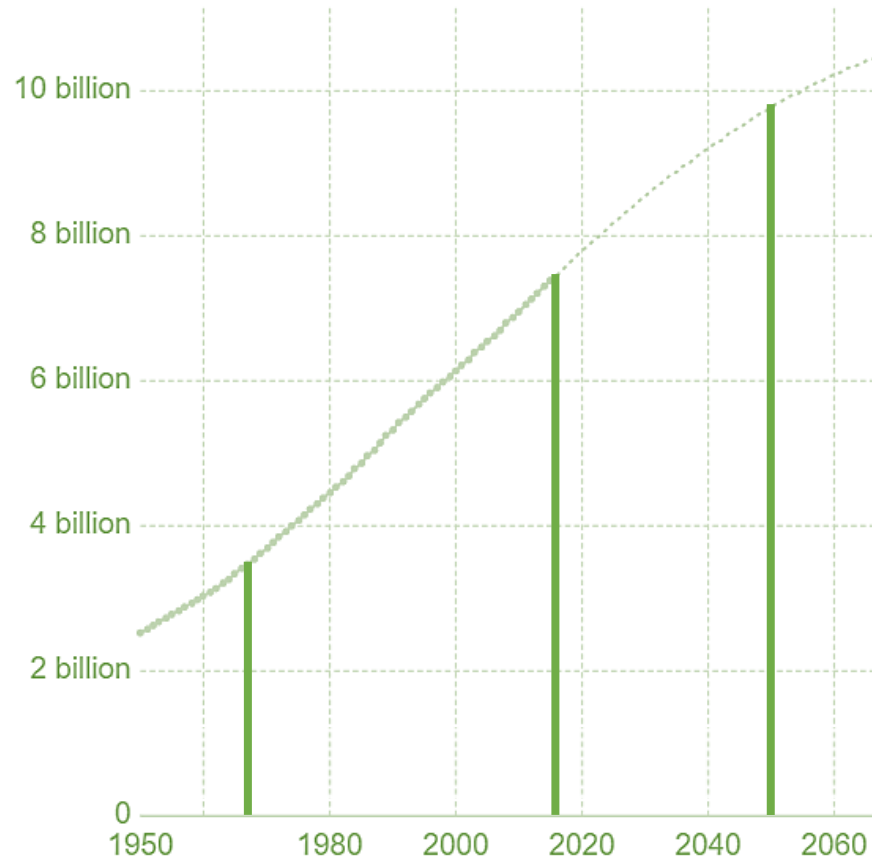


AI and Communications for the Future of Agriculture



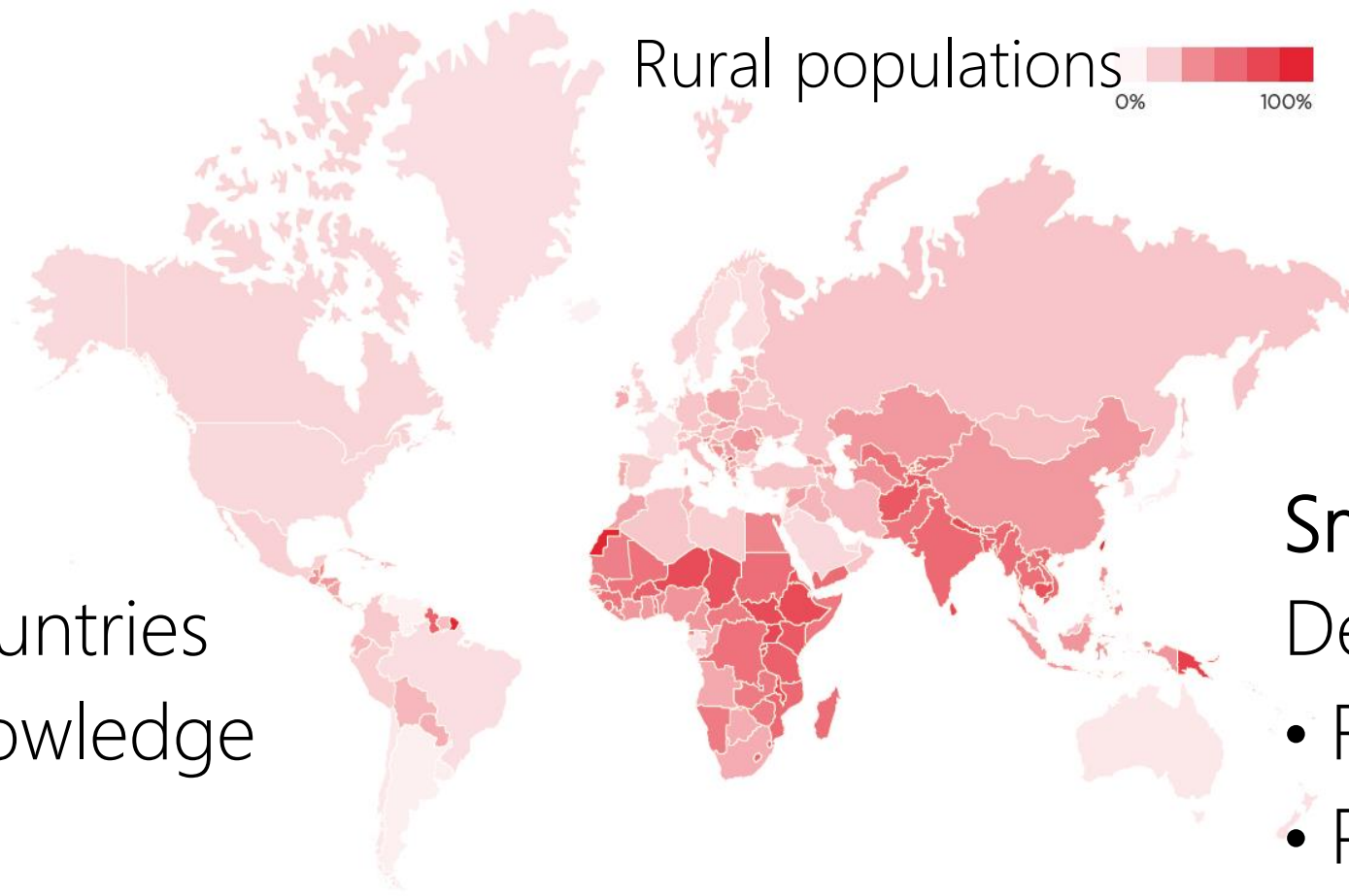
Global agricultural production has tripled over the last 50 years, but today still 820 million suffer from hunger and 2.5 billion suffer from malnutrition

