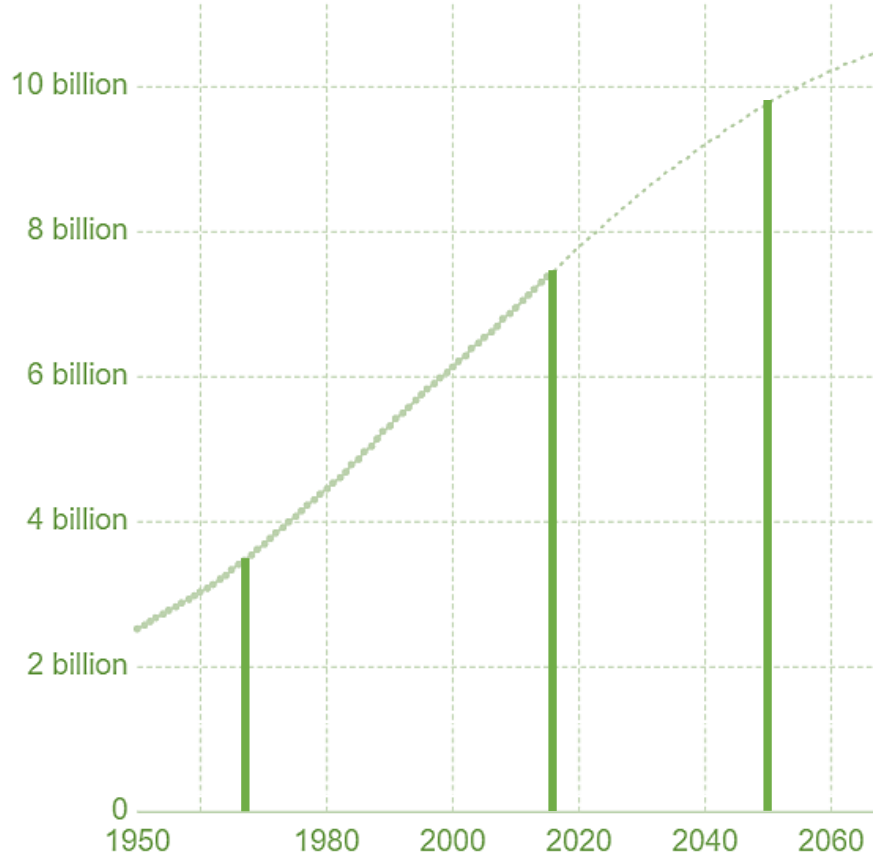


Global agricultural production has tripled over the last 50 years, but today still 820 million suffer from hunger and 2.5 billion suffer from malnutrition

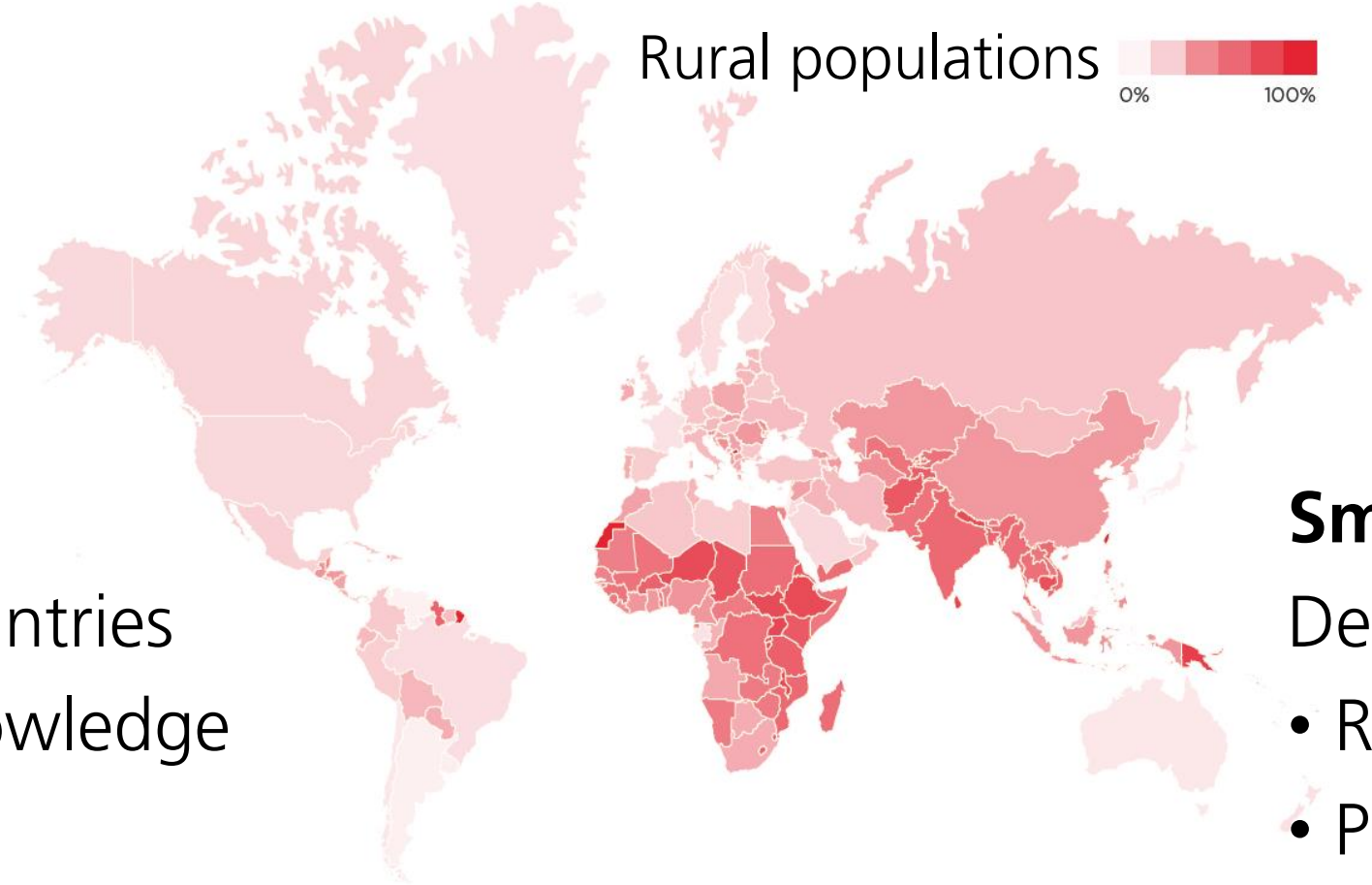
Agricultural production must rise, despite

- limited natural resources
- climate change
- water scarcity
- soil degradation
- loss of biodiversity

Agriculture must simultaneously

- use resources more efficiently
- minimize food loss
- increase sustainability
- improve animal welfare
- adapt better to local conditions
- provide decent jobs
- revenue along the supply chain

https://ourworldindata.org/world-population-growth
https://www.gffa-berlin.de/en/deckblatt-communuque/



