



Food and Agriculture Organization
of the United Nations

Animal Production and
Health Division



Sustainable livestock goes digital

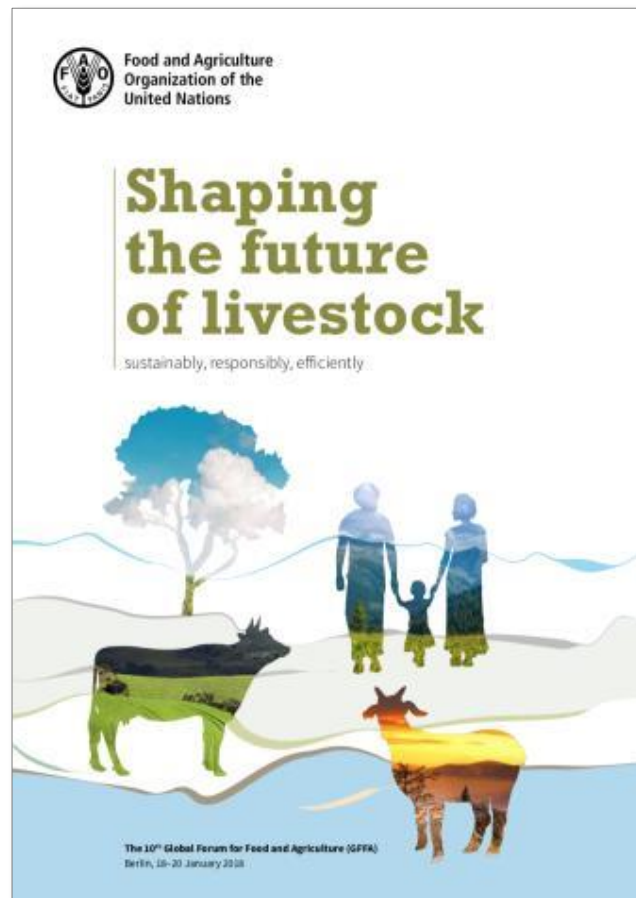
Henning Steinfeld, FAO



A framework for sustainable livestock

GLOBAL FORUM FOR FOOD AND AGRICULTURE

The 10th Global Forum for Food and Agriculture (GFFA) aims to address concerns about the sustainability of the global livestock sector. The Brundtland Commission introduced the concept of sustainable development in 1987, defining it as that *“which meets the needs of current generations without compromising the ability of future generations to meet their own needs.”*



Livestock sector drivers and outcomes

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A vision of sustainable livestock



- Focus on the UN 2030 Agenda
- Recognize diversity and multiple functions of livestock
- Optimize contribution to healthy diets – particularly the first 1,000 days
- Strengthen roles in poverty reduction, food security, economic growth and resilience
- Focus on conversion of human-inedible feed resources into valuable protein
- Reduce losses and waste
- Reduce emissions and environmental externalities, and promote a circular bio-economy
- Improve animal welfare and managed animal disease constraints
- One Health: food safety, emerging diseases, pandemic risk and AMR

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- Foresight modelling (e.g. GAPS, IMPACT, GLOBIOM)
- Household survey data
- Precision livestock farming (e.g. artificial intelligence and robotics)
- Advances in biotechnology
- Satellite remote sensing
- Digital mapping and geographic information systems
- Distributed ledger technology
- Genomics and whole genome sequencing
- Telecommunications and mobile technology
- Lifecycle analysis



