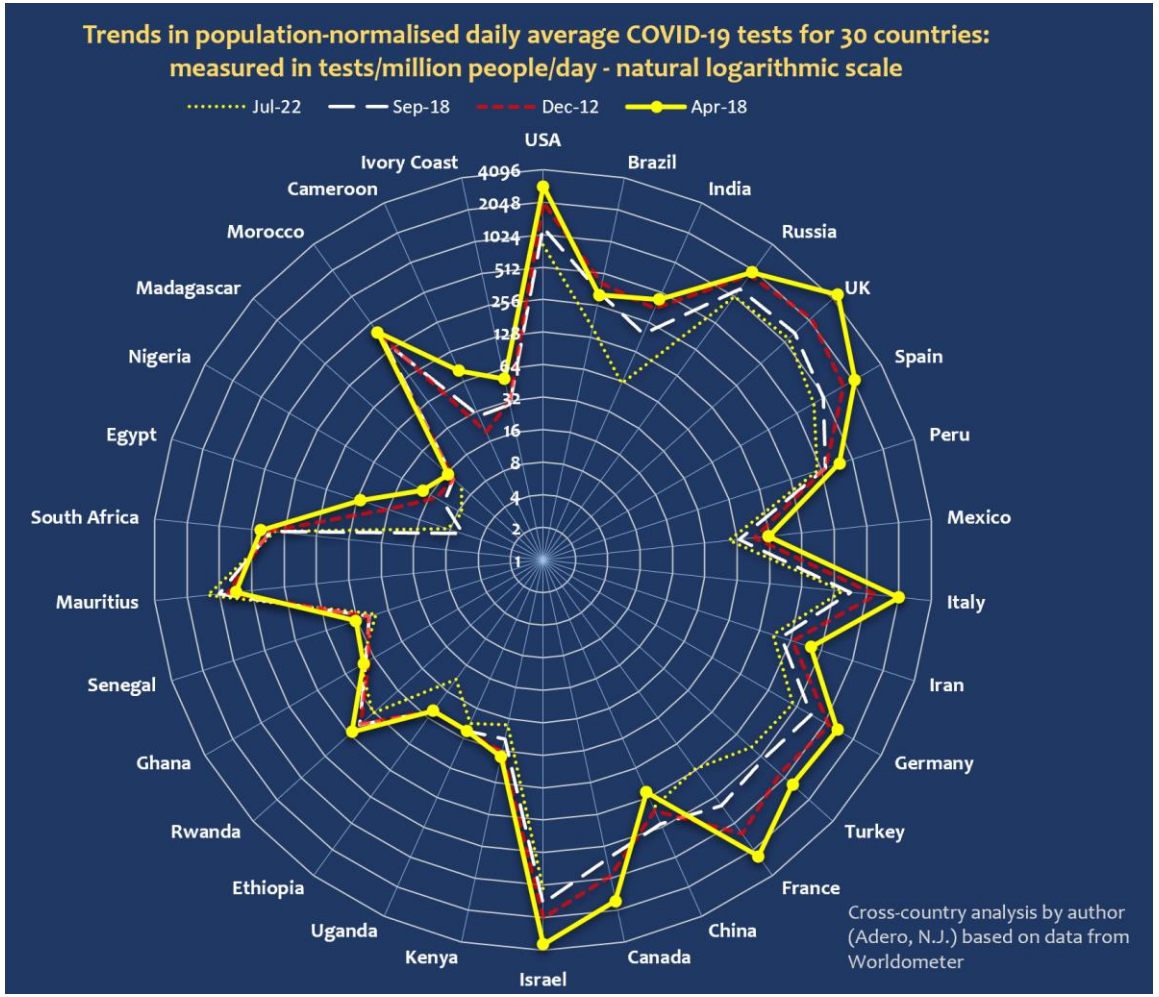
25.0%
20.0%
15.0%
10.0%
5.0%
0.0%
Cross-country analysis by Adero, N. based on data from Worldometer (2021)

Choice of plotting scale for visualisation - logarithmic



Acknowledgement, further resources, contact

Esri Eastern Africa (& Prof. S. Onywere) for helping promote GIS education at Taita Taveta University

Taita Taveta University (TTU) & TAITAGIS – platform for thought leadership and knowledge-led influence

System Dynamics Society (SDS) – for global networking in system dynamics and **Elsevier Researcher Academy –** platform for research networking and capacity building in modern research

FORCE11 – forum and community for open science communication and e-scholarship

Links to further reading: Journal paper recommending GIS for COVID models

| Website with web version of GIS and eHealth presentation | Book on COVID-19 | nashon.adero@gmail.com