E-Agriculture

Developing countries

- Access to Knowledge
- Emancipation
- Vicinity to Markets

Smart Farming

Developed countries

- Remote Monitoring
- Permanent Control
- Extended Security

Common Goals

- Extend competiveness
- Increase sustainability
- Improve quality of life

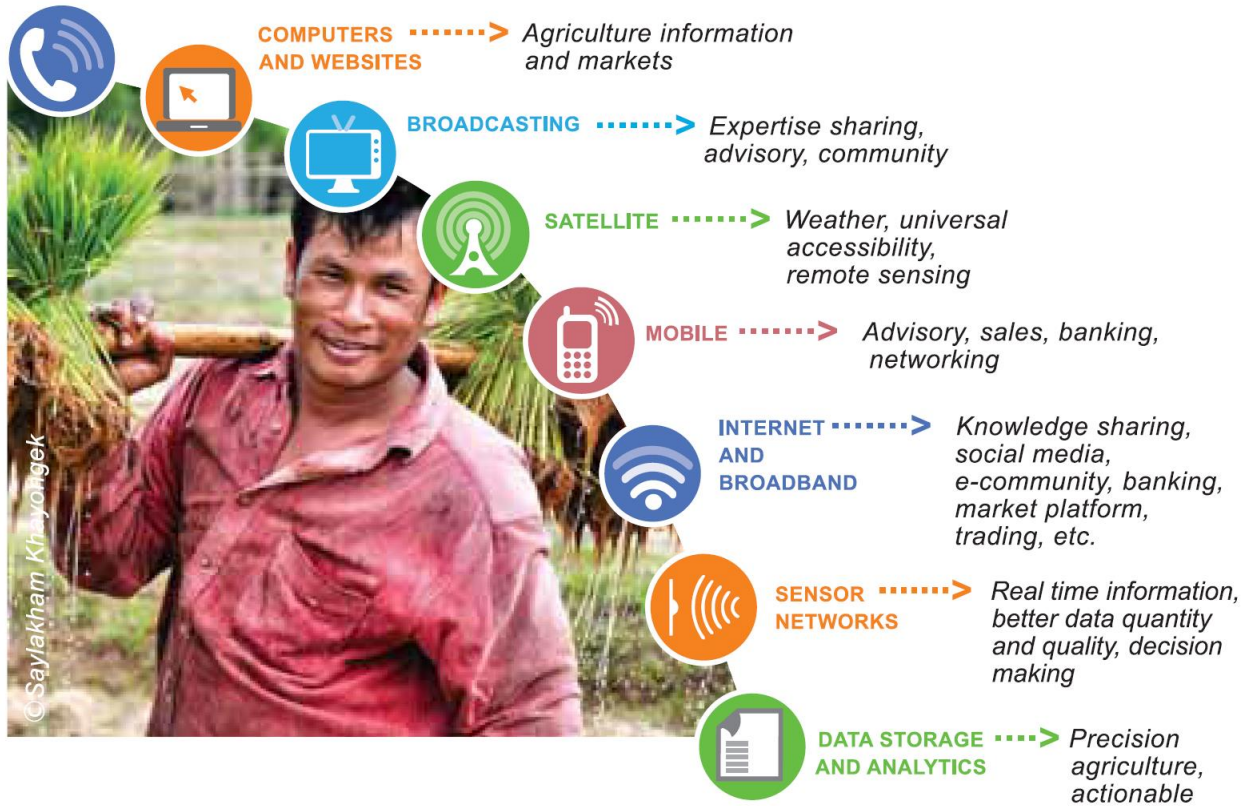
https://www.gsmaintelligence.com/research/?file=9186f77efc0a47fe7f127d79d789c64c&download
https://www.itu.int/en/ITU-T/Workshops-and-Seminars/ict/201309/Documents/S3P2_Daniele_Trinchero.ppt.pdf

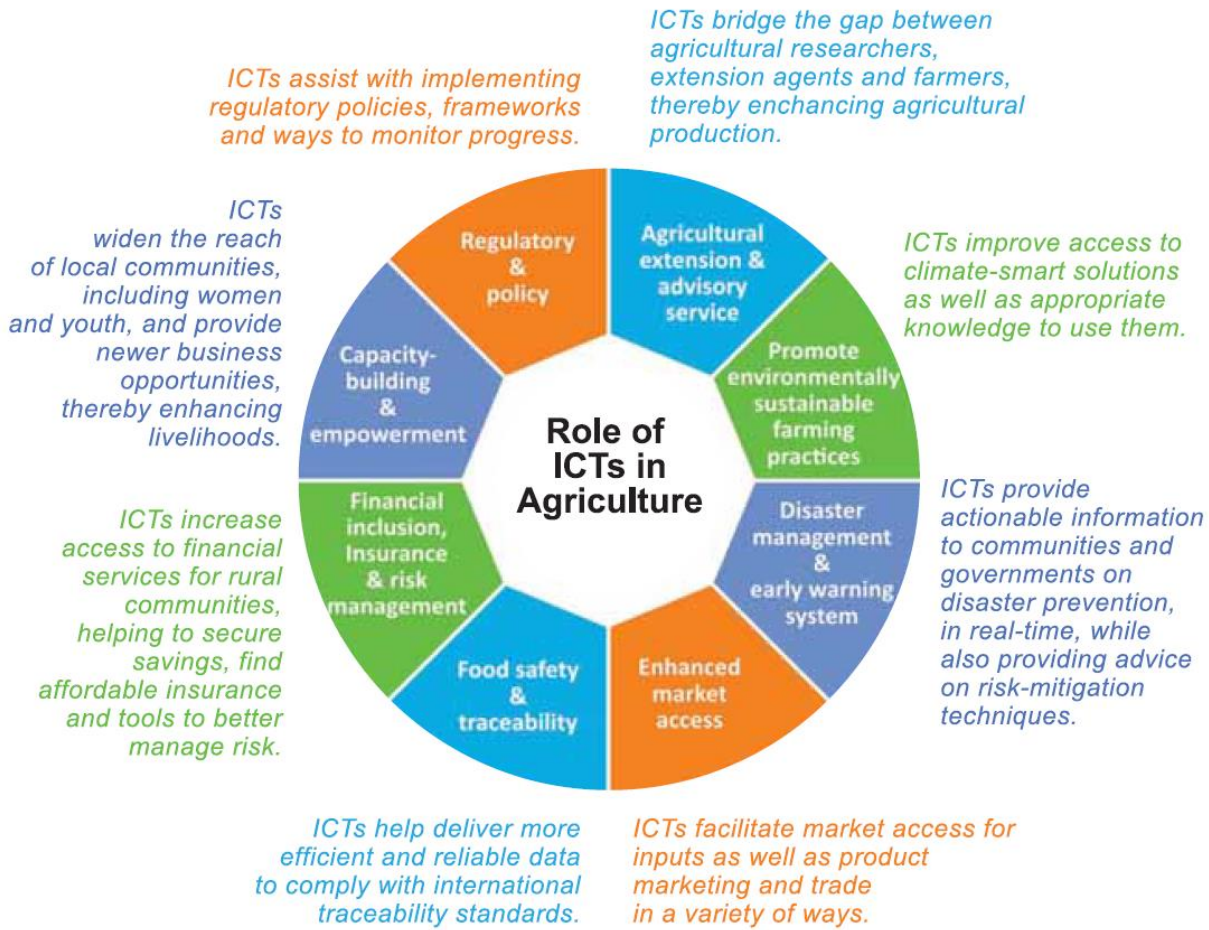
E-agriculture involves designing, developing and applying innovative ways to use information and communication technologies (ICTs) in the rural domain, with a primary focus on agriculture.*

The aim is to boost agricultural and rural development by improving access to valuable information that can help agricultural stakeholders to make the best possible decisions and use the resources available in the most productive and sustainable manner.