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



E-Agriculture

Developing countries

- Access to Knowledge
- Emancipation
- Vicinity to Markets

Smart Farming

Developed countries

- Remote Monitoring
- Permanent Control
- Extended Security

Common Goals

- Extend competitiveness
- Increase sustainability
- Improve quality of life

Family farms make up around 90% of all agricultural enterprises worldwide and account for approximately 56% of agricultural production.



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.



TELEPHONE> Interactive voice response



COMPUTERS AND WEBSITES> Agriculture information and markets



BROADCASTING> Expertise sharing, advisory, community



SATELLITE> Weather, universal accessibility, remote sensing



MOBILE> Advisory, sales, banking, networking



INTERNET AND BROADBAND> Knowledge sharing, social media, e-community, banking, market platform, trading, etc.



SENSOR NETWORKS> Real time information, better data quantity and quality, decision making



DATA STORAGE AND ANALYTICS> Precision agriculture, actionable knowledge



© Saylakham Khayongek

ICTs assist with implementing regulatory policies, frameworks and ways to monitor progress.

ICTs bridge the gap between agricultural researchers, extension agents and farmers, thereby enhancing agricultural production.

ICTs widen the reach of local communities, including women and youth, and provide newer business opportunities, thereby enhancing livelihoods.

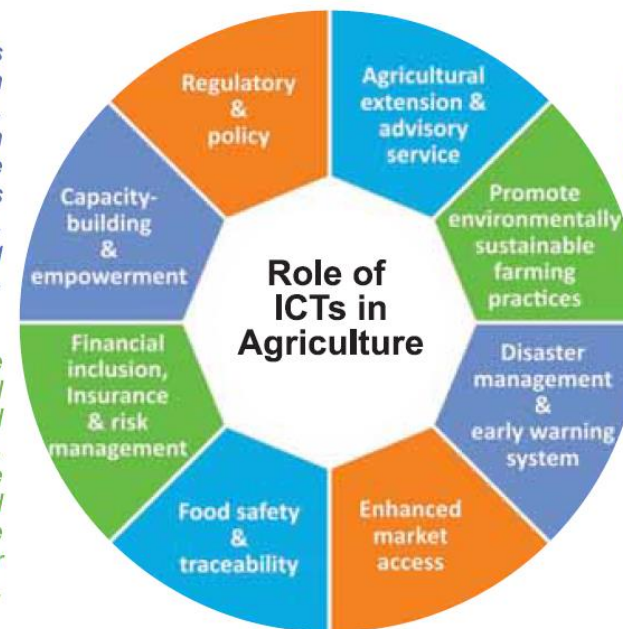
ICTs increase access to financial services for rural communities, helping to secure savings, find affordable insurance and tools to better manage risk.

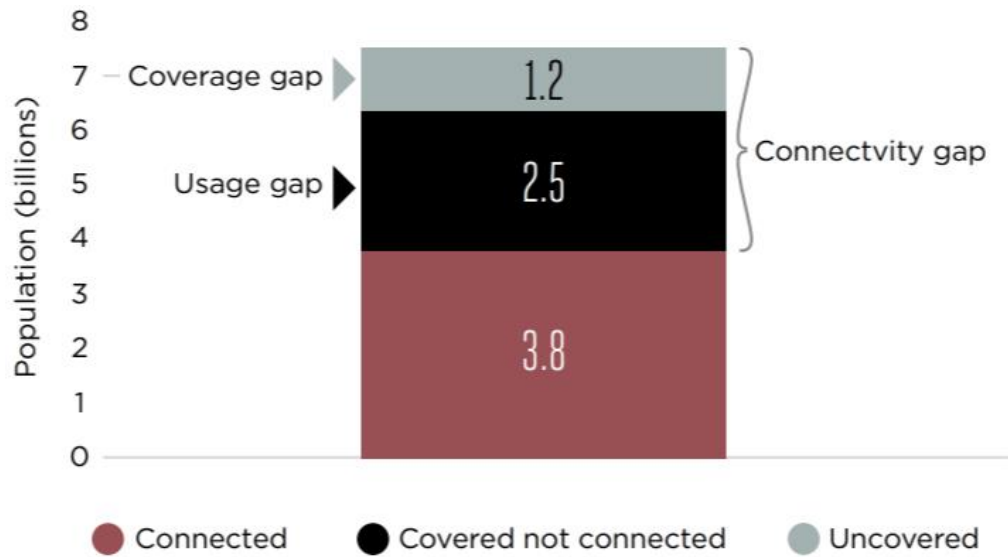
ICTs help deliver more efficient and reliable data to comply with international traceability standards.

