



AFFORDABLE  
TECHNOLOGIES  
TO  
**EMPOWER**  
RURAL ECONOMIES

IoT for the developing countries from  
research to business transformation

**GECON 2017**  
**20<sup>th</sup> September**  
**France**

*Abdur Rahim*  
*Open IoT*  
*FBK CREATE-NET*

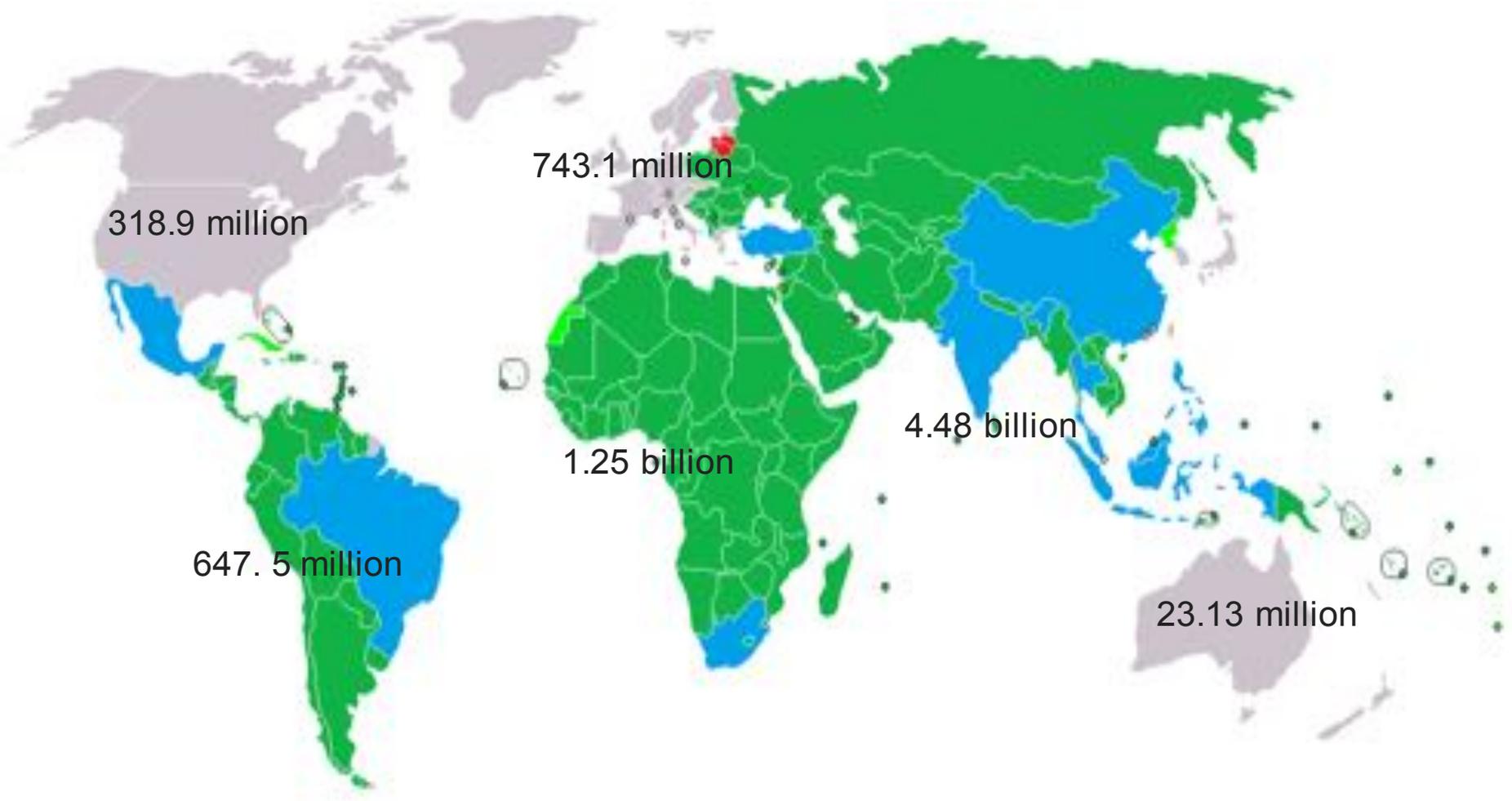


IoT is not the story only for the industrialized countries



Source: L-nitwo

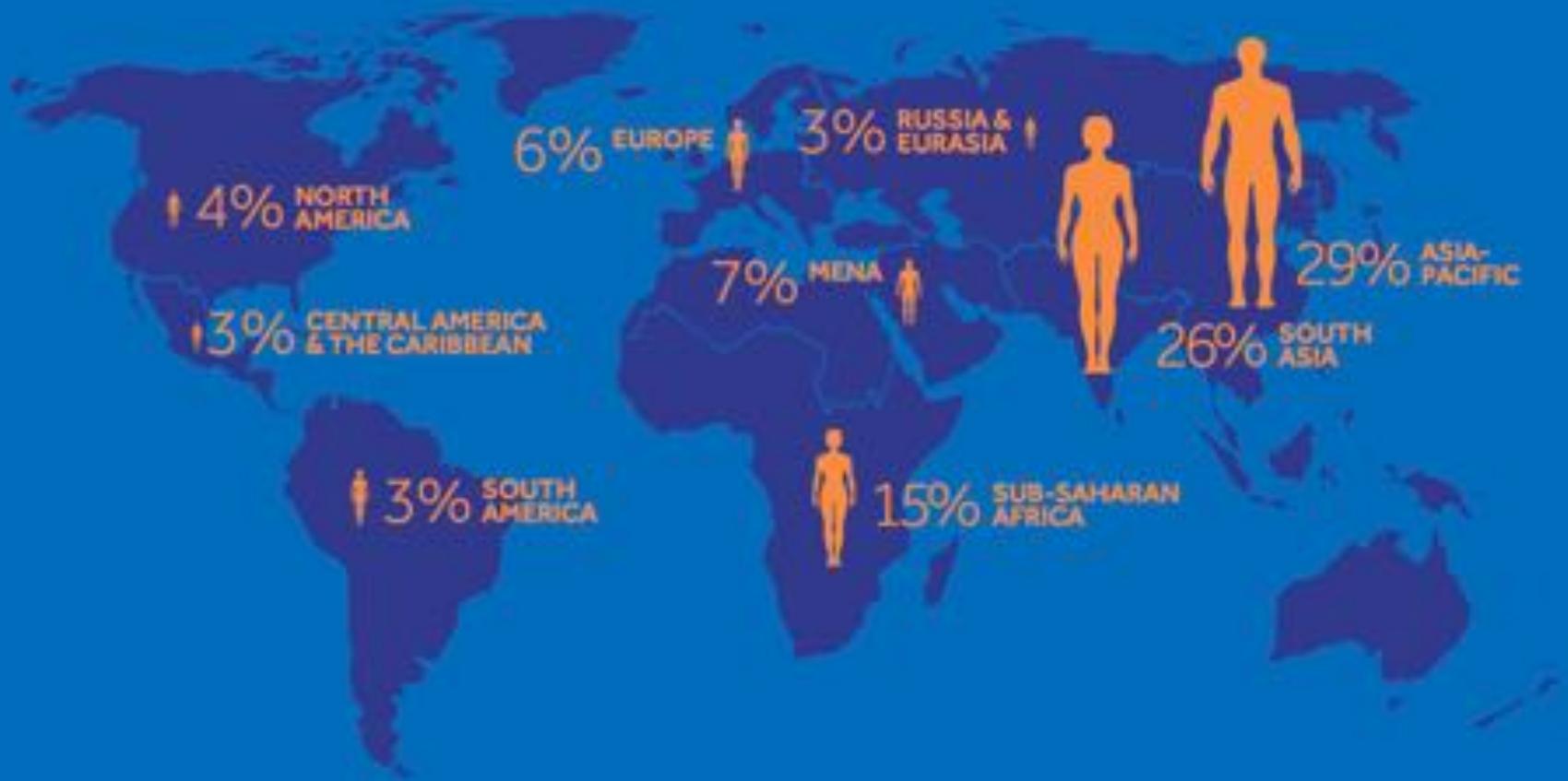
**IoT transition from industrial to developing and emerging market**