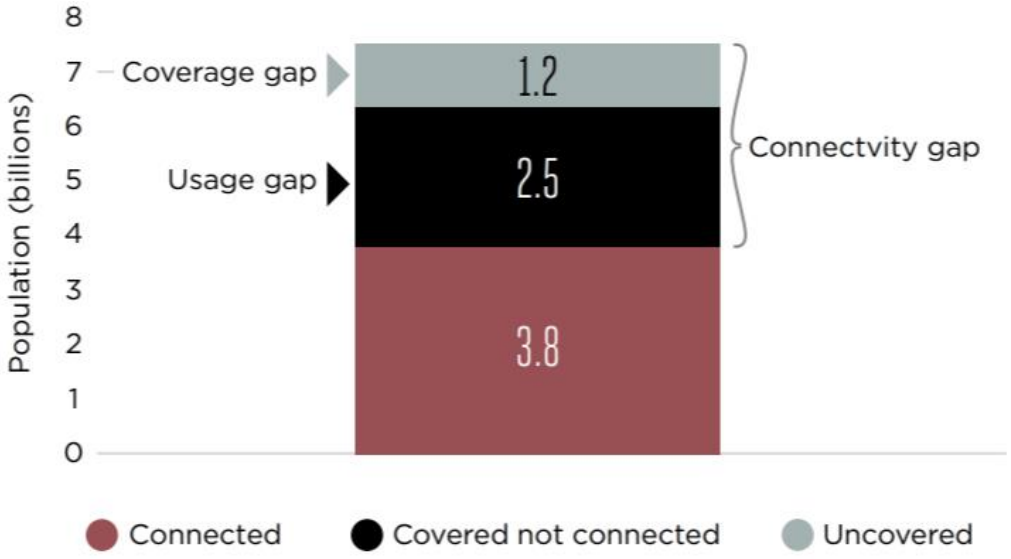
ICTs that can be harnessed for e-agriculture may include devices, networks, services and applications. These can range from cutting edge Internet-based technologies and sensing tools to other technologies that have been around for much longer, such as radio, telephones, televisions, mobile phones and satellites.

http://www.fao.org/3/a-i5564e.pdf

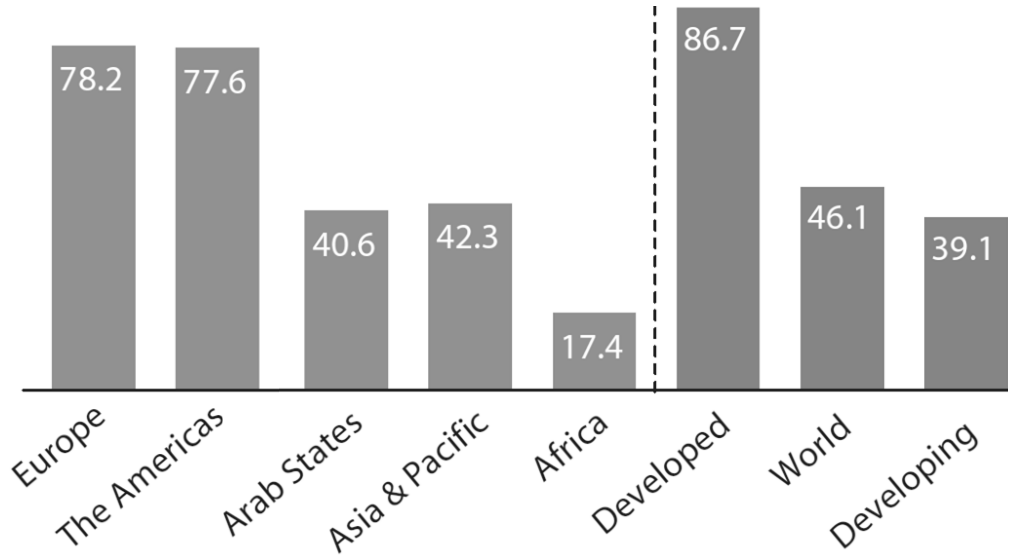




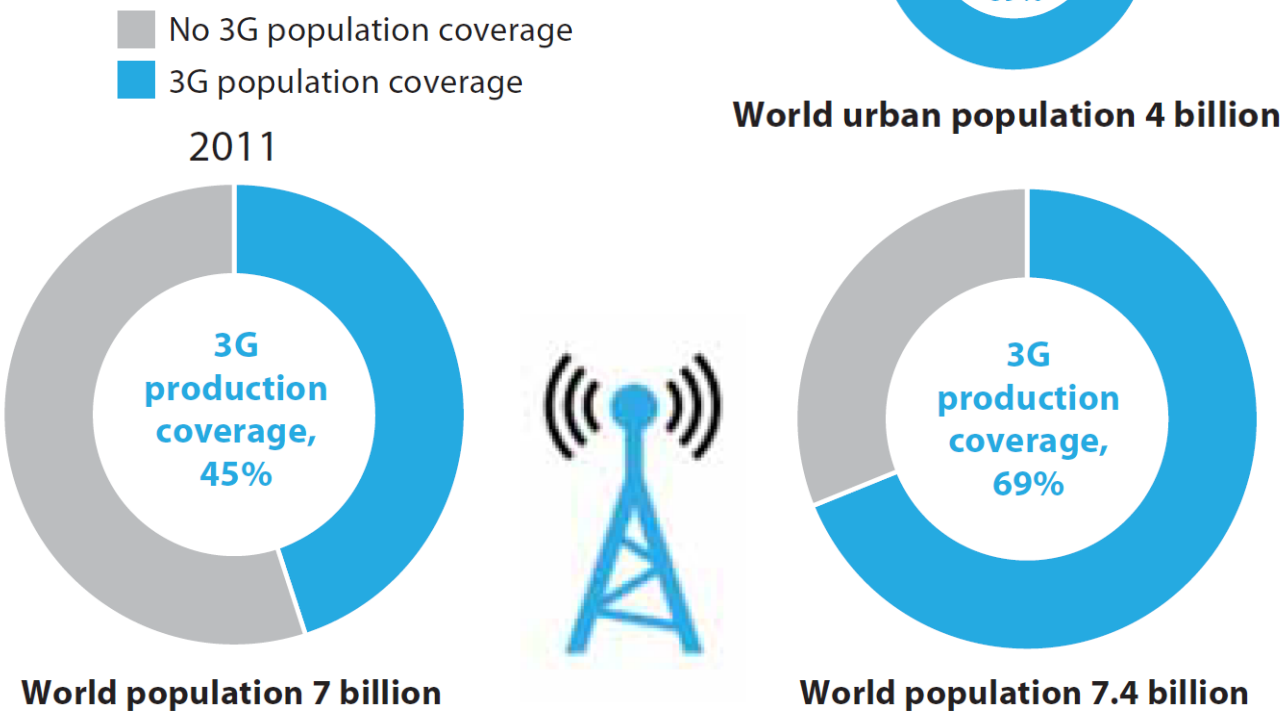
http://www.fao.org/3/a-i5564e.pdf

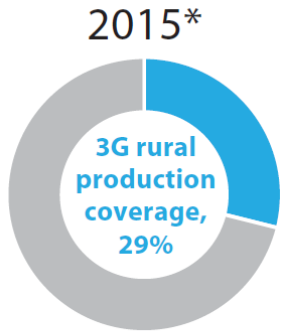


Divide of mobile penetration: less than 20% of Africans have an active subscriptions, compared to 80% in the West

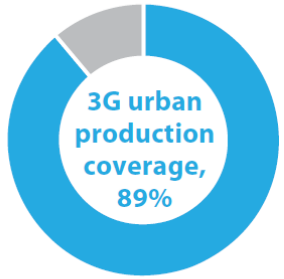


Divide of rural and urban: overall coverage increase, but half of the world population has 3 times more coverage