ICTs facilitate market access for inputs as well as product marketing and trade in a variety of ways.

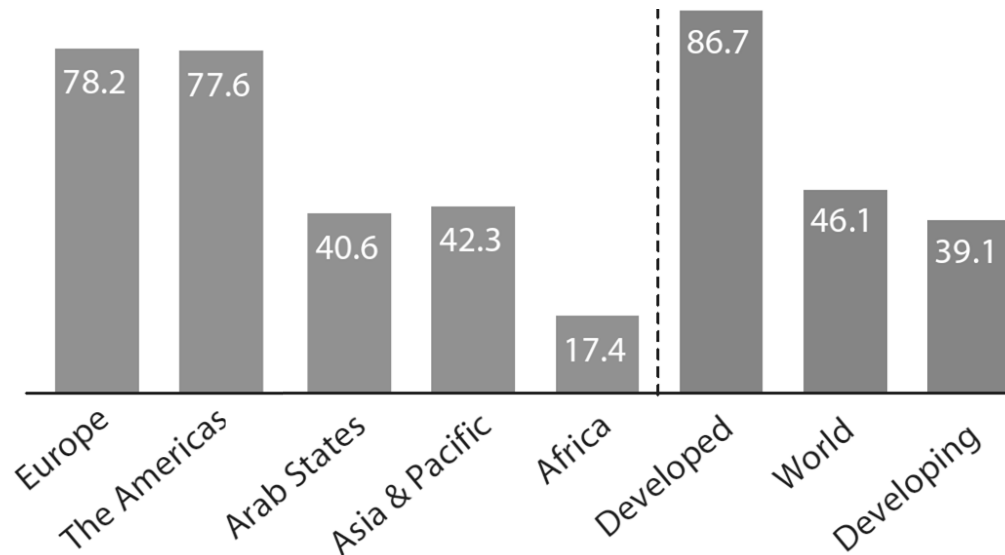
ICTs improve access to climate-smart solutions as well as appropriate knowledge to use them.

ICTs provide actionable information to communities and governments on disaster prevention, in real-time, while also providing advice on risk-mitigation techniques.

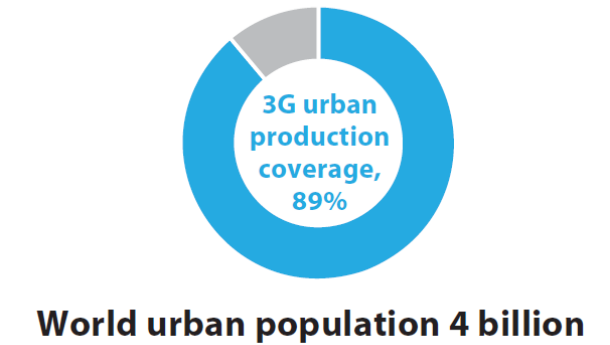
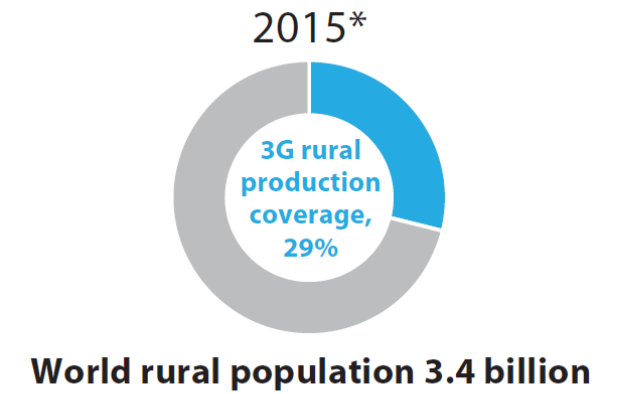
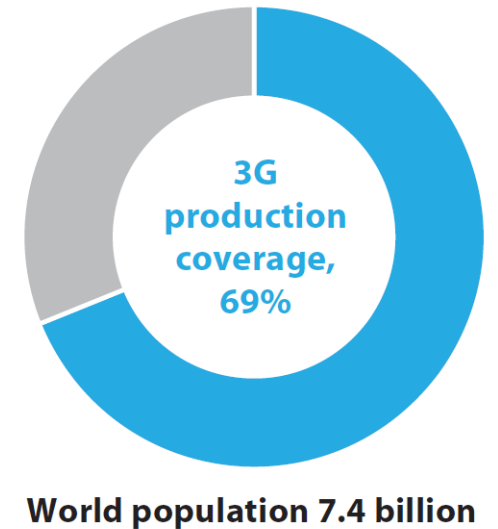
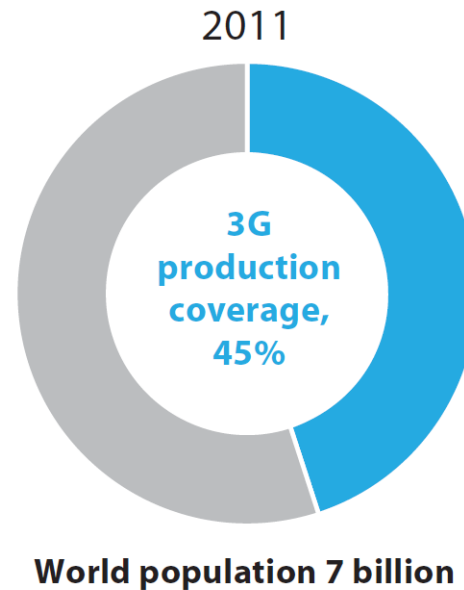
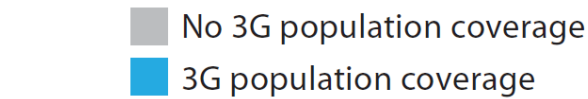