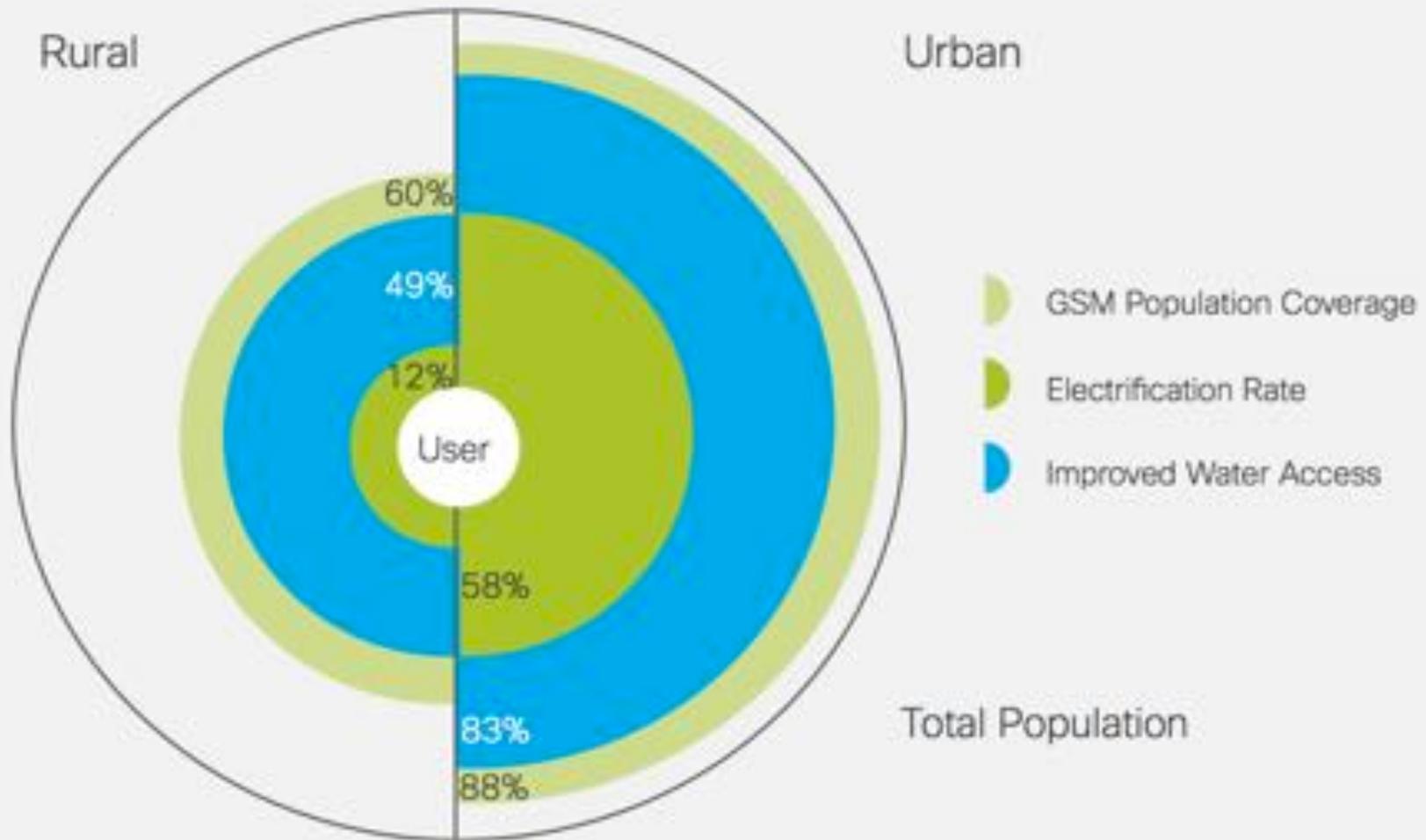
**Total world population 7.4 billion (2017) and 70-80% people living in the developing and emerging countries**

# ...the driver of the digital transformation

Global youth population by region:



Source: UN Data



60%

40%

Source: GSMA, "Sustainable Energy & Water Access through M2M Connectivity." <http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2013/01/Sustainable-Energy-and-Water-Access-through-M2M-Connectivity.pdf>.

# IoT applications domain in Africa

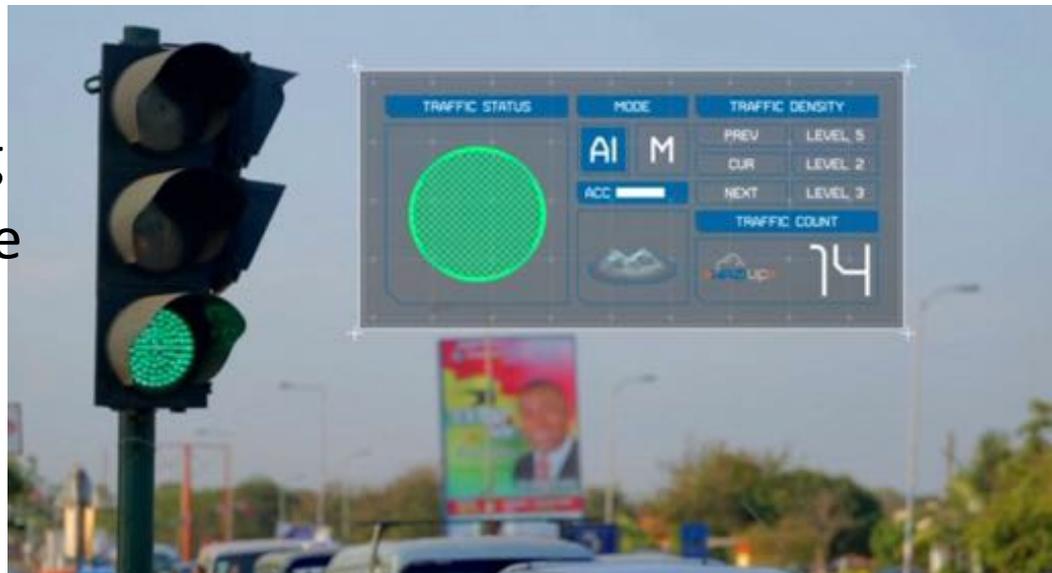
## • Rural applications

- Agriculture and weather
- Cattle farms
- Fish farming
- Logistic and storage
- Remote health