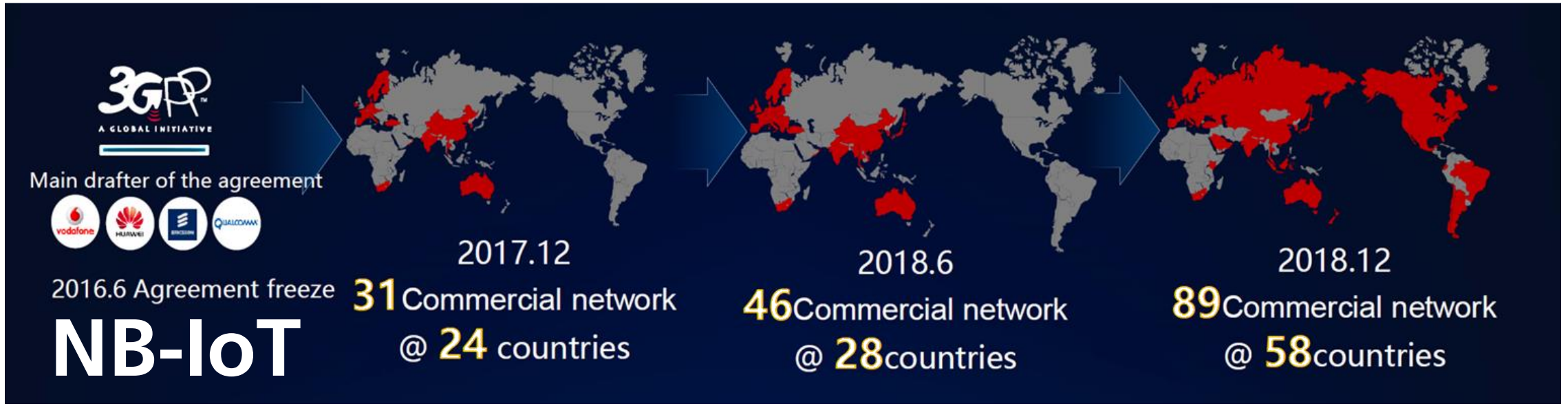


World rural population 3.4 billion



World urban population 4 billion

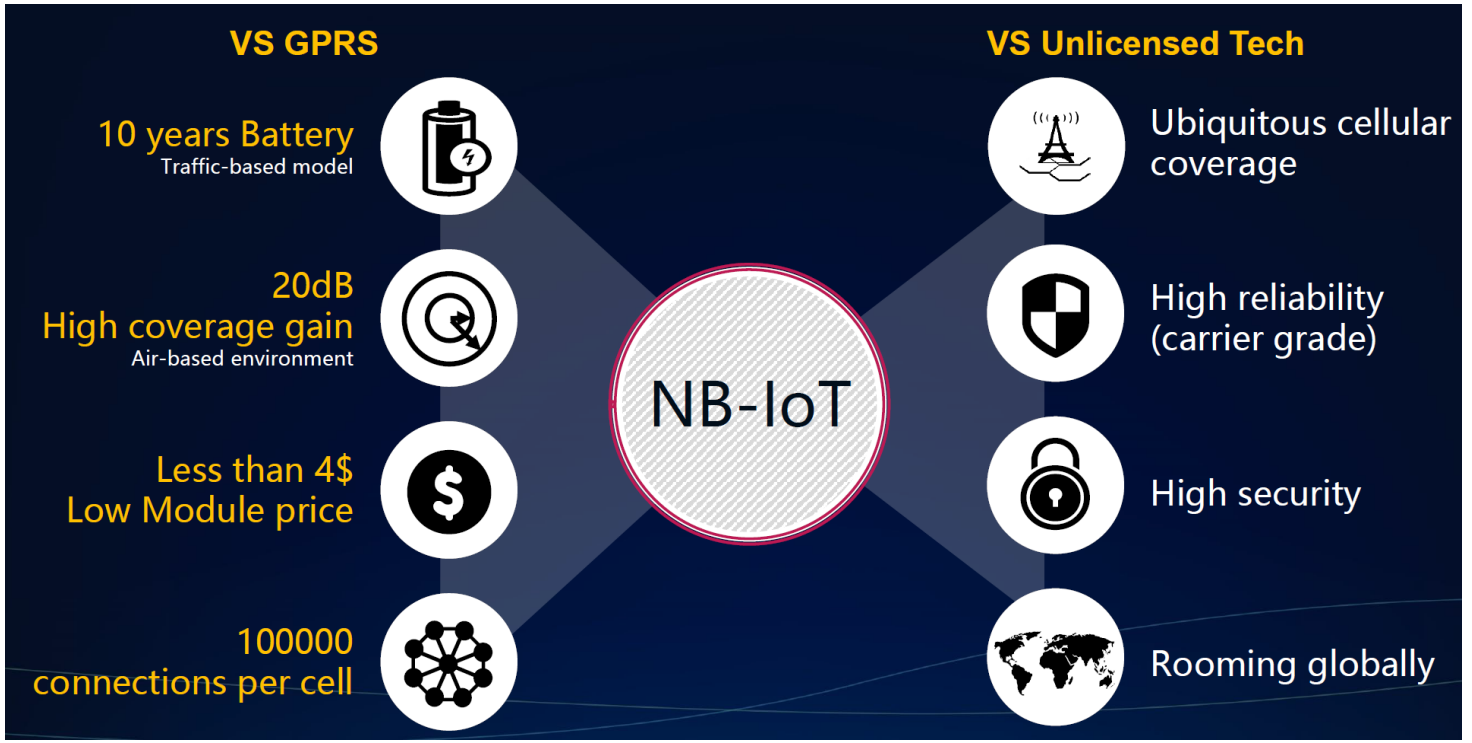
https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2018/02/Enabling_Rural_Coverage_English_February_2018.pdf



Price of NB-IoT module is similar to price of a GSM module

Cost of single user connection is around 0.05 USD per day

→ Best option for future E-Agriculture?



https://www.itu.int/en/ITU-D/Regional-Presence/AsiaPacific/SiteAssets/Pages/E-agriculture-Solutions-Forum-2018/NBIoT%20Enables%20Digitization%20of%20Agriculture%20-%20NANJING%20V4.pdf

Alternatives? Pieces of a Puzzle?

LoRaWAN™

OpenCellular
A Telecom Infra Project

LOON™

- Huawei's RuralStar
- TIP's OpenCellular
- LoRa WAN
- DIY "The Village Base Station"
- 3GPP NB-IoT
- …
- Loon
- Satellites
- Drones
- …

https://loon.co/
https://oc.telecominfraproject.com
https://carrier.huawei.com/en/trends-and-insights/emsite/ruralstar
https://lora-alliance.org/
https://kurti.sh/pubs/vbts_nsdr10.pdf

How will drones impact business?

Predicted commercial applications and market value by industry

Infrastructure
Investment monitoring, maintenance, asset inventory
$45.2 bn

Agriculture
Analysis of soils and drainage, crop health assessment
$32.4 bn

Transport
Delivery of goods, medical logistics
$13.0 bn

Security
Monitoring lines and sites, proactive response
$10.5 bn

Entertainment & Media
Advertising, entertainment, aerial photography, shows and special effects
$8.8 bn