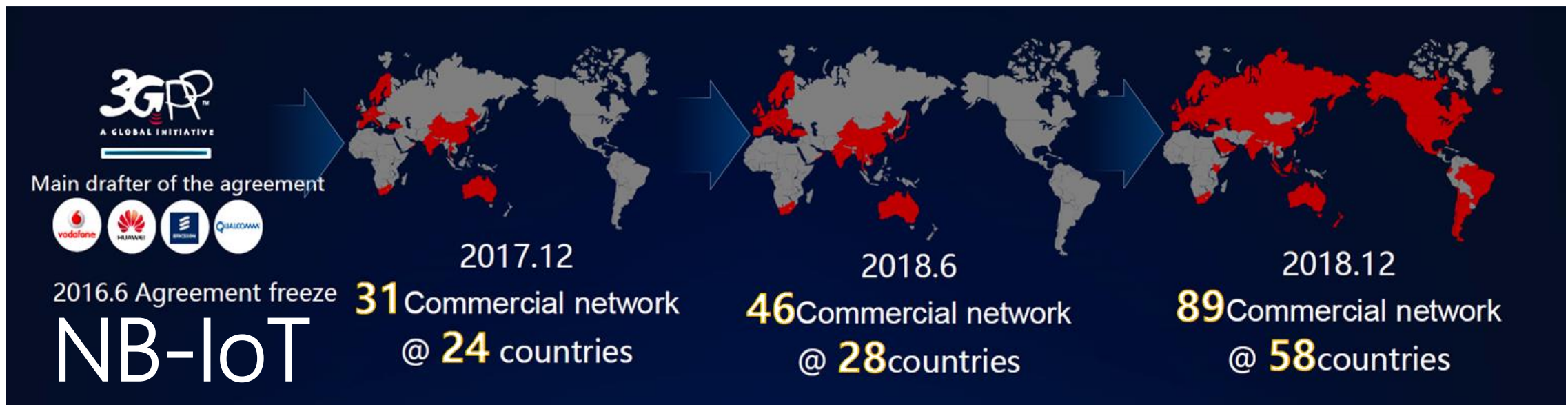


Divide of mobile penetration:
less than 20% of Africans have
an active subscriptions,
compared to 80% in the West



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

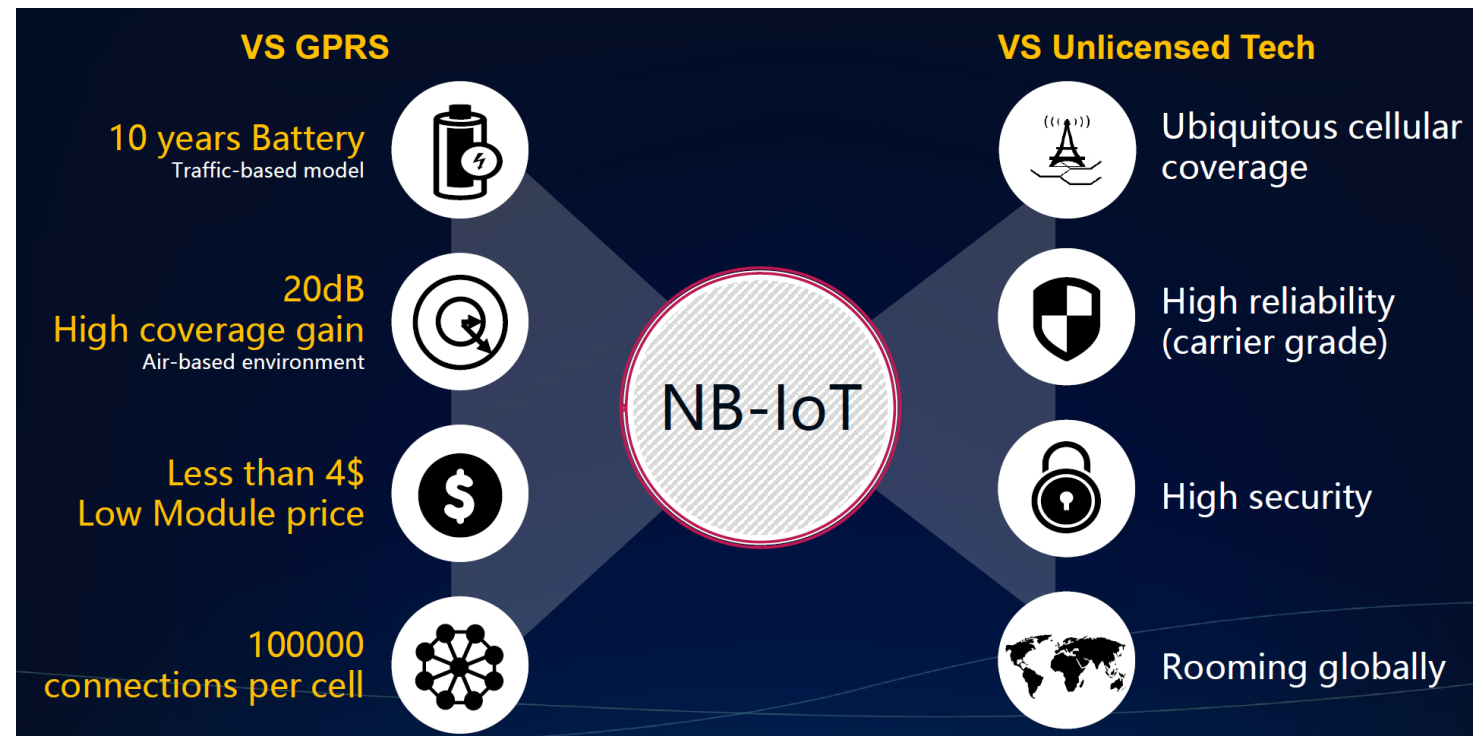




Price of NB-IoT module is similar to price of a GSM module

Cost of single user connection is around 0.05 USD per day

→ Best option for future E-Agriculture?