## • Urban applications

- Traffic and transportation
- City lighting/energy saving
- Urban agriculture-promote
- Air quality



# Digitalization in developing countries

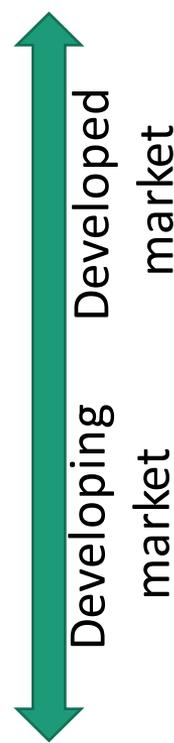
Exhibit E1

## The MGI Industry Digitization Index

2015 or latest available data



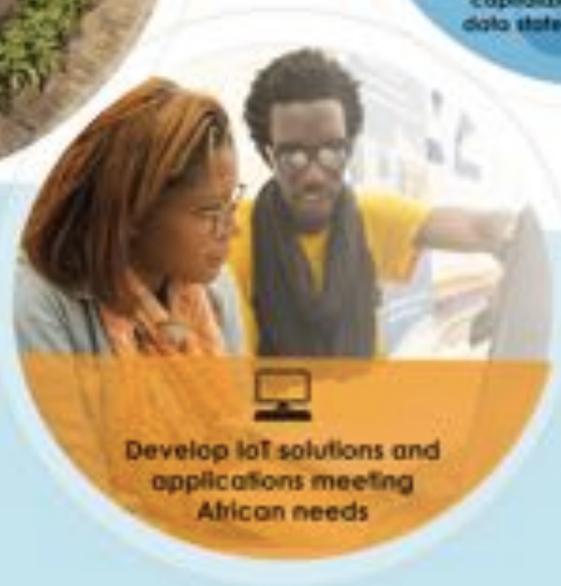
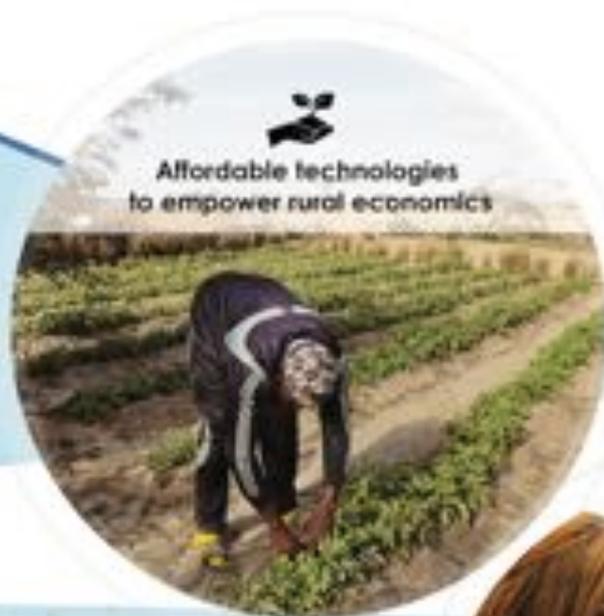
Sector	Overall digitization <sup>1</sup>	Assets						Usage			Labor			GDP share %	Employment share %	Productivity growth, 2005-14 <sup>2</sup>
		Digital spending	Digital asset stock	Transactions	Interactions	Business processes	Market making	Digital spending on workers	Digital capital deepening	Digitalization of work	Digital spending on workers	Digital capital deepening	Digitalization of work			
ICT														5	3	4.6
Media														2	1	3.6
Professional services		1												9	6	0.3
Finance and insurance														8	4	1.6
Wholesale trade														5	4	0.2
Advanced manufacturing														3	2	2.6
Oil and gas			2											2	0.1	2.9
Utilities														2	0.4	1.3
Chemicals and pharmaceuticals														2	1	1.8
Basic goods manufacturing														5	5	1.2
Mining														1	0.4	0.5
Real estate	●													5	1	2.3
Transportation and warehousing	●													3	3	1.4
Education														2	2	-0.5
Retail trade	●													5	11	-1.1
Entertainment and recreation	●													1	1	0.9
Personal and local services	●													6	11	0.5
Government	●													16	15	0.2
Health care														10	13	-0.1
Hospitality	●													4	8	-0.9
Construction														3	5	-1.4
Agriculture and hunting														1	1	-0.9



Developing countries as well as their main economical sector are less digitalized

- 1 Knowledge-intensive sectors that are highly digitized across most dimensions
- 2 Capital-intensive sectors with the potential to further digitize their physical assets
- 3 Service sectors with long tail of small firms having room to digitize customer transactions
- 4 B2B sectors with the potential to digitally engage and interact with their customers
- 5 Labor-intensive sectors with the potential to provide digital tools to their workforce
- 6 Quasi-public and/or highly localized sectors that lag across most dimensions

<sup>1</sup> Based on a set of metrics to assess digitization of assets (8 metrics), usage (11 metrics), and labor (8 metrics); see technical appendix for full list of metrics and explanation of methodology.  
<sup>2</sup> Compound annual growth rate.