Insurance
Support in claims settlement process, fraud detection
$6.8 bn

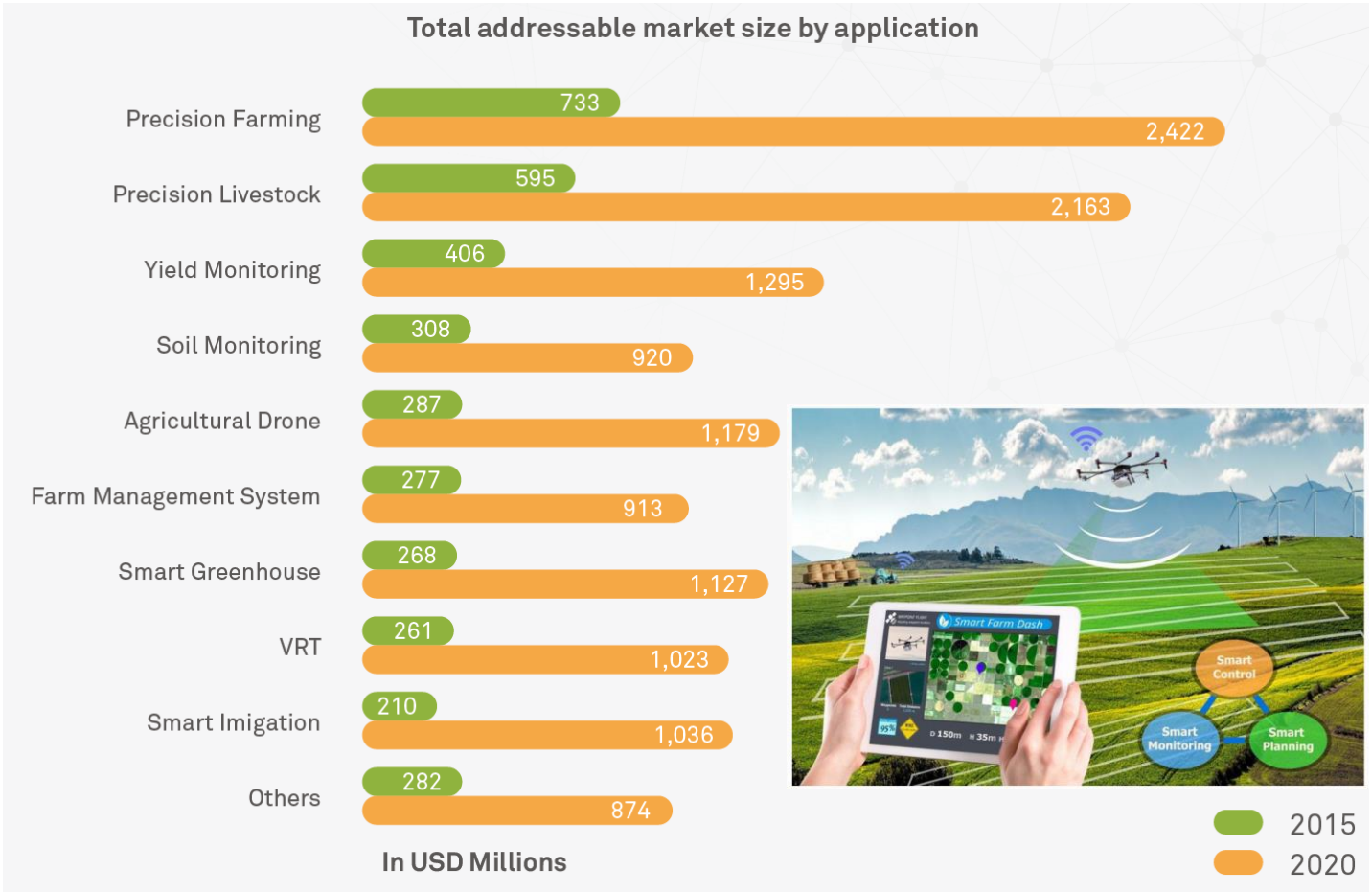
Telecommunication
Tower maintenance, signal broadcasting
$6.3 bn

Mining
Planning, exploration, environmental impact assessment
$4.3 bn

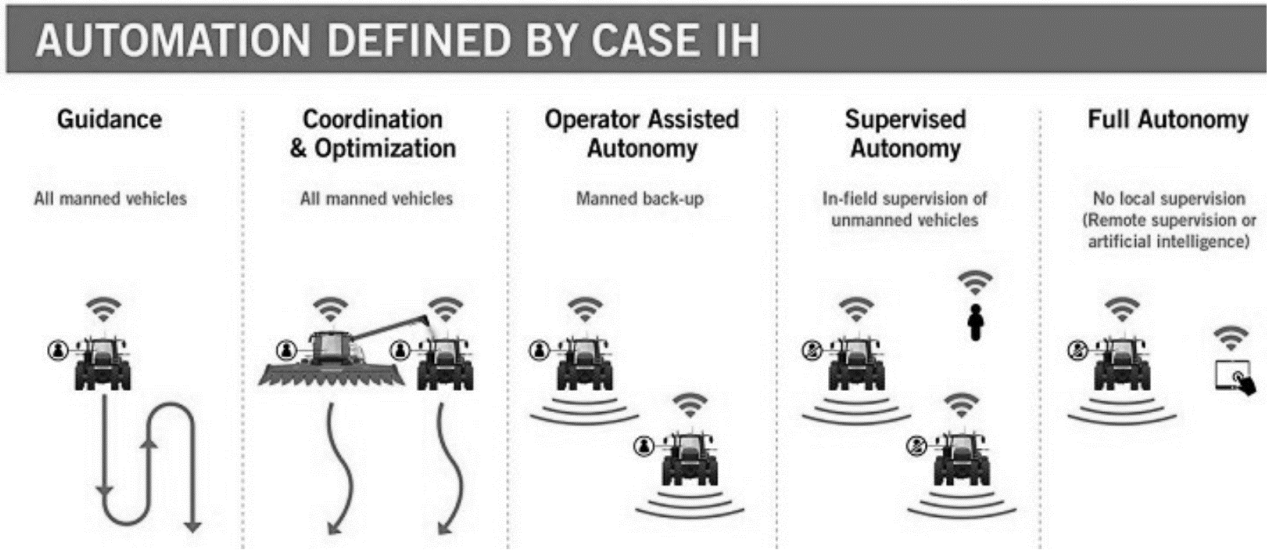
Drones in agriculture can be used for crop production, early warning systems, disaster risk reduction, forestry, fisheries, wildlife conservation…

… can they also provide "piggyback" connectivity?

