

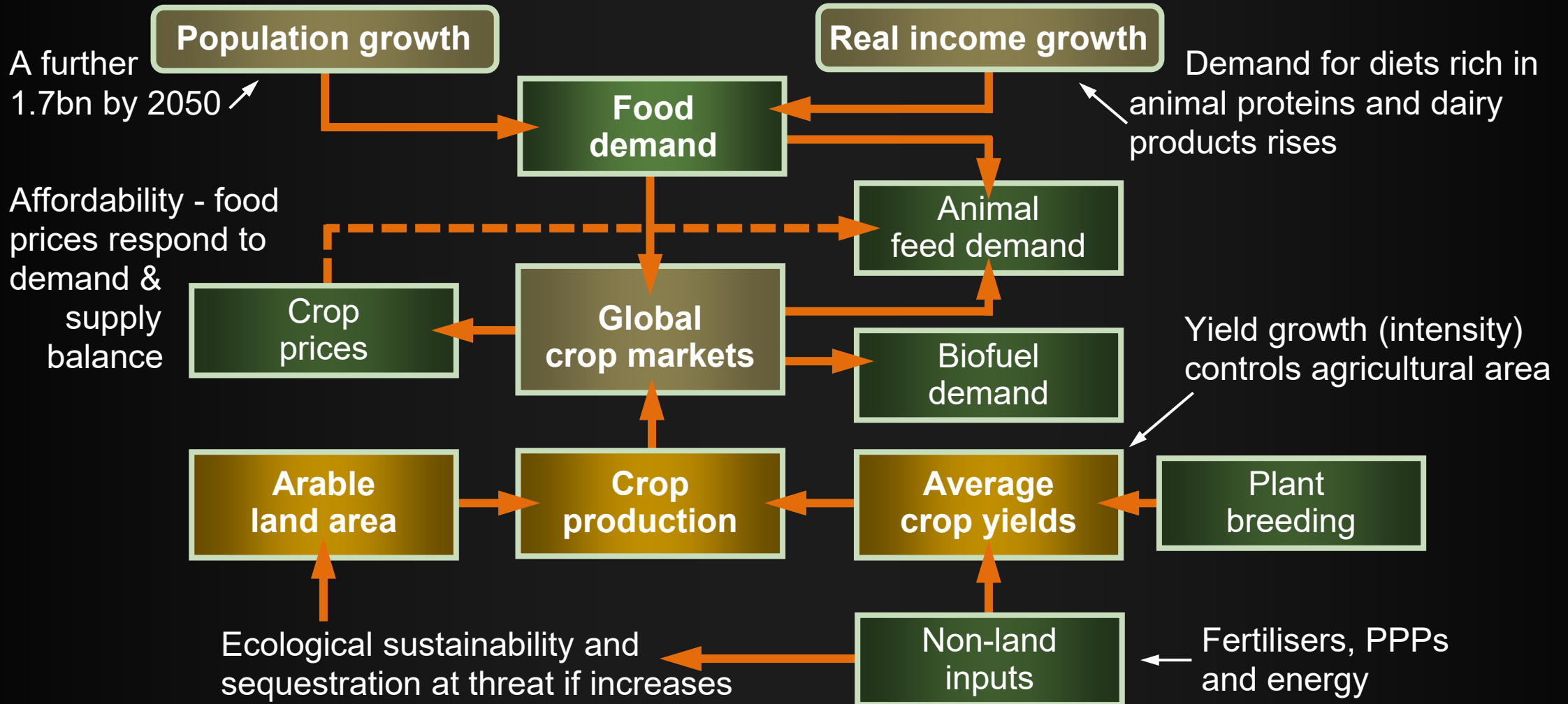
AGRICULTURE'S TRILEMMA: An Opportunity for UK Agriculture