- www.waziup.eu
- Waziup IoT
- Waziup IoT
- Waziup
- Waziup

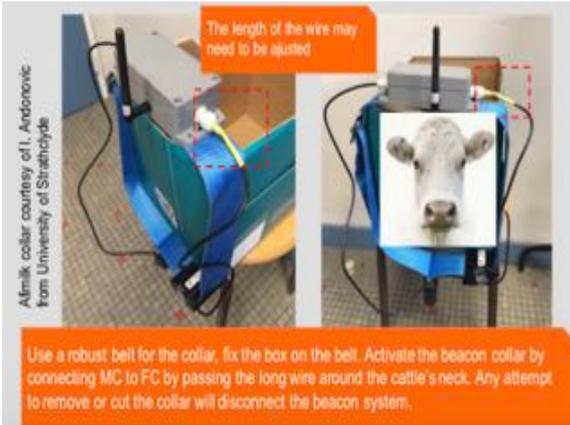


# *Getting ready to adapt IoT for the daily lives and business operations*



WAZIUP

ACCELERATING  
AFRICAN  
INNOVATION  
THROUGH  
BIG  
DATA &  
IoT



**Cattle rustling  
Senegal**



**Incubateur Connecté  
Benin**

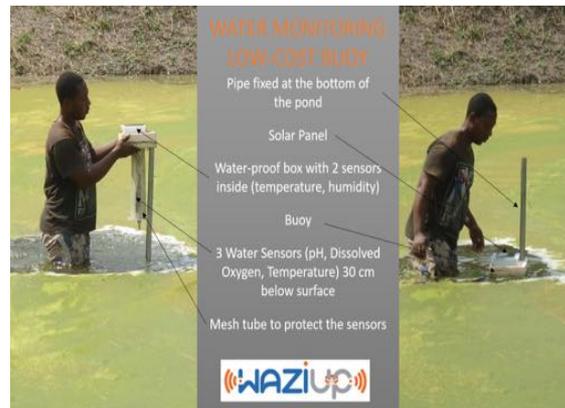


**ElevUp**

# African IoT entrepreneurs



**Urbanatic  
Togo**



**Fish farming  
Ghana**



**Urban waste  
Togo**

# IoT product made in Africa

Local adaptation addressing the local problems and needs



*.. not for African but with African*



*Vision to redesign homegrown cost-effective alternative*



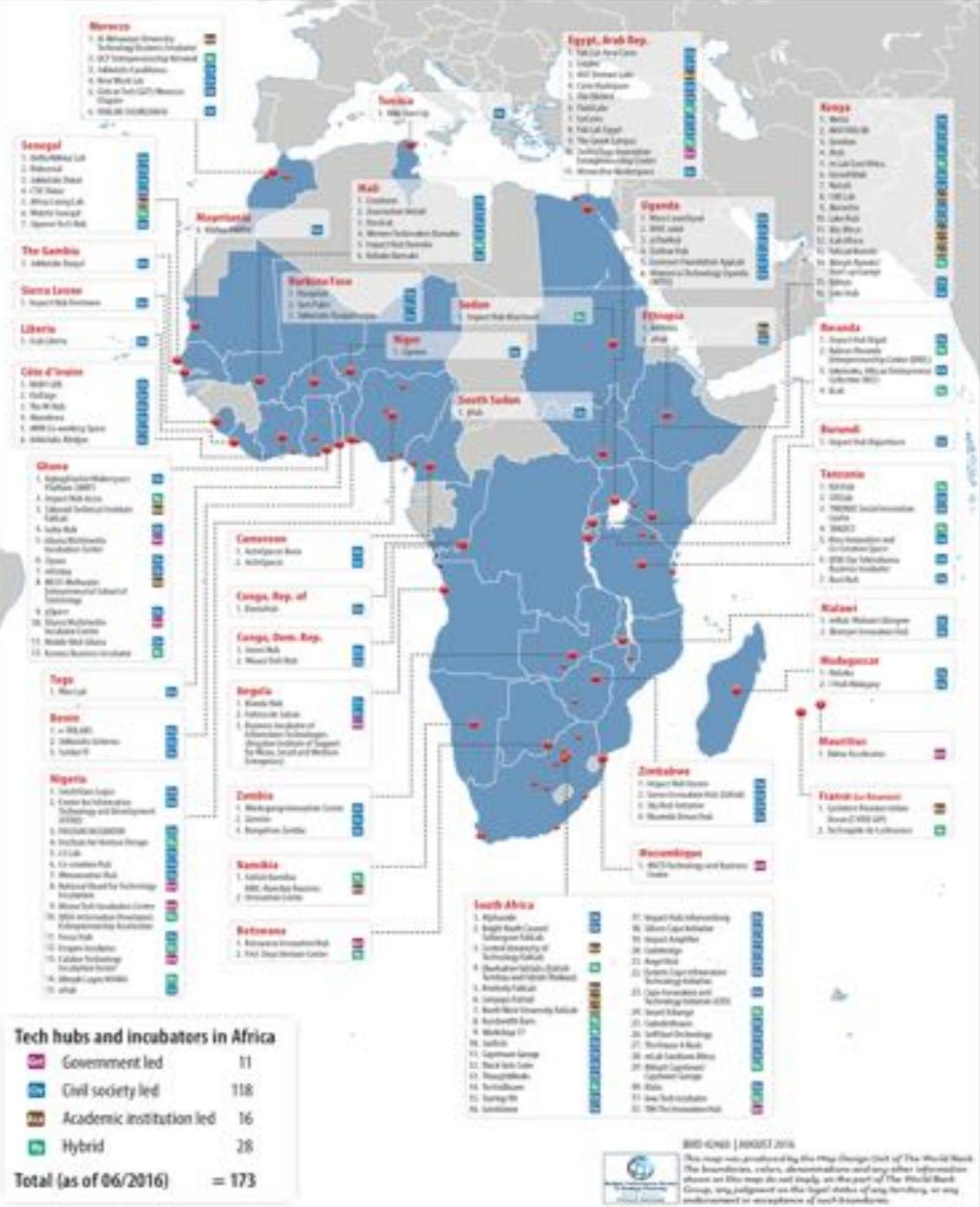
*Local innovation hubs are the main driver of IoT innovation*



# Fablab in Lome



**HubCité:**  
Fablab replication  
on all the city



Tech hubs and incubator are springing up across Africa, a source of local innovation

**AFRICA:**  
**314 ACTIVE\* TECH HUBS IN 93 CITIES IN 42 COUNTRIES**



**5 Countries:** South Africa, Kenya, Nigeria, Egypt and Morocco hold 40% of the tech hubs in Africa

**4.3 years old:** Average age of tech hubs is 4.3 years old (coverage begins date 2012)

**12% of Tech Hubs:** 12% of tech hubs have partnerships with mobile operators. Orange, MTN and Vodafone are the most represented

**49% of Tech Hubs:** 49% of tech hubs have partnerships with tech giants: Microsoft, Google and Alibaba are the most represented

**1.5 millions followers:** Tech hubs Facebook pages have more than 1.5 million followers

**600 thousand followers:** Tech hubs Twitter pages have more than 600 thousand followers

With the rise of tech hubs, African are coming together to collaborate to develop and prototype the ideas

# Pan African IoT local hub



*To empower African IoT innovation  
“Made in Africa” and “by Africa”  
through IoT service creation and  
business transformation in the  
African local value-added setting  
by creating an IoT OpenHUB for  
local adaptation*

**To offer the better accessibility of IoT to hub distributed  
across the countries and region**

# IoT catalyst for local hub

*Accessibility of the IoT low cost and easy to deployment technologies for African innovation users*

*Accessibility of process for IoT start-up creation and acceleration for African innovation users*

*Accessibility of partnership for sustainability and growth-hacking for the African innovation users*



**Technology Support:**  
 “Out-of-Box” LoRa IoT development kit including SDK. The kit will cost maximum 100 Euro and offer all the features to develop IoT sensor application

**Accelerator:** Accelerator programs for technical and business capacity building through training, seminars and workshops

**Sustainability:**  
 Foster the creation of local IoT ecosystems. The ecosystem will include major users and actors from various disciplines, including those with industry backgrounds.