Alternatives? Pieces of a Puzzle?



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



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



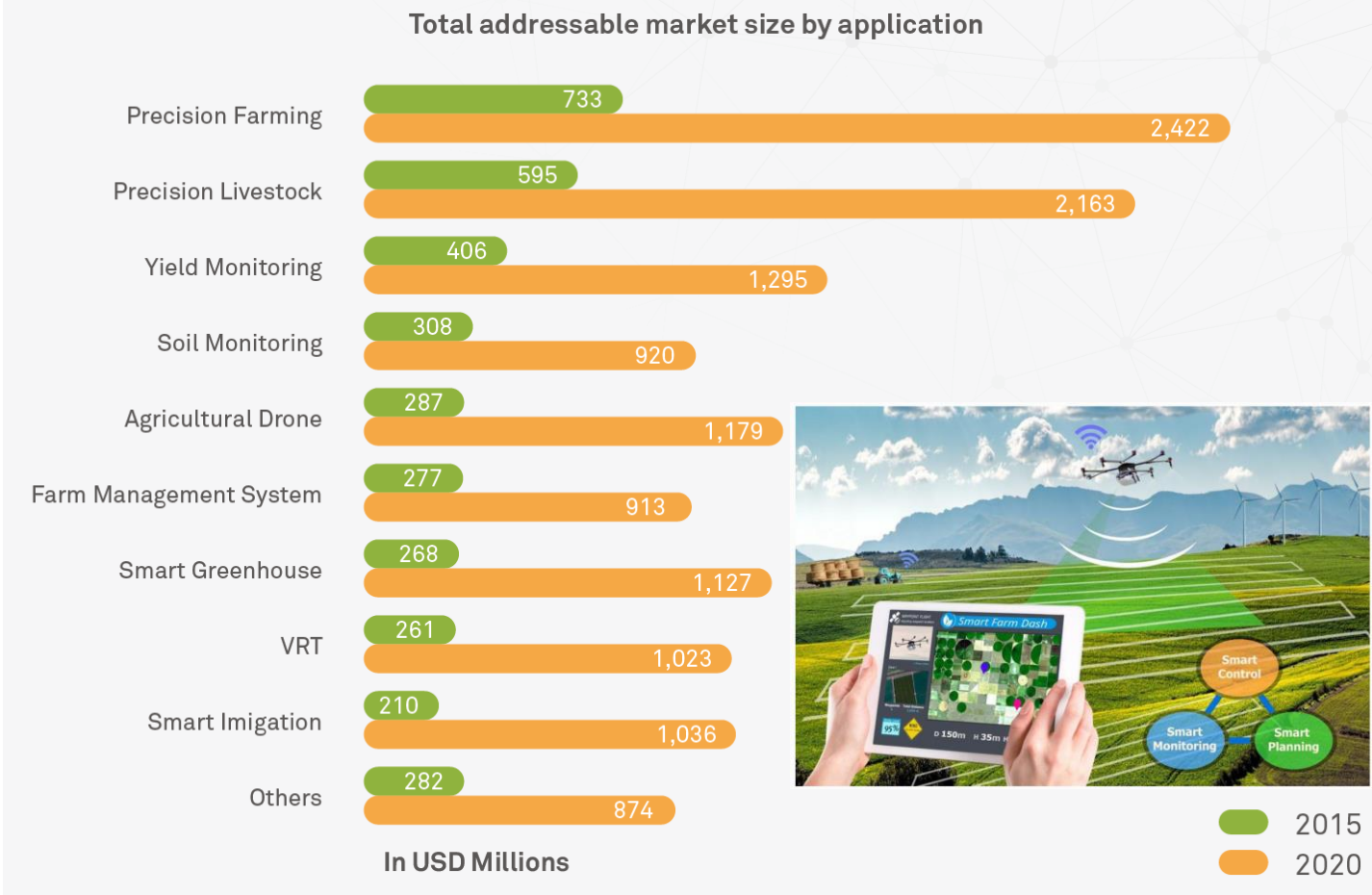
Mining

Planning, exploration,