http://www.fao.org/3/I8494EN/i8494en.pdf

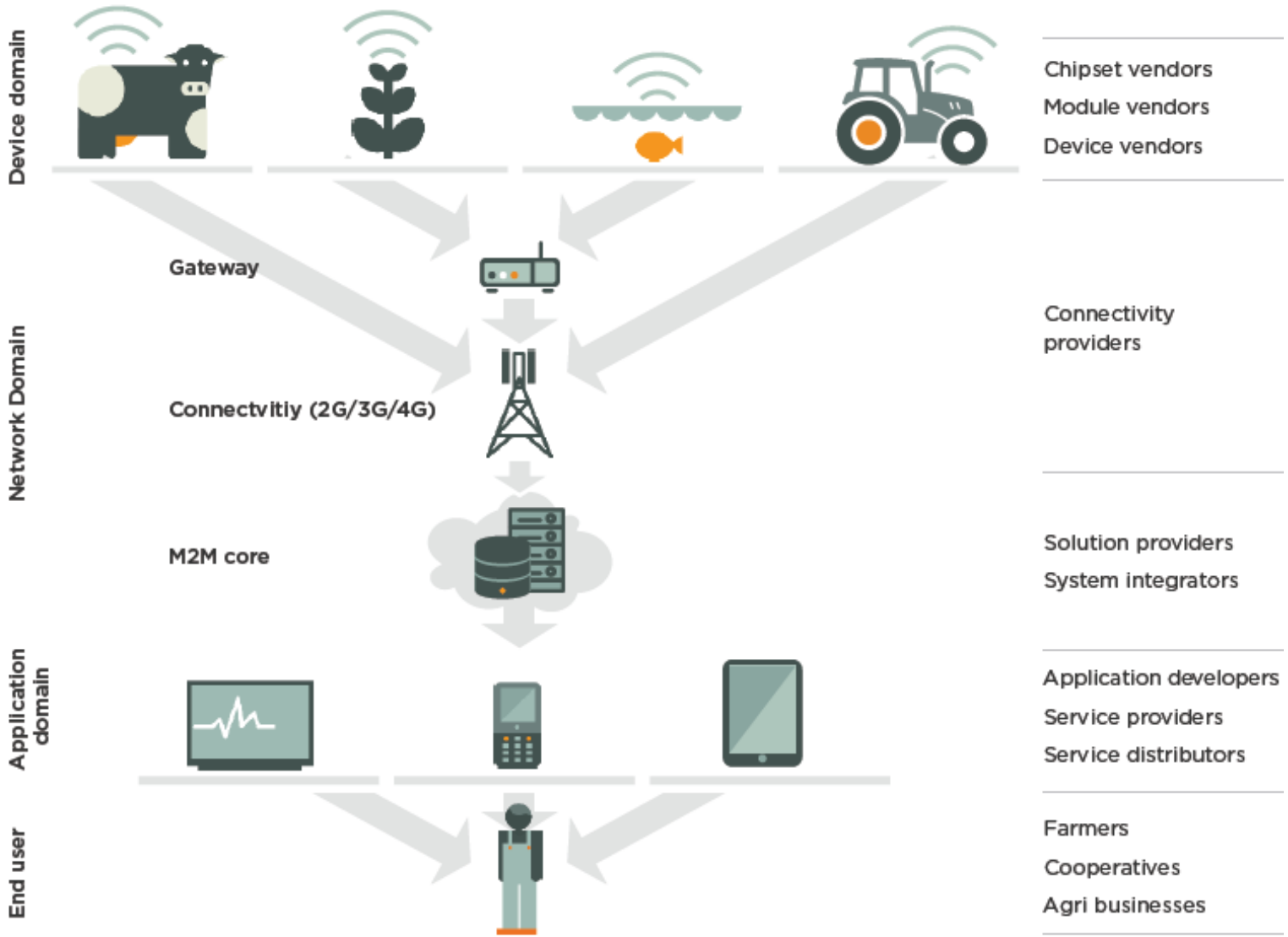


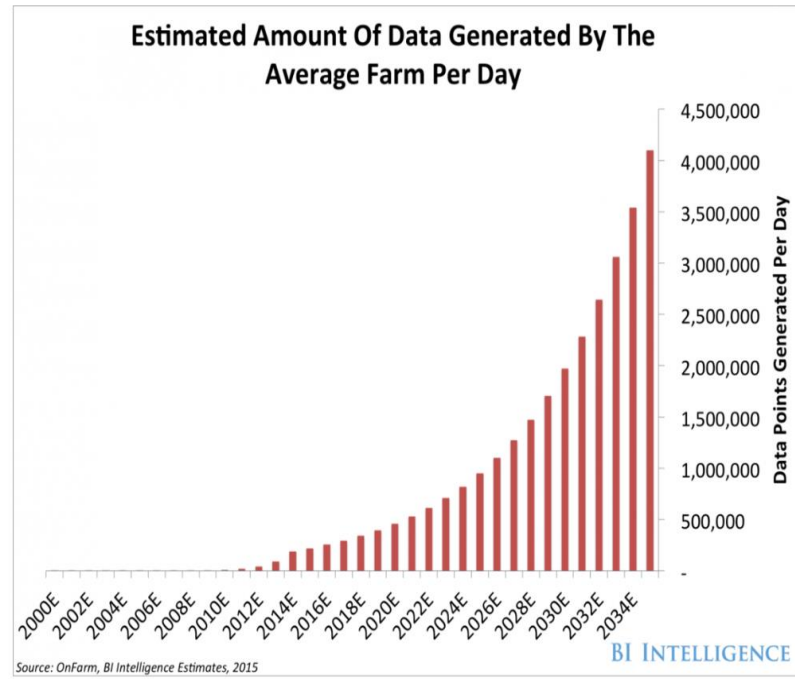
https://www.iso.org/files/live/sites/isoorg/files/news/magazine/ISOfocus%20(2013-NOW)/en/2017/ISOfocus_122/ISOfocus_122_EN.pdf#page=11
https://www.huawei.com/-/media/CORPORATE/Images/PDF/v2-smart-agriculture-0517.pdf?la=en



Technology pathway to autonomy	Tractor manufacturer					
	John Deere	CNH	AGCO	CLAAS	SAME Deutz-Fahr	Kubota
Automated tractor guidance	X	X	X	X	X	X
Variable rate technology	X	X	X	X	X	X
Drive by wire functionality	X	X	X	X	X	X
Performance optimisation	X	X	X	X	X	X
Operation & path planning	X	X	X	X	-	X
Machine to machine communication	X	X	X	-	X	-
Sensing - perception	X	X	-	X	X	-
Sensing - process monitoring	X	X	-	X	-	X
Telematics	X	X	X	X	-	X
Infield coms. and data infrastructure	X	-	-	X	-	X

https://www.caseih.com/northamerica/en-us/innovations/automation
https://www.asirobots.com/farming/
https://grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2017/07/developments-in-autonomous-tractors
https://medium.com/invironment/autonomous-tractors-on-corporate-anti-pirate-mega-farms-17c42ce1b62
https://agfax.com/2016/08/30/autonomous-solutions-cnh-industrial-unveil-autonomous-tractors/





https://www.businessinsider.com/internet-of-things-smart-agriculture-2016-10
https://www.gsmaintelligence.com/research/?file=9186f77efc0a47fe7f127d79d789c64c&download

AI: HELPING FARMERS FEED 10 BILLION PEOPLE

WITH SENSORS, DRONES, ROBOTS, AND SERIOUS COMPUTE POWER, AI IS GIVING FARMERS THE TOOLS THEY NEED TO GROW CROPS MORE SUSTAINABLY.

THE CHALLENGE

Increase global food production 50% by 2050 to feed an additional 2 billion people[1].

HOW AI CAN HELP

IDENTIFYING PLANT DISEASE

Algorithms can identify 26 diseases in 14 different species with 99% accuracy[2].