# Framework for IoT local adaptation

WAZIHUB IoT Smart village in Senegal



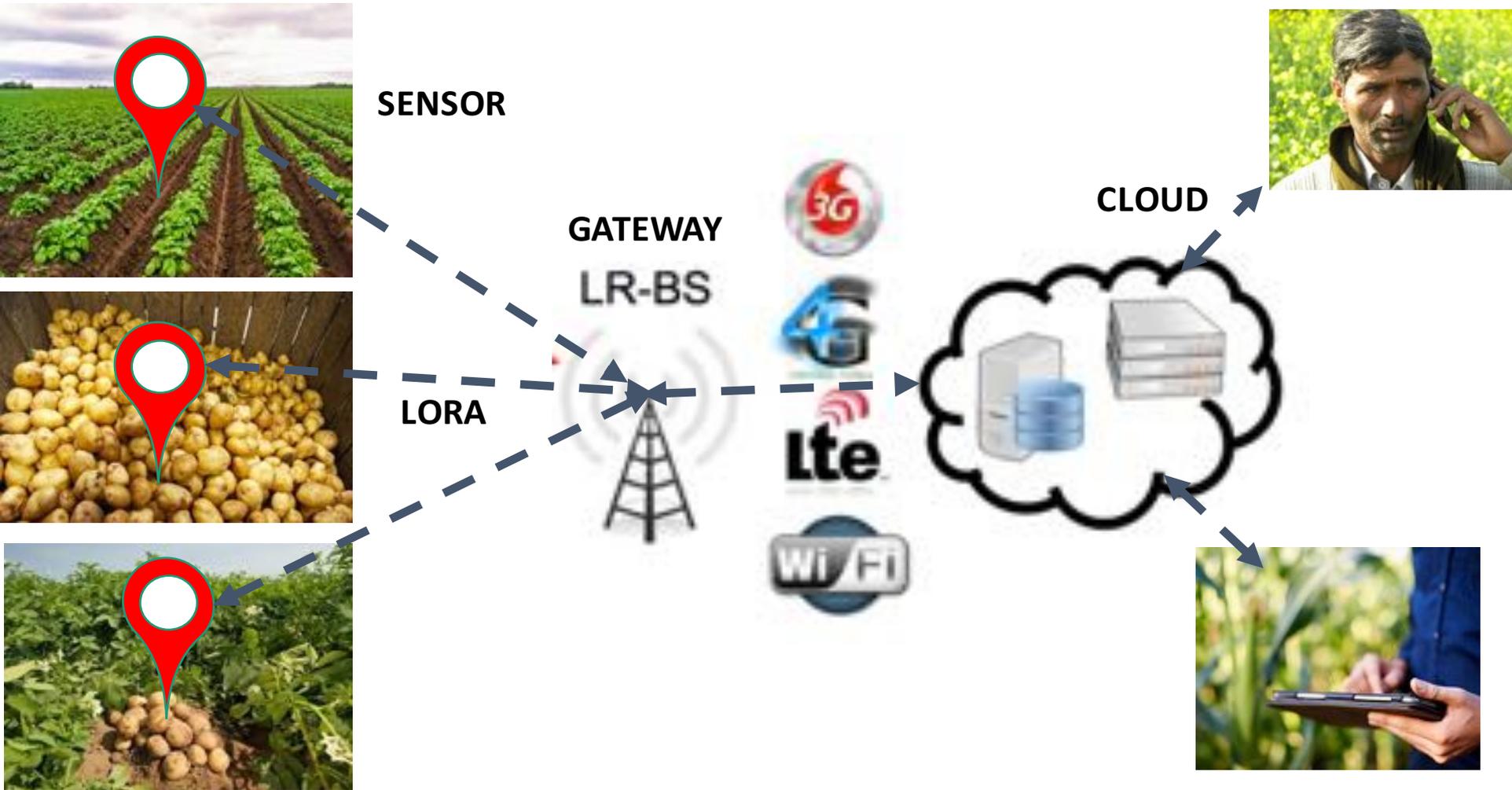
WAZIHUB IoT Global Cloud  
(FIWARE node in Senegal/  
Public cloud)

WAZIHUB  
applications



WAZIHUB Local IoT Cloud in Hubs

# System overview



# Need for Specialized IoT solutions

- To addresses fundamental problems
  - ✓ Internet and network connectivity,
  - ✓ Cost of solutions,
  - ✓ Simplicity and robustness in terms of deployment and operation,
  - ✓ User-centric design for notification (SMSs, voice, WhatsApp and Facebook)
  - ✓ Local language

# Accessibility of IoT LoRa prototyping



IoT LORA  
development kit

do it  
YOURSELF



LoRa radios that our library already supports

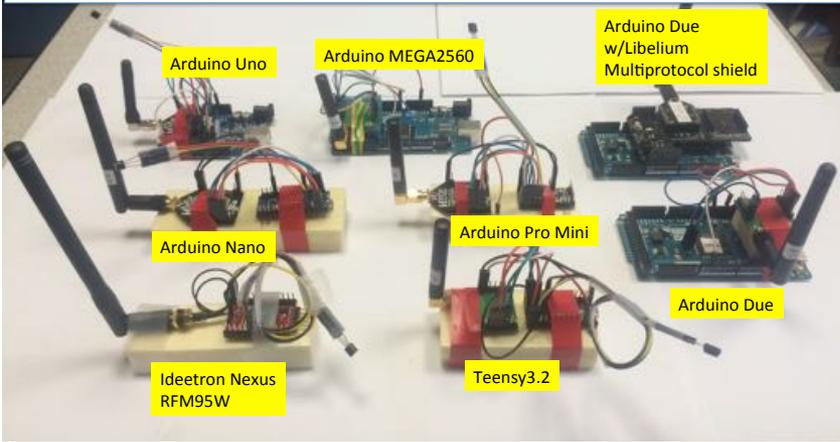
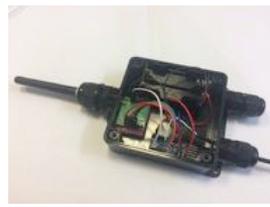