environmental impact
assessment

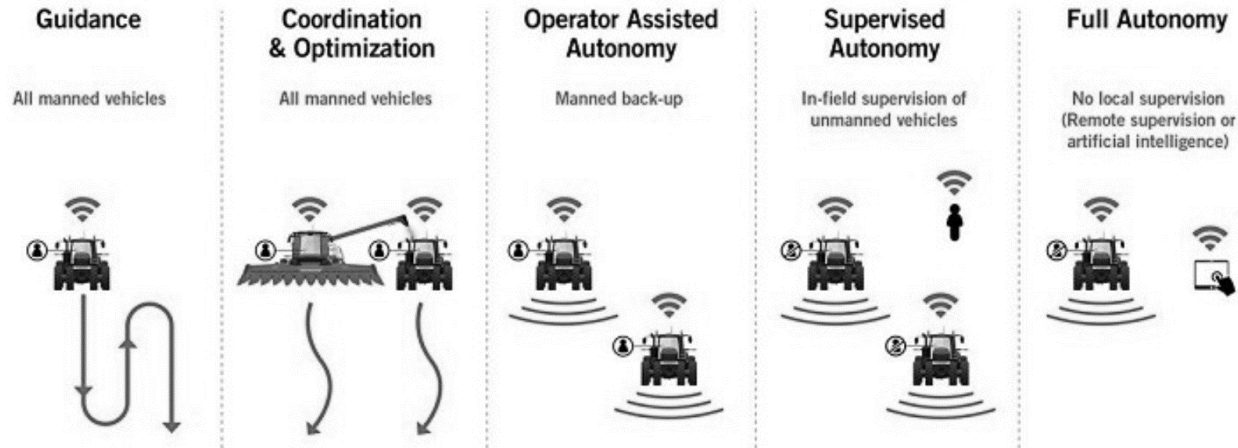
\$4.3 bn

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?

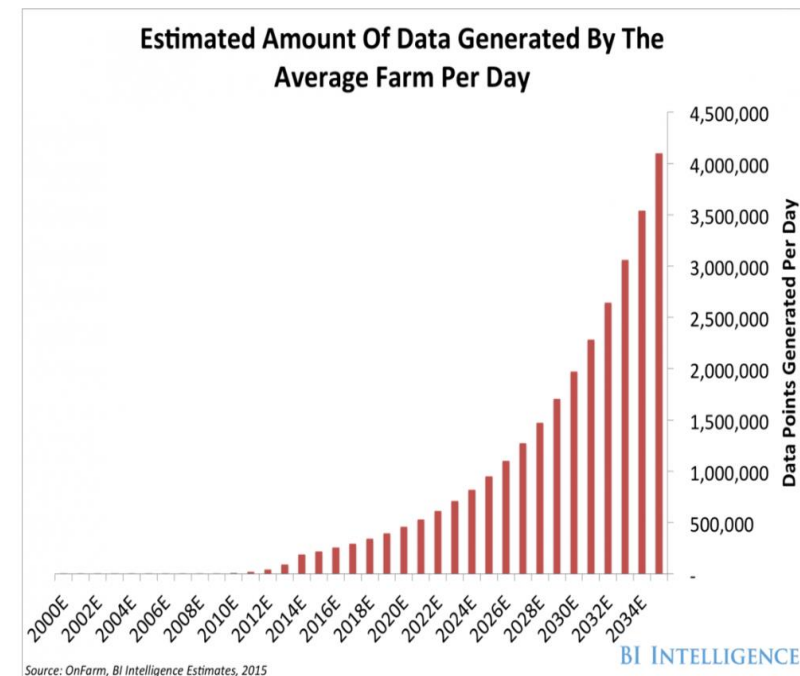
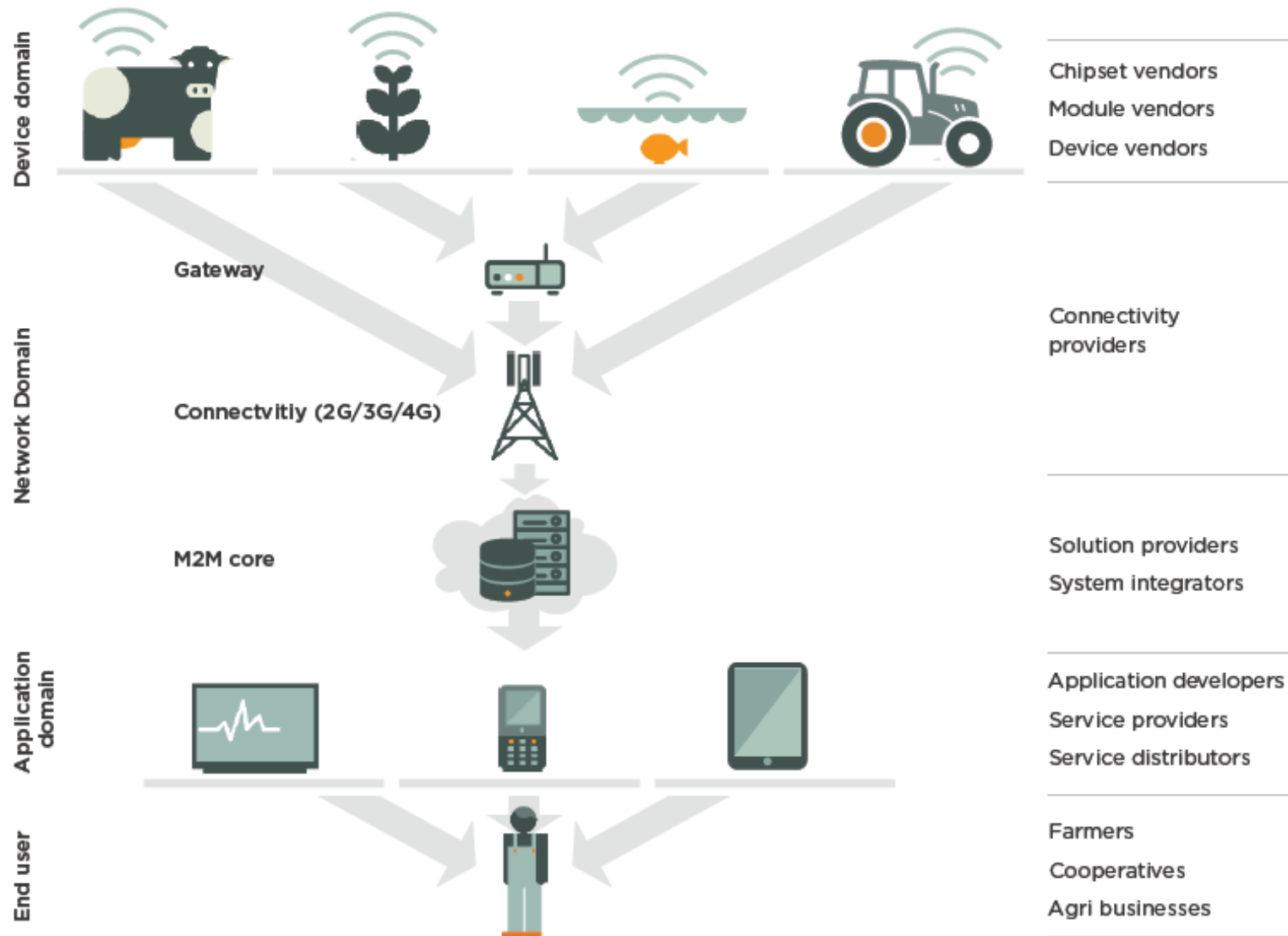