Examples of issues and digital solutions

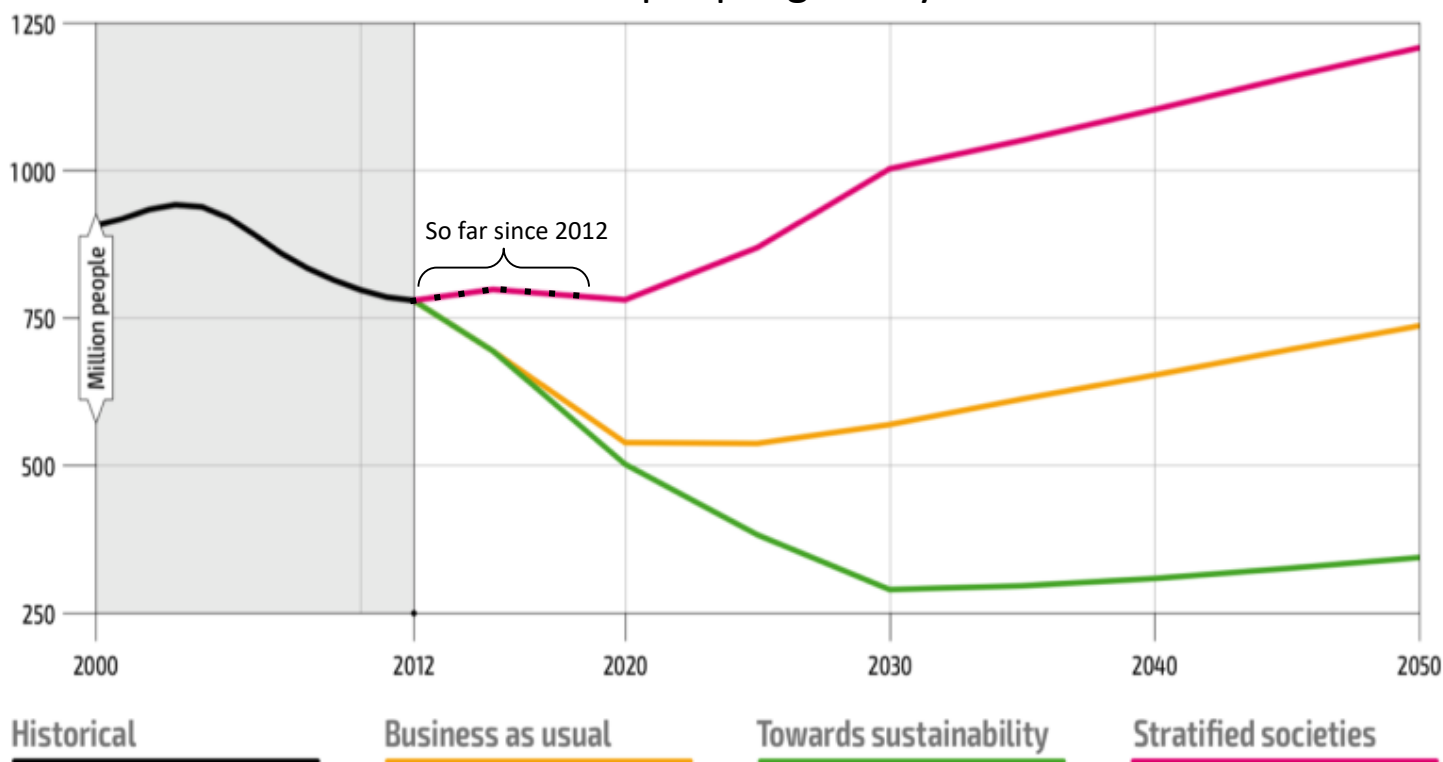
Food and
nutrition security



Issue: Food security projections

Digital solution: Global models: GAPS, IMPACT, GLOBIOM

Number of undernourished people globally



Examples of issues and digital solutions

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Livelihoods and
economic growth



Issue: Supply chain traceability

Digital solution: Distributed ledger technology (DLT)

- Transparency from farm to fork
- Improved food safety
- Faster response to recalls
- Rapid identification of sources of contamination
- Reduced waste and operational costs
- Certification for
 - Animal welfare standards
 - Disease freedom
 - Antibiotic use levels
 - Environmental footprint
 - Organic
 - Fair trade
 - Social standards