HopeRF RFM92W/95W

Libelium LoRa

Modtronix inAir9/9B

NiceRF LoRa1276



Arduino Uno

Arduino MEGA2560

Arduino Due w/Libelium Multiprotocol shield

Arduino Nano

Arduino Pro Mini

Arduino Due

Ideetron Nexus RFM95W

Teensy3.2



# Sensor node design: DIY IoT sensors nodes



LoRa radios that our library already supports



HopeRF RFM92W/95W

Libelium LoRa

Modtronix inAir9/9B

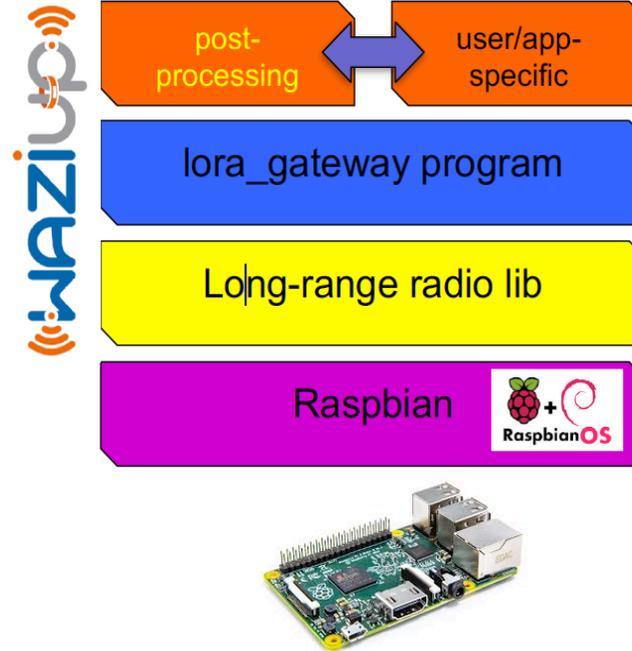
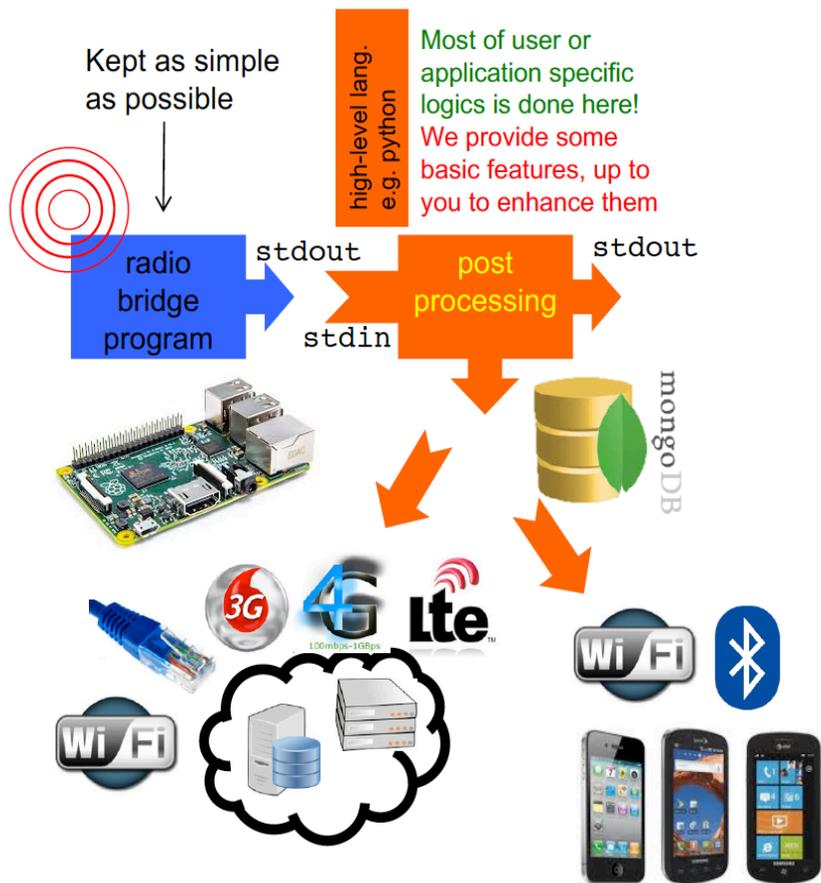
NiceRF LoRa1276



```
sendPacketTimeout(1, "18.5", 4);  
// 1: sends to gateway  
// 18.5 : temperature message  
// 4 : message size
```