AUTOMATING FARM EQUIPMENT

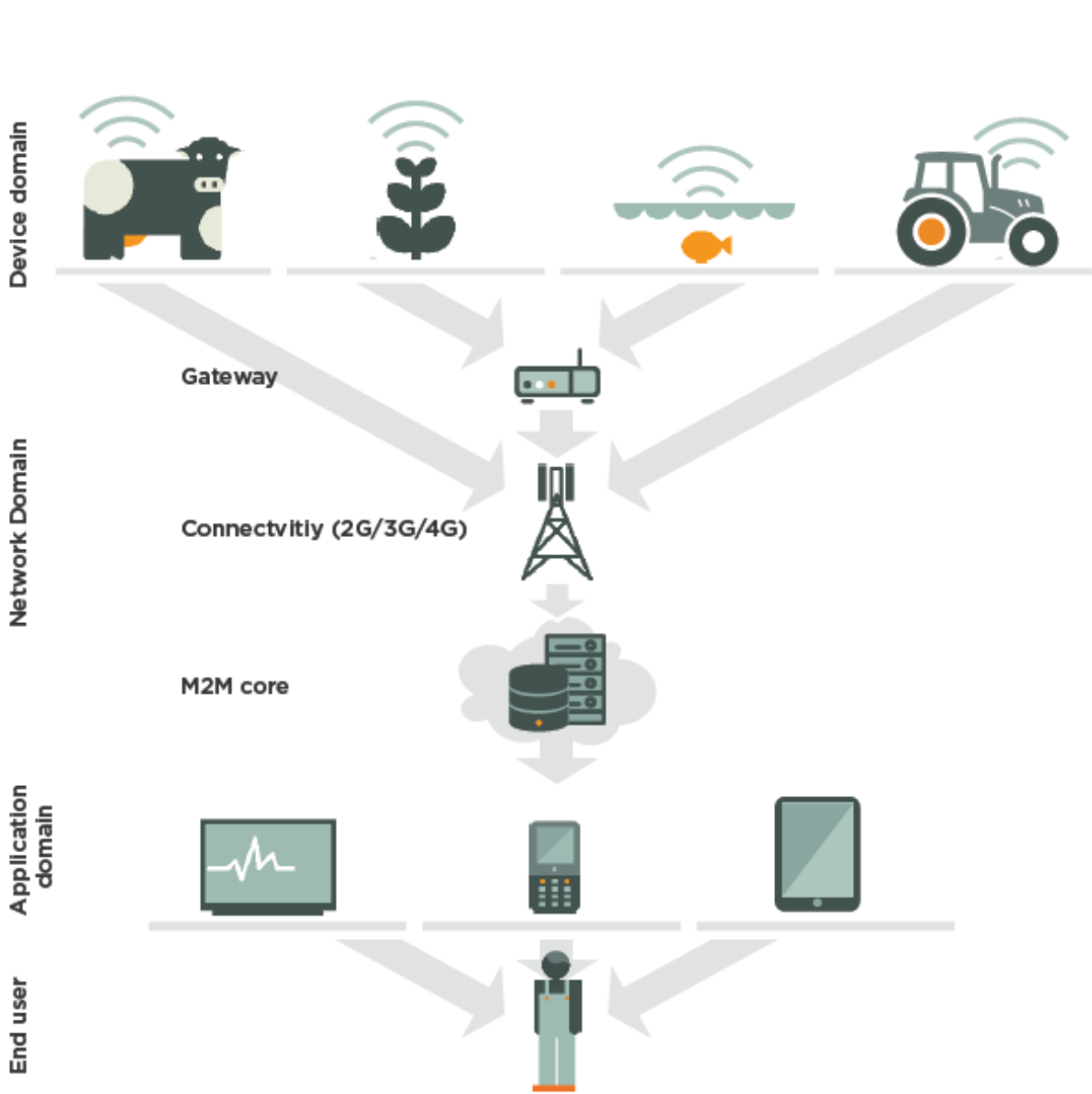
Machine learning helps equipment avoid obstacles and monitor plants to save water.

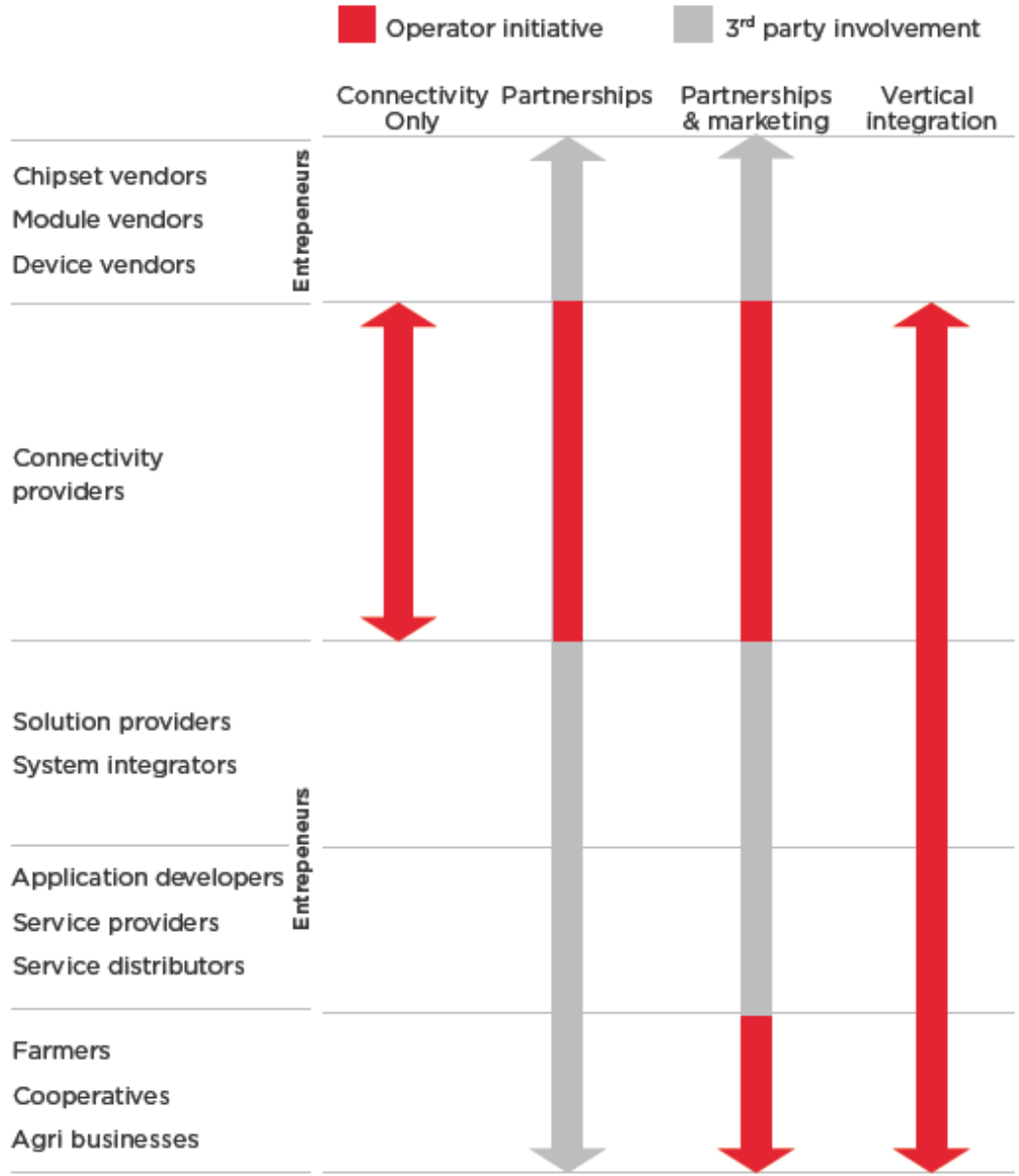
DETECTING PEST INFESTATIONS

Early detection allows farmers to act quickly and minimize losses.