Dr Séan Rickard
www.seanrickard.co.uk
sean@seanrickardltd.co.uk

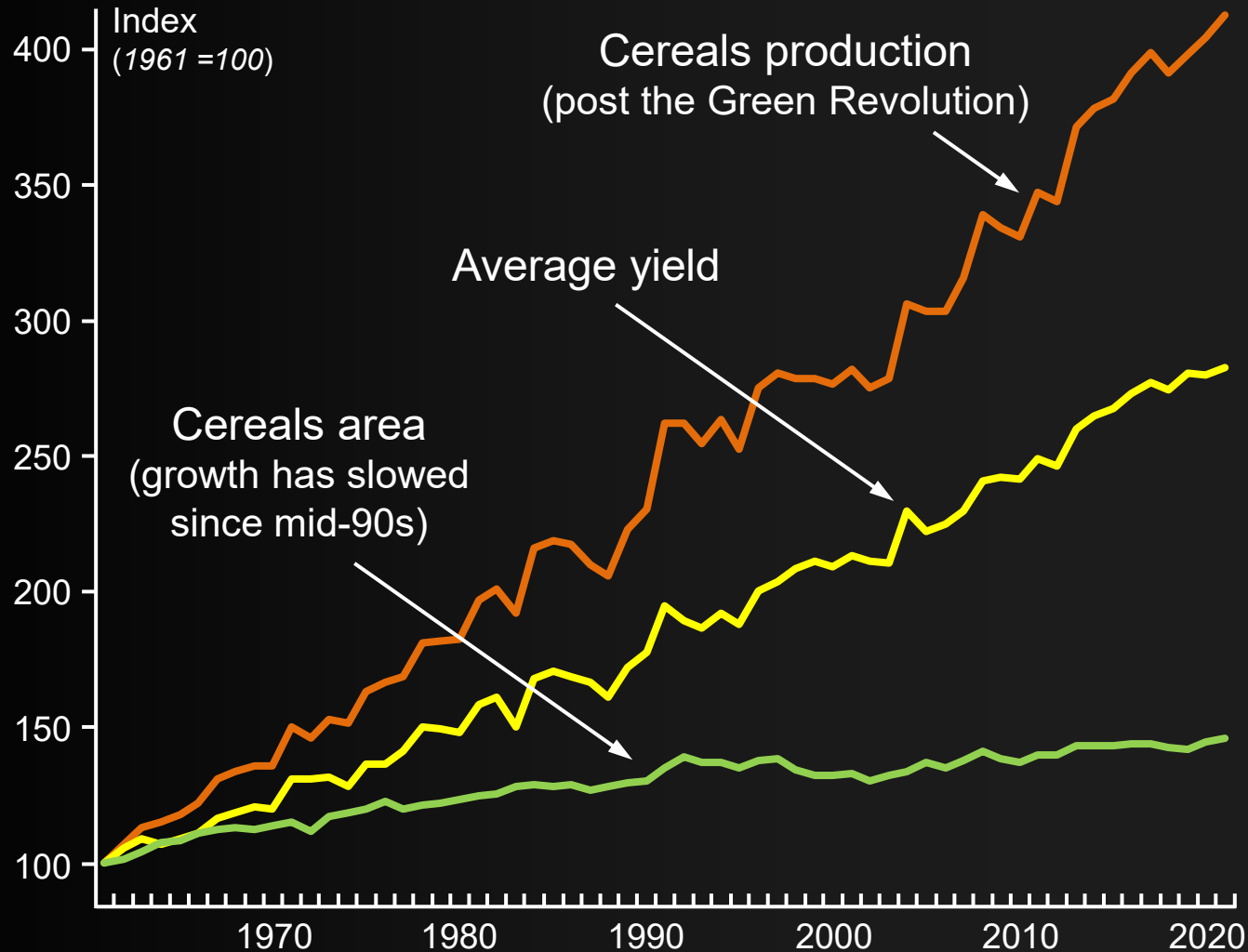
- Achieving universal food security a major challenge. Some 670mn facing hunger and food demand will rise 50% by 2050;
- Food security needs a significant rise in agricultural output, but this must be secured without further harm to the Earth's biodiversity to protect ecosystem services and achieve Net Zero;
- Only practical solution is continued intensification that is ecologically sustainable and integral to this process will be the widespread adoption of Agriculture's 4th Revolution.

Determinants of food security ...

Agricultural production is founded on arable crops and particularly cereals



Global cereals production ...



Source: World Bank

Pertinent considerations

- ➔ By 2050 global cereals output needs to rise 60%
- ➔ 1960 cereals hectares per capita = 0.42 but is projected to = 0.18 hectares by 2050
- ➔ Cereal yields must overcome myriad problems e.g., climate warming

Affordable food the priority ...