**1 send function!**

# LoRa Gateway design



***The Gateway collects the data from the sensors and push it to the Cloud***

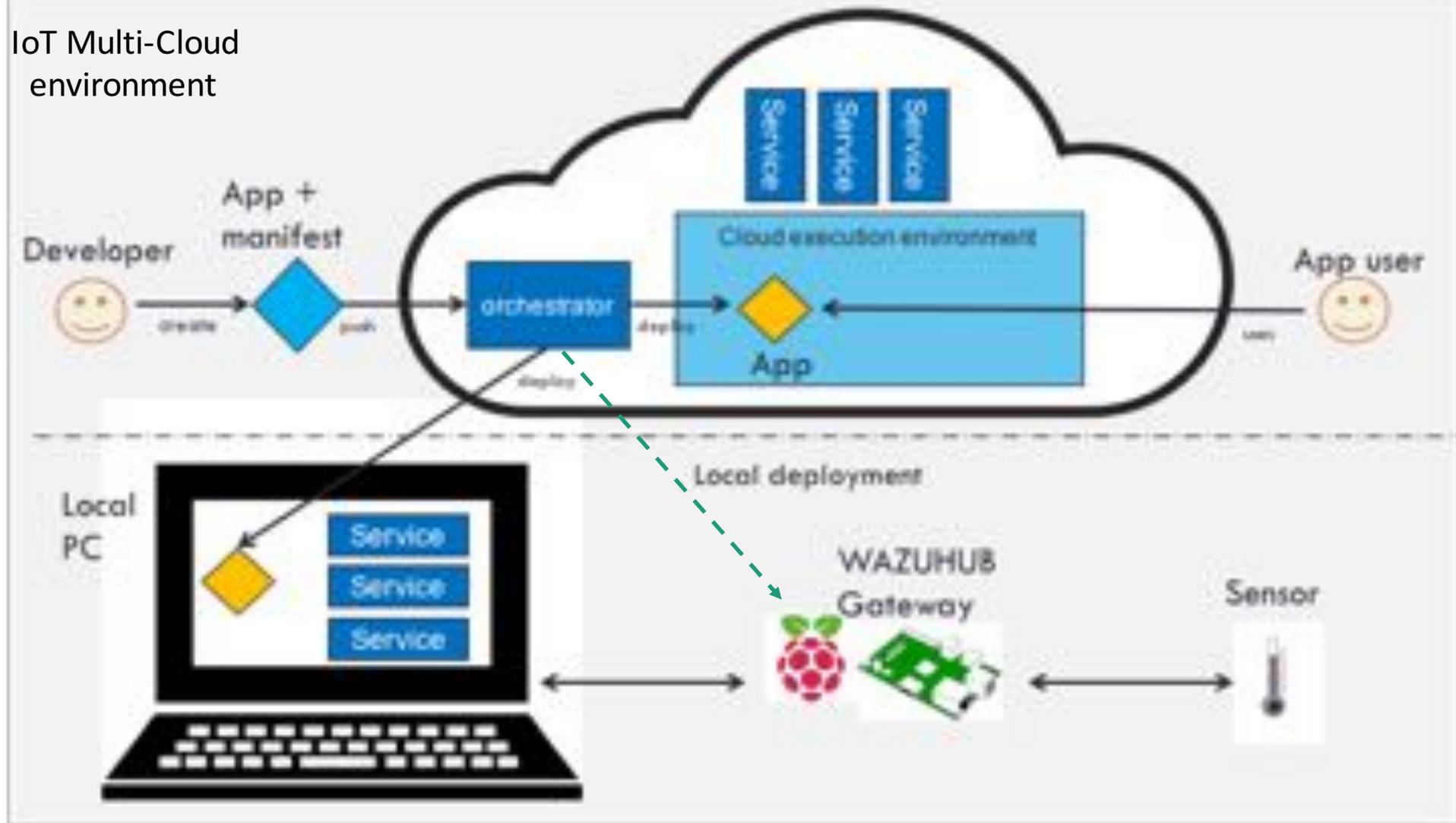
# IoT cloud platform



**WAZIUP platform** ([www.waziup.io](http://www.waziup.io)) and all the source code in Github, <https://github.com/Waziup>

# Multi-cloud environment

IoT Multi-Cloud environment



# IoT smart village model



Large-Scale real-life testing  
infrastructure

A reference IoT smart  
village models in Senegal

Accessibility  
Innovation  
process



Selection and showcase of IoT entrepreneurs



Training and development of IoT entrepreneurs



Co-design and development of high potential IoT products and services



Piloting and testing service in large scale smart village infrastructure



Growth hacking and unlocking finance for IoT entrepreneurs



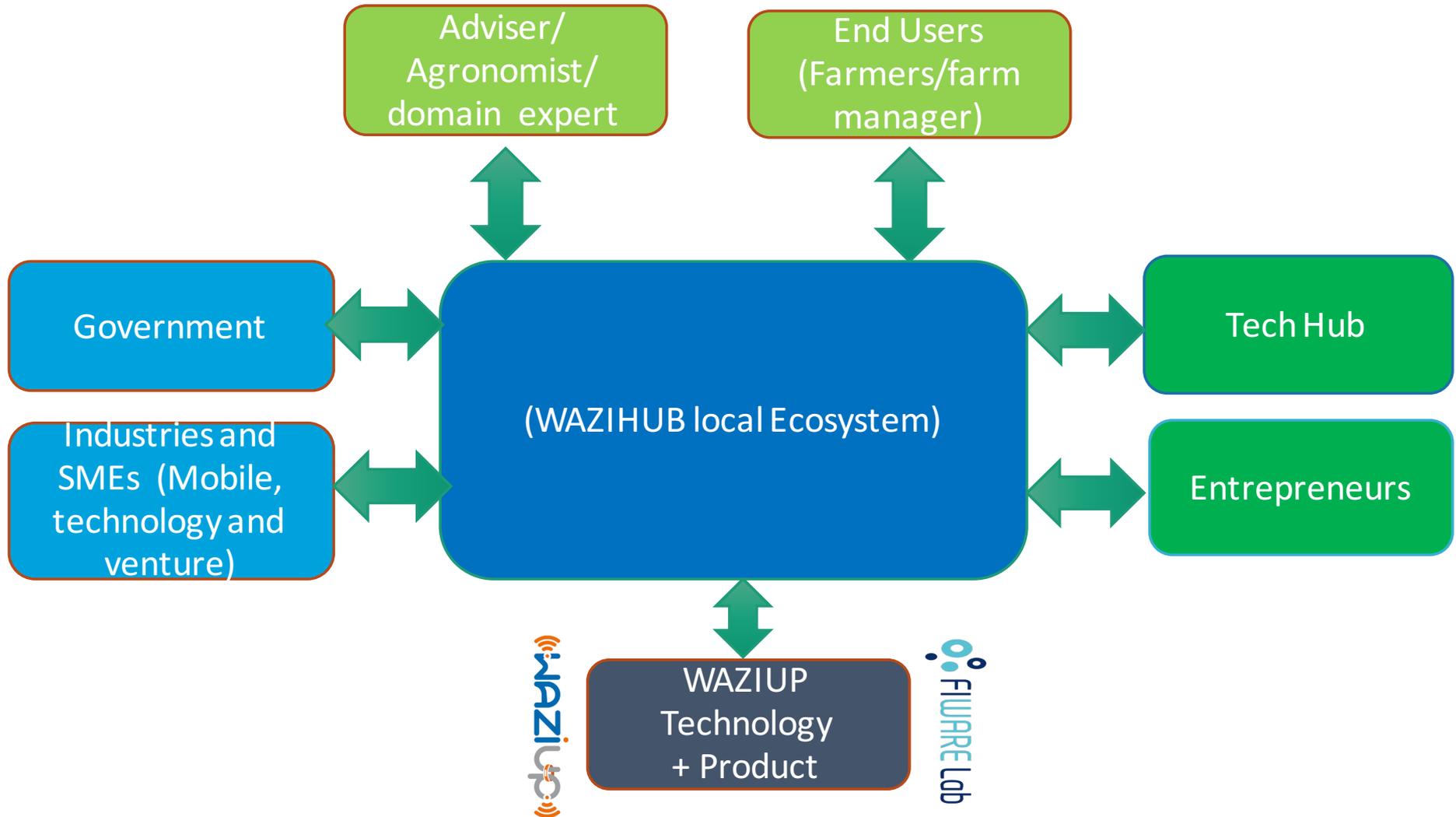
Strengthen network of IoT collaborators in Africa and the developing world

# Sustainability of the start-up and hub

IoT is not the story only for the industrialized countries

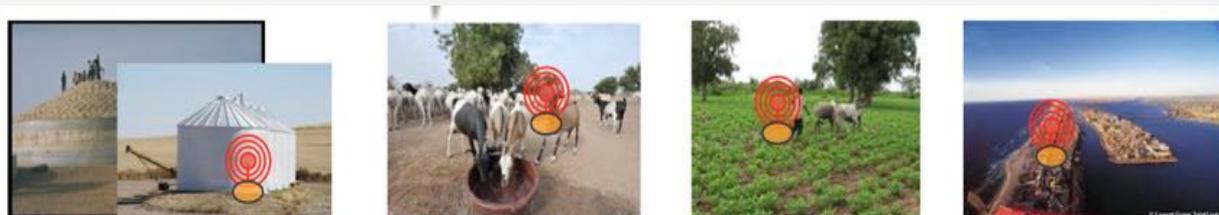


# Ecosystem for sustainability



# Market penetration

*Start-up and service creation shared by HUBs*



*Creation of start-ups in agriculture, health, transportation, livestock, environment domain*