Examples of issues and digital solutions

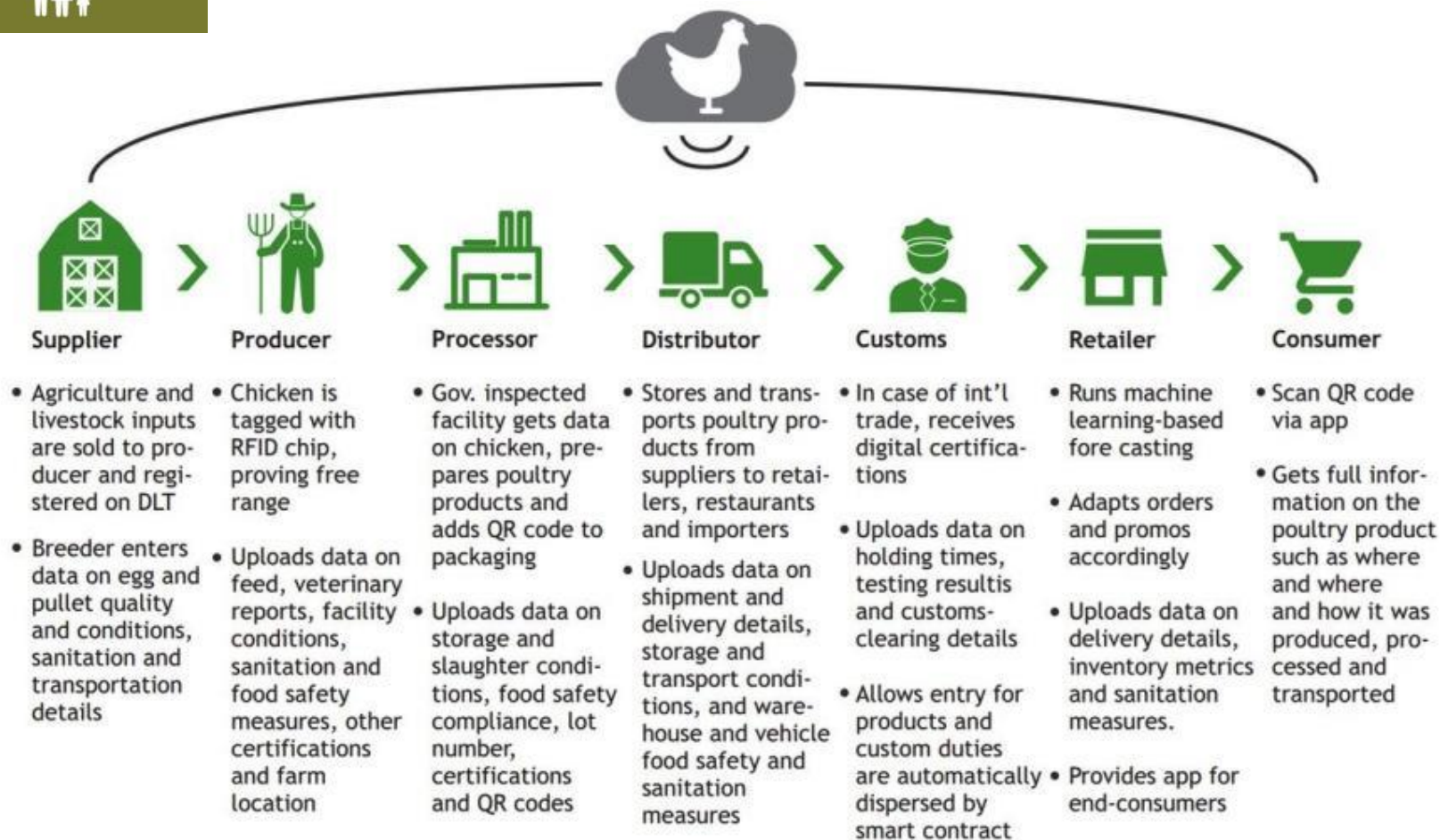
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Livelihoods and
economic growth



Issue: Supply chain traceability

Digital solution: Distributed ledger technology (DLT)



Examples of issues and digital solutions

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Animal health
and welfare



Issue: Antimicrobial Resistance (AMR)

Digital solution: Genomics and whole genome sequencing

- Reduced size
- Reduced infrastructure, capital outlay and running costs
- Reduced sample preparation time and requirements
- Reduced logistics – sending live samples of pathogens across borders is bureaucratic, complex, time-consuming and expensive



Examples of issues and digital solutions

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Animal health
and welfare

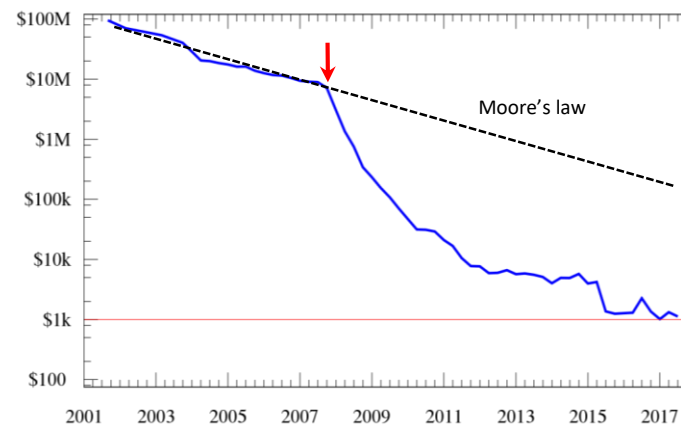


Issue: Antimicrobial Resistance (AMR)