AUTOMATION DEFINED BY CASE IH



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





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 people¹.

HOW AI CAN HELP

IDENTIFYING PLANT DISEASE

Algorithms can identify 26 diseases in 14 different species with 99% accuracy².

DETECTING PEST INFESTATIONS

Early detection allows farmers to act quickly and minimize losses.

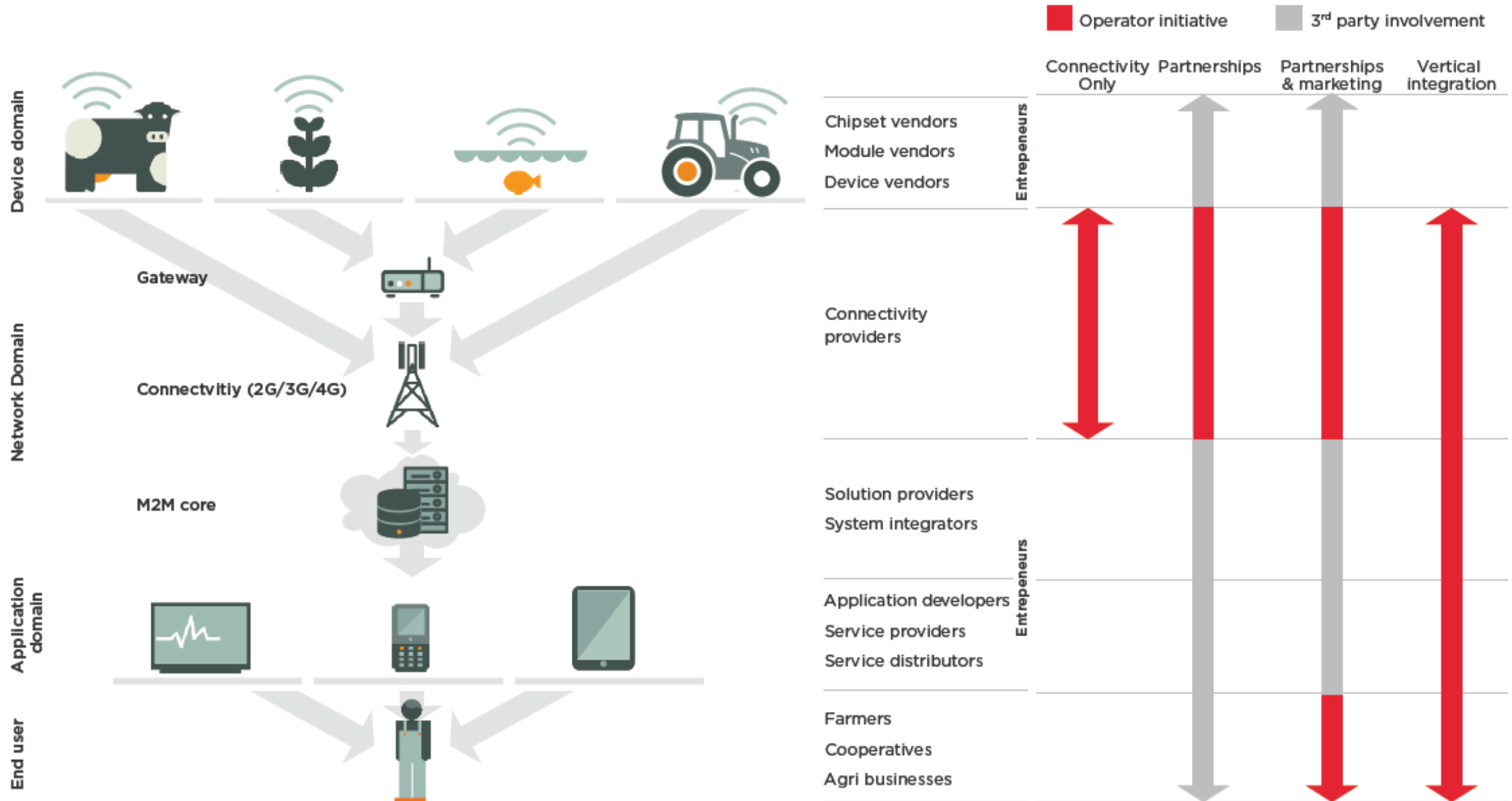
AUTOMATING FARM EQUIPMENT

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



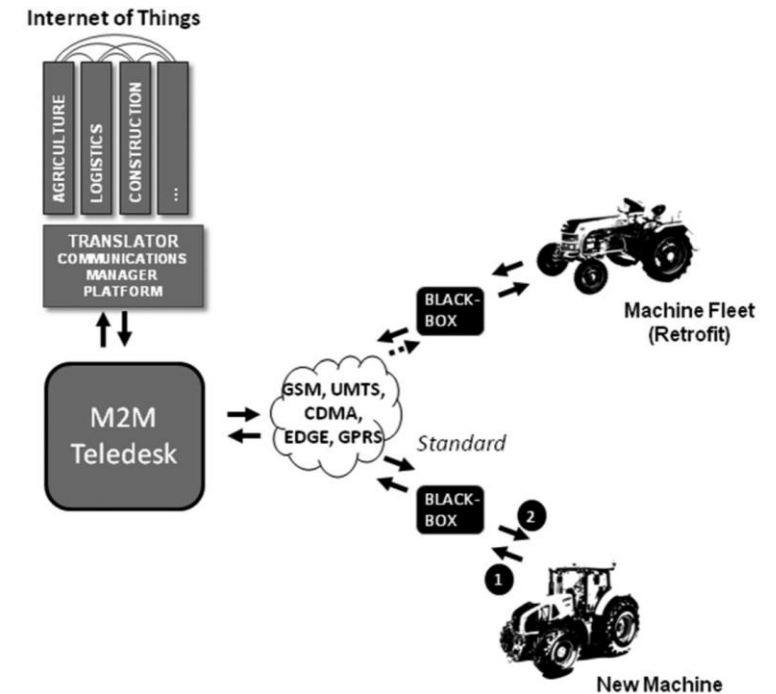
¹http://www.fao.org/state-of-food-security-nutrition/en/?utm_source=faohomepage&utm_medium=web&utm_campaign=featurebar

²<https://arxiv.org/pdf/1604.03169.pdf>



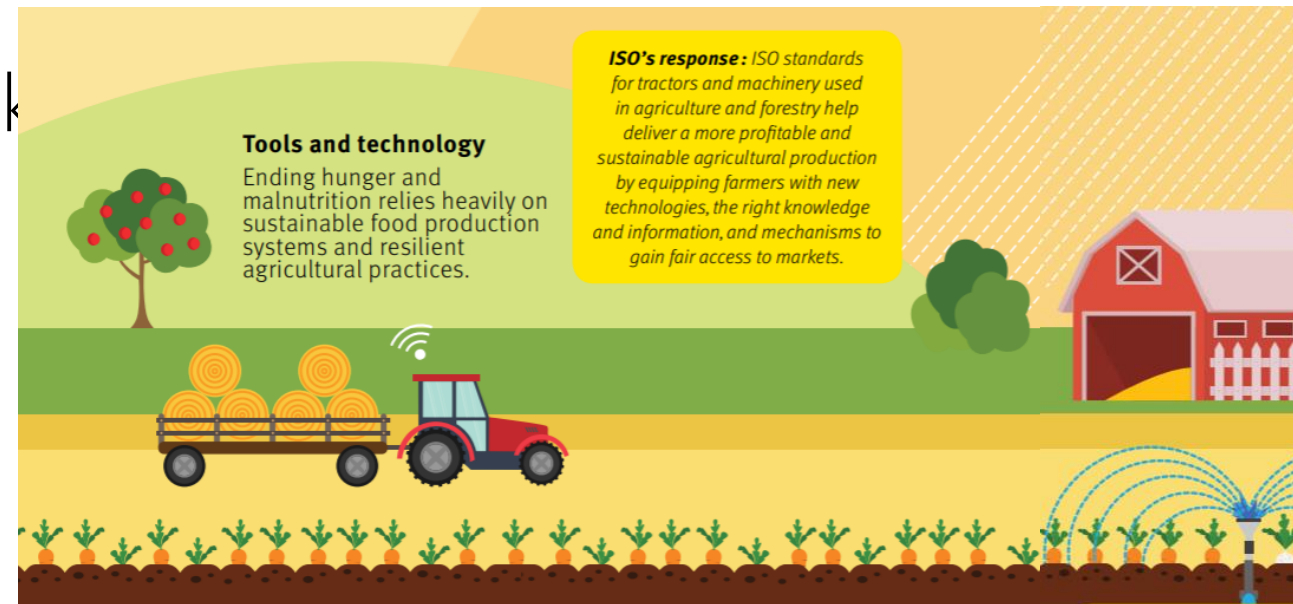
Towards Standards for Agricultural ICT

Market Segment	Connections in 2020 (Billion)	Requirements	Technology
<ul style="list-style-type: none"> ● CCTV(Camera) ● In-vehicle Entertainment... 	0.2B	<ul style="list-style-type: none"> >10Mbps 	NR mMTC
<ul style="list-style-type: none"> ● IoT Gateway Backhaul ● Wearable ● Connected Elevator 	0.8B	<ul style="list-style-type: none"> ~1Mbps Low power consumption 	eMTC
<ul style="list-style-type: none"> ● Sensors, Meters ● Asset Tracking ● Smart Parking ● Smart agriculture 	2B	<ul style="list-style-type: none"> <100kbps 20dB Coverage Gain 10+ Years Life <\$5 Cost Per Module 	NB-IoT



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.

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



Wireless Research and
Innovation Development

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