UK's food and non-alcoholic drinks inflation rate rose to a record 19.1% in April the impact falling most heavily on those with the lowest incomes



Food security
Access to sufficient, affordable, safe, and nutritious food now high on the UK's political agenda

Policy rethink?
Ripe to reassess view that high prices and shortages are low risk offering opportunity for a production strategy

Source: FAO Indices
2014-2016 = 100

Agriculture's trilemma ...

Food security needs a production strategy but must avoid the unintended adverse consequences of Green Revolution for biodiversity and ecosystem services

ATTAIN FOOD SECURITY

Yield based production growth to meet increasing demand for a sufficient and varied quantity of affordable nutritious food

Rising to these challenges means **prioritising** subject to constraints:

The priority is food production and this must be achieved by **sustainable intensification**

AVOID HARMING BIODIVERSITY

Production methods protective of farmed land ecosystem services and also the vegetation- forestry of non-agricultural land

ACHIEVE NET ZERO BY 2050

Production methods and machinery that lowers net greenhouse gas emissions and increases the scope for land to sequester carbon

Sustainable intensification accommodates productivity growth – more output per unit of input – alongside environmentally responsible farming practices and carbon management strategies

Sustainable intensification ...

Competing versions?

① **land sparing** – land for habitats and ecosystem services maximised by separating it from high-yielding farmland; ② **land sharing** – food and conservation produced on same land at the cost of lower yields;

Questioning version 2

If demand for food is growing ② implies conversion of natural vegetation and forests into arable land causing significant damage to the Earth's biodiversity as well as increased carbon levels e.g., reduced sequestration;

Doubtful assumption

Version ② seeks to avoid farmland expansion by assuming that diets should and can be changed to include much less meat and dairy products thereby significantly reducing the demand for farmland;

Dangerous & discriminating

meat, eggs and milk crucial sources of nutrients not easily obtained from plant-based diets and if people unwilling to give up livestock products taxes/higher prices would force mostly lower income households to avoid livestock products;

A further consideration for the UK

Land sharing version would suppress the growth and trade opportunities for the UK agri-food chain and may result in increased imports possibly from countries whose production systems remain harmful to the environment and climate change mitigation.

Precision agriculture ...

INDUSTRIALISATION

Sustainable intensification coincided with Agriculture 3.0 bringing together information and engineering technologies for a step change in the automation of all farming operations

IMPROVING THE EFFICIENCY OF INTENSIFICATION ...

Precision agriculture enabled the more efficient management of inputs e.g., PPPs to attain higher yields – narrowing yield gaps – based on integration of three advances:

... AND SUSTAINABILITY

is enhanced by operations including regenerative practices that have the ability to identify and target localised nutrient deficiencies and pest incursions thereby lowering usage which with mini-tillage reduces the risk to ecosystem services and helps progress towards Net Zero

- 1 **recording technologies** – spatial mapping, remote and proximal sensors;
- 2 **reacting technologies** – varying the quantities and precision of inputs;
- 3 **guidance technologies** – GPS enabled guidance for self-propelled machinery

Agriculture is on the cusp of new technologies that promise to take the benefits of precision agriculture to levels that will revolutionise farming as we know it

Agriculture 4.0 enhancements ...

All farming revolutions

driven by advances in science-technology. 4th Industrial Revolution identified in 2016 to capture merging of disruptive/drastring advances in biological, digital, and engineering technologies;

Industry 4.0 technologies

enable collection/analysis of vast amounts of information to drive commercial innovative technologies including genome editing, nanoparticles, machine learning and artificial intelligence (AI);

Connectivity of these

technologies via the Internet of Things (IoT) enables machines and devices to autonomously exchange data/commands – creating production systems capable of acting independently of humans;