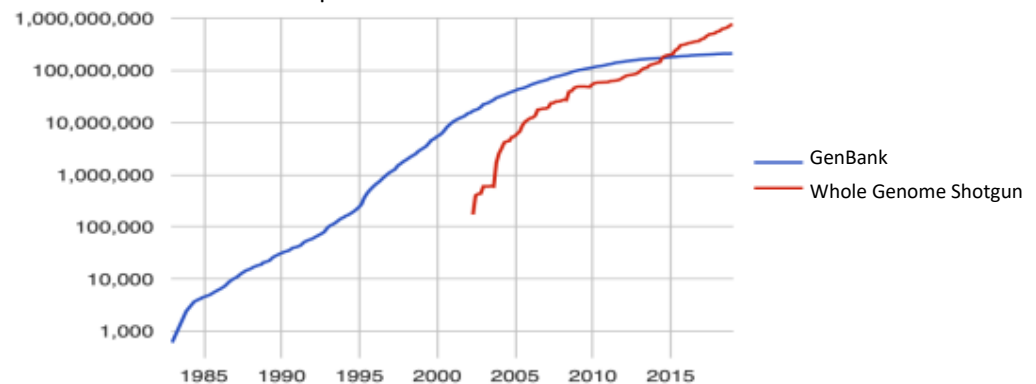
Digital solution: Genomics and whole genome sequencing

- Note the log scales!
- 2001-2008 followed the line of Moore's law for computing costs
- After 2008, the arrival of next generation, high through-put sequencers meant that sequencing cost reductions far outstripped computing cost reductions
- Reduced costs are reflected in increased availability of sequences – for example through GenBank

Cost per per sequence (human genome) over time



Genetic sequences held in GenBank over time



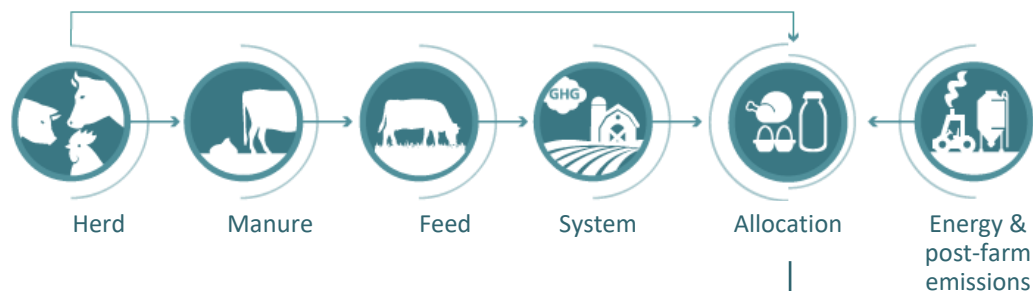
Examples of issues and digital solutions

Climate and
natural resource use

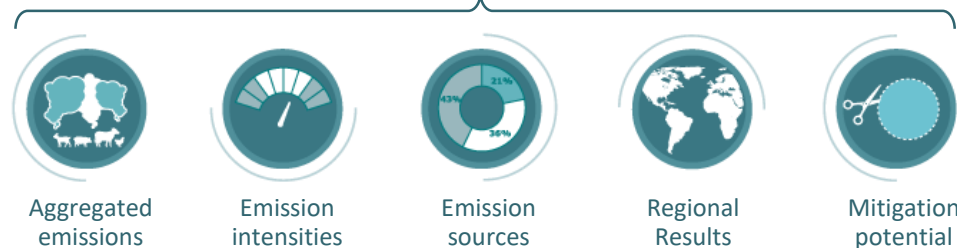


Issue: GHG emissions intensities

Digital solution: Lifecycle analysis (GLEAM)