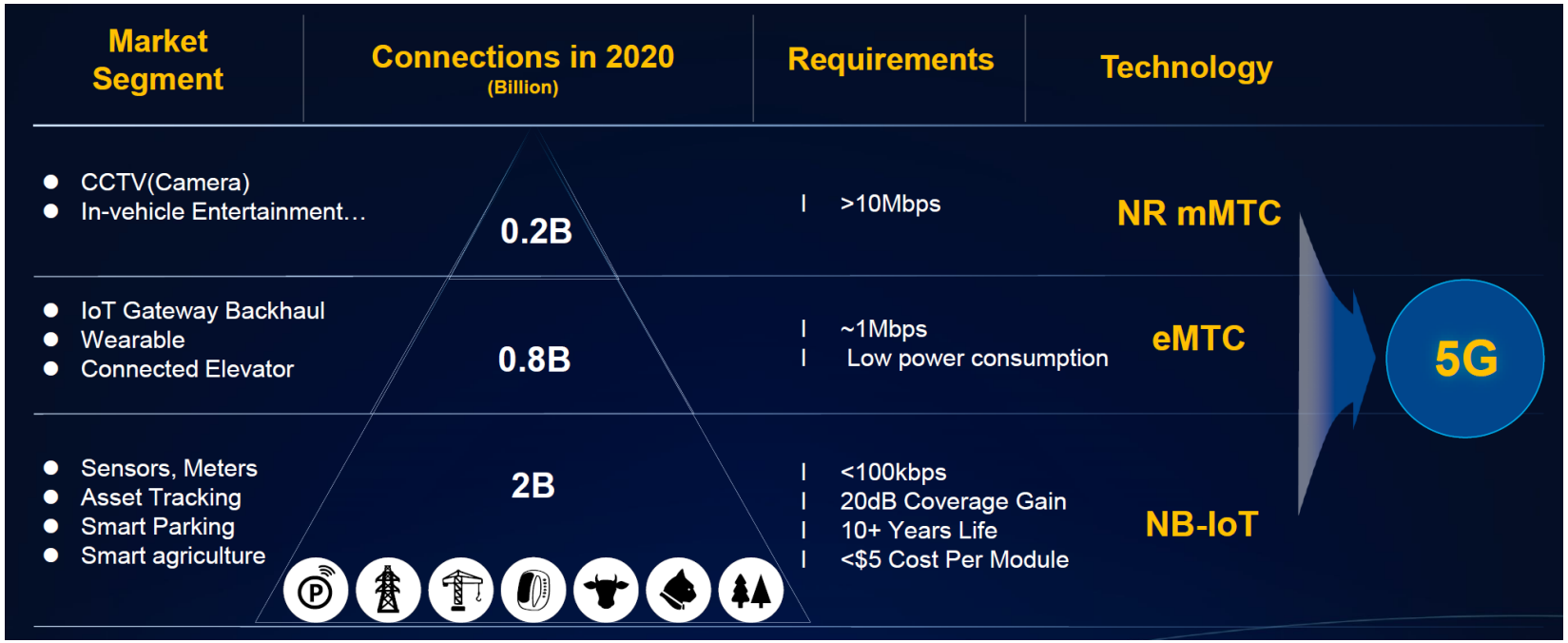
[1] http://www.fao.org/state-of-food-security-nutrition/en/?utm_source=faohomepage&utm_medium=web&utm_campaign=featurebar
[2] https://arxiv.org/pdf/1604.03169.pdf

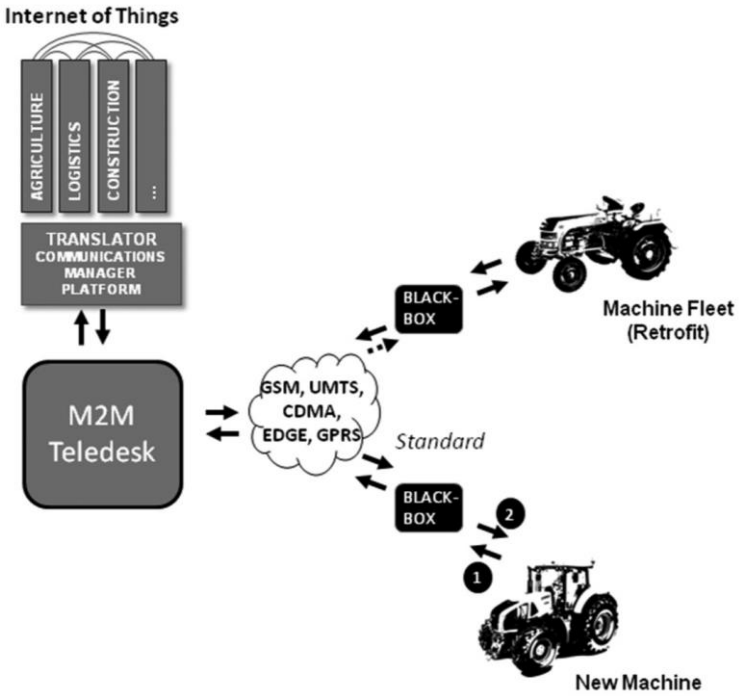
https://www.intel.com/content/www/us/en/big-data/article/agriculture-harvests-big-data.html





Towards Standards for Agricultural ICT

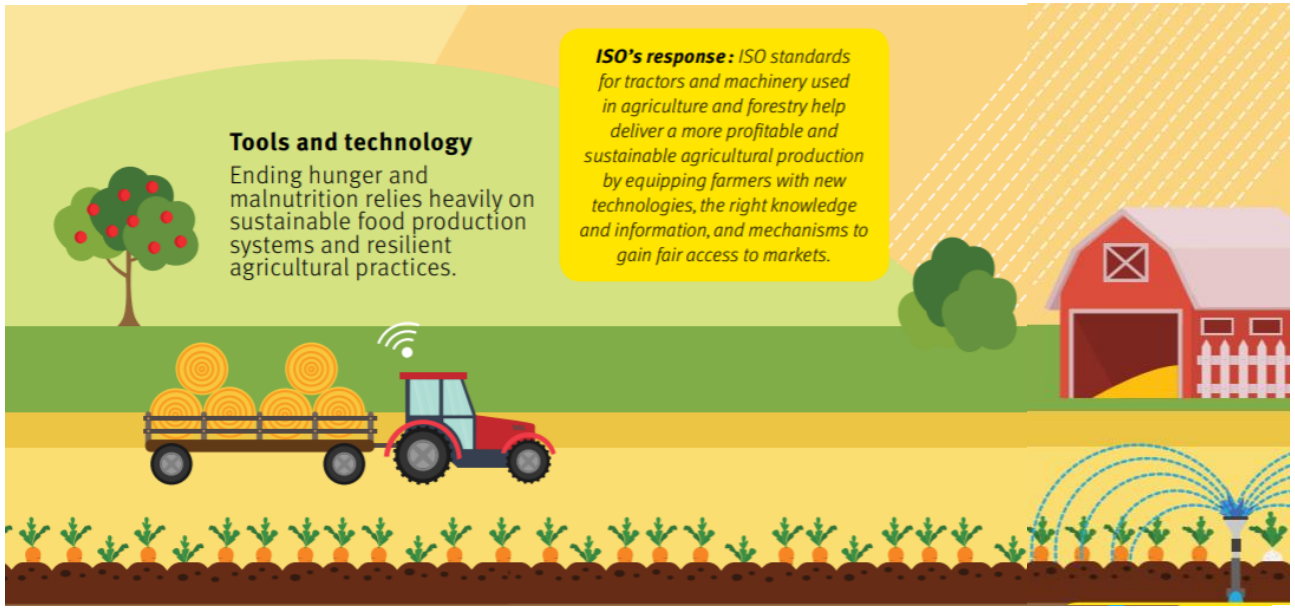




https://www.riverpublishers.com/pdf/ebook/chapter/RP_9788793237049C13.pdf
https://www.itu.int/en/ITU-D/Regional-Presence/AsiaPacific/SiteAssets/Pages/E-agriculture-Solutions-Forum-2018/NBIoT%20Enables%20Digitization%20of%20Agriculture%20-%20NANJING%20V4.pdf

Towards Standards for Agricultural AI

- Agricultural Information Management Standards
- ISO 11783 Serial control and communications data network for agricultural tractors
- ISO/TC 23/SC 19 Agricultural electronics
- …



→Agricultural AI cannot be standardized, but we might need common data formats, interfaces, trusted frameworks etc.

https://www.iso.org/committee/47156.html http://aims.fao.org/ https://en.wikipedia.org/wiki/ISO_11783

https://www.iso.org/files/live/sites/isoorg/files/news/magazine/ISOfocus%20(2013-NOW)/en/2017/ISOfocus_122/ISOfocus_122_EN.pdf#page=11

Conclusions

- We need global harmonization of agricultural ICT standards
- E-Agriculture requires low-cost, low-complexity solutions with standardized methods, approaches, devices
- Smart Farming requires an integrated ICT solution as standard to account for the various emerging use cases

→ Establishment of a new ITU Focus Group might be a good start