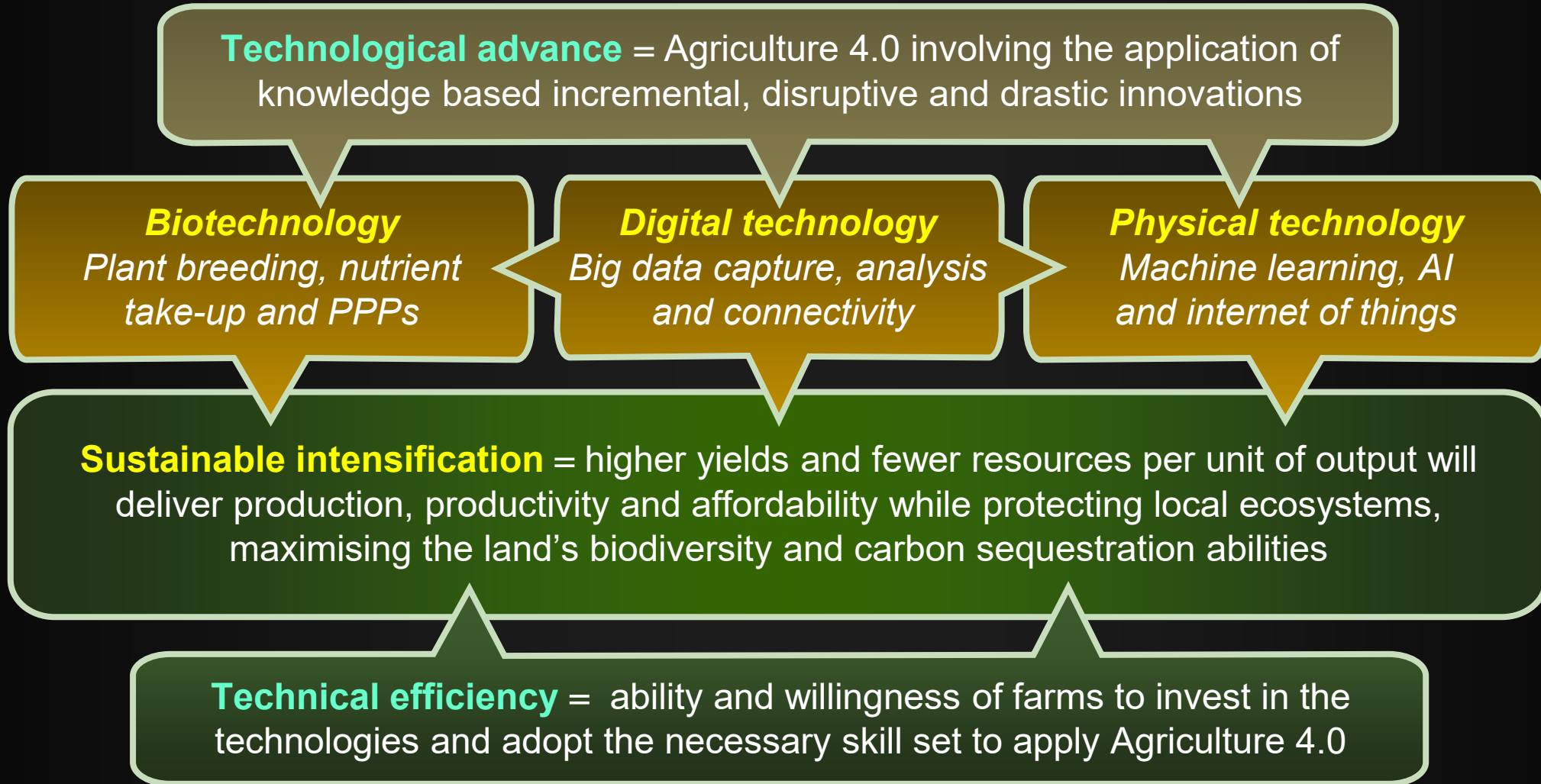
Agriculture 4.0 will utilise

these advances to greatly reinforce sustainable intensification's ability to solve agriculture's trilemma with step-changes in crop/livestock breeding, input and agronomic innovations and the sophistication of precision farming;

Brief overview of Agri 4.0's potential

Yields potential and resilience will increase, nanopesticide formulations will deliver safer/more effective protections while machine learning and AI will greatly improve accuracy in their applications enabling farming to approach the ultimate goal of zero waste thereby releasing the full benefits of higher productivity.

Agriculture 4.0 and sustainable intensification ...



Agr-food opportunities ...

COMPETITIVENESS

Domestic and foreign demand from middle class consumers increasingly includes a preference for food products that not only offer the experience attributes of taste and value but also credence attributes

CREDENCE ATTRIBUTES

are characteristics that cannot be seen and rely on consumer beliefs and trust e.g., they include

provenance, safety, animal welfare, mitigation of climate warming and encouragement of biodiversity all of which can be summarised as 'ethical production'