Based on IPCC guidelines
Tier 2 approach



Measuring GHG at
Mazingira Centre, ILRI



Examples of issues and digital solutions

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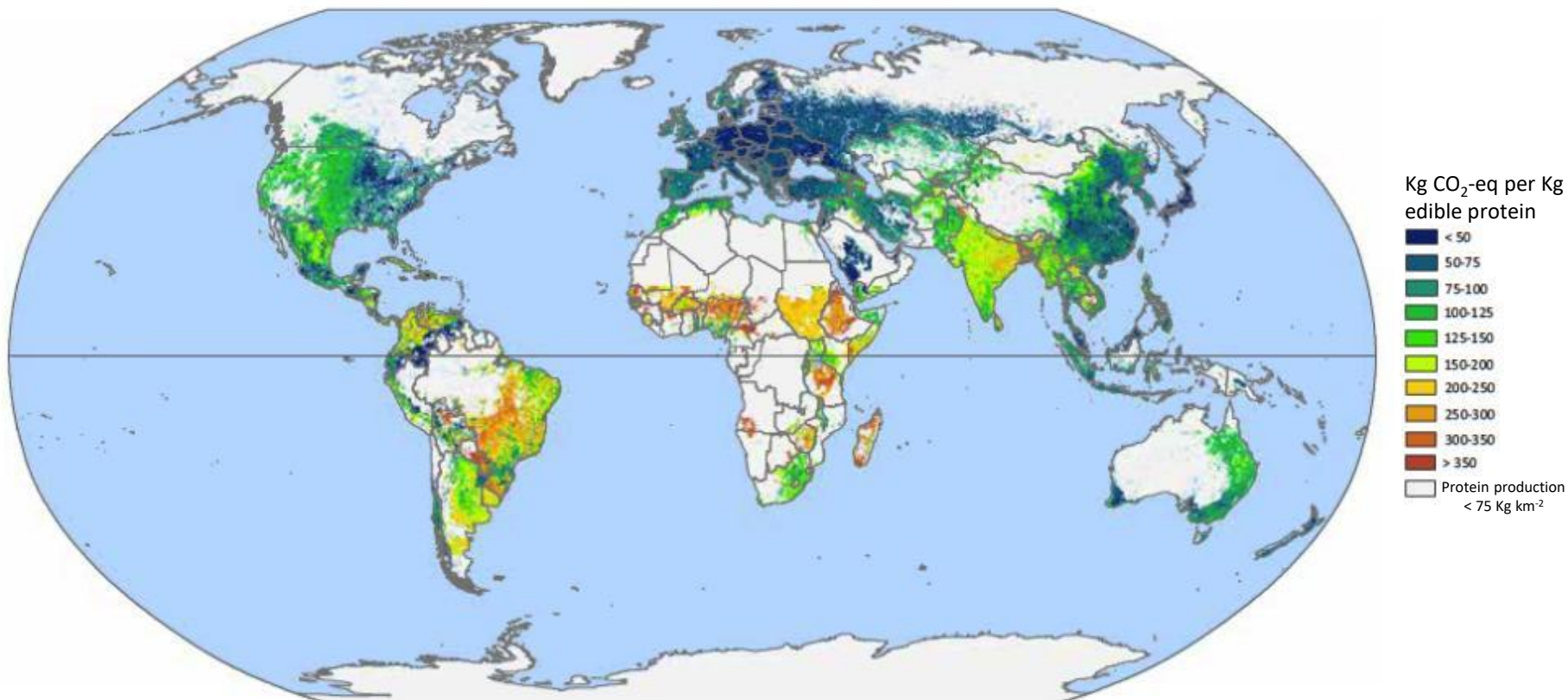
Climate and
natural resource use



Issue: GHG emissions intensities

Digital solution: Lifecycle analysis (GLEAM)

GHG emissions intensity per unit of edible protein



Big data approaches

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- Balancing opportunities and trade-offs for sustainability requires integrated analyses
- Big Data approaches can integrate diverse data sources to look at complex interactions (i.e. synergies and trade-offs for sustainable livestock agrifood systems)
- Need linchpins to tie the diverse data sources together (unique ID, geographic coordinates, time)



In conclusion



- There are great opportunities for digitalization to contribute to sustainable livestock systems
- Digitalization can help maximize opportunities and minimize risks
- The 'digital divide' refers to asymmetric access to technology: potentially disadvantaging smaller-scale producers
- To be adoptable by smaller-scale producers these technologies must be simple, robust and accessible
- Can be both enabling and disruptive