*Shared market plans*

*Common market plans*

*Connected with entrepreneurs, SMEs and industries*

*Connected with other hubs*

**Core technology**  
Development kit IoT Smart Village Multi-Cloud platform Open IoT Data

**Adaptation and available in local IoT Ecosystem  
Local Hub**

# Engagement and community building

- Social media
- Local events
- Tools

**Accelerator**

Leading IoT start-up program in Africa



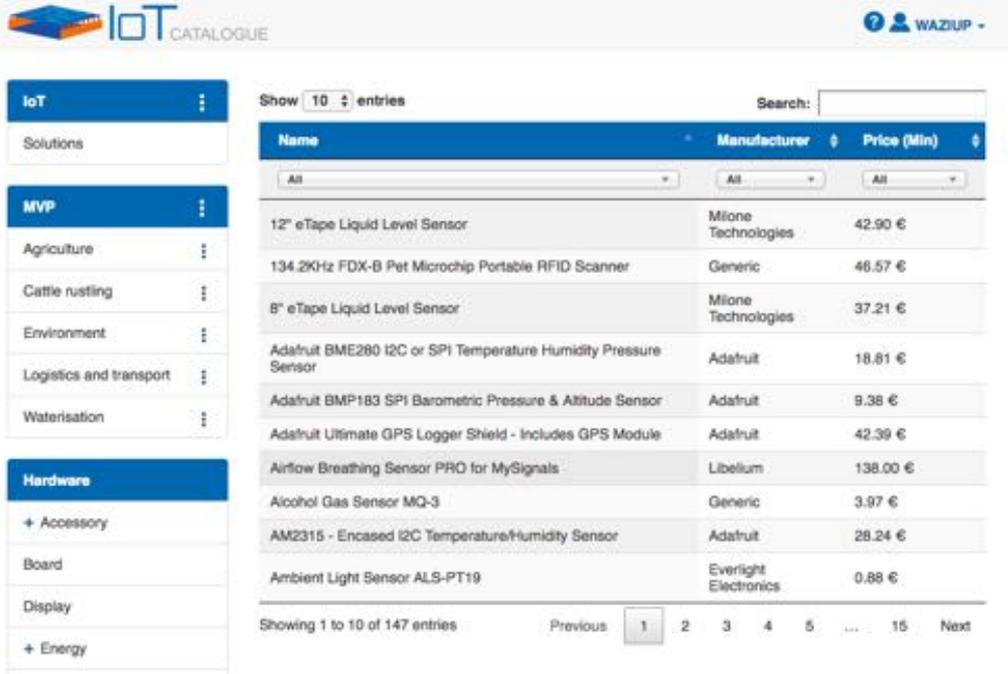
**WAZIbase**

Rich IoT African database



dream café

# IoT Catalogue- selecting the hardware



The screenshot displays the IoT Catalogue interface. On the left, there are navigation menus for 'IoT Solutions' and 'MVP' (Agriculture, Cattle rustling, Environment, Logistics and transport, Waterisation), and a 'Hardware' section with sub-categories like Accessory, Board, Display, and Energy. The main content area shows a table of hardware items with columns for Name, Manufacturer, and Price (Min). The table lists various sensors and modules with their respective manufacturers and prices.

Name	Manufacturer	Price (Min)
12" eTape Liquid Level Sensor	Milone Technologies	42.90 €
134.2KHz FDX-B Pet Microchip Portable RFID Scanner	Generic	46.57 €
8" eTape Liquid Level Sensor	Milone Technologies	37.21 €
Adafruit BME280 I2C or SPI Temperature Humidity Pressure Sensor	Adafruit	18.81 €
Adafruit BMP183 SPI Barometric Pressure & Altitude Sensor	Adafruit	9.38 €
Adafruit Ultimate GPS Logger Shield - Includes GPS Module	Adafruit	42.39 €
Airflow Breathing Sensor PRO for MySignals	Libellium	138.00 €
Alcohol Gas Sensor MQ-3	Generic	3.97 €
AM2315 - Encased I2C Temperature/Humidity Sensor	Adafruit	28.24 €
Ambient Light Sensor ALS-PT19	Everlight Electronics	0.88 €

- **IoT Catalogue:**
  - Lists available sensors for each specific domain
  - Provide price information so that a low cost solution can be achieved
  - Provide detailed information of the sensors interfaces to prevent interoperability issues form occurring in WAZIUP hardware solutions

# Find IoT information with WAZIBase

## IoT SOLUTIONS

### Market Segments: Close

- Agriculture
- Transportation
- Environment
- Healthcare
- General IoT

### Types of Solutions: Open

- Hardware components
- Software component
- Services
- Systems
- Complete IoT Solutions

## Ecosystem STAKEHOLDERS

### Market Segments: Close

- Agriculture
- Transportation
- Environment
- Healthcare
- General IoT

### By Locations: Open

- West Africa: Ghana, Senegal, Nigeria, Togo, Benin, Burkina Faso
- East Africa: Kenya, Rwanda, Uganda, Tanzania
- Southern Africa: Namibia, South Africa

**A rich IoT  
information  
directory for  
the Africa.**

**(Find and build  
your own  
innovative  
solutions.)**

# WAZIHack- an event for entrepreneurs



*Do More With Less*

**LOW-COST  
LONG-RANGE**

*IoT to*

**EMPOWER  
RURAL ECONOMIES**

**WAZIHack**

14 & 15 Décembre  
Hôtel de Ville de Dakar



 [Cticdakar.com](http://Cticdakar.com)

 [fb.com/tekk48](https://fb.com/tekk48)

 [#tekk48](https://twitter.com/tekk48)



 Infos et résa sur [samaevent.com](http://samaevent.com)

# Dream café



- Orange digital café is a community platform on which online qualitative studies are realized with real end-users
  - ✓ efficiently collect users 'needs (SMES, startups, etc.)
  - ✓ test mock-ups and prototypes & get feedback
  - ✓ give orientations to development choices
  - ✓ test usages opportunities & scenarios
- 5 steps process:



**We vision for the IoT local Adaptation**

***Made in Africa***

**Co-working with hubs and entrepreneurs**





Thanks.

# Let's make it happen

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[facebook.com/waziupIoT](https://facebook.com/waziupIoT)



[twitter.com/waziupIoT](https://twitter.com/waziupIoT)



[linkedin.com/groups/8156933](https://linkedin.com/groups/8156933)



[github.com/waziup](https://github.com/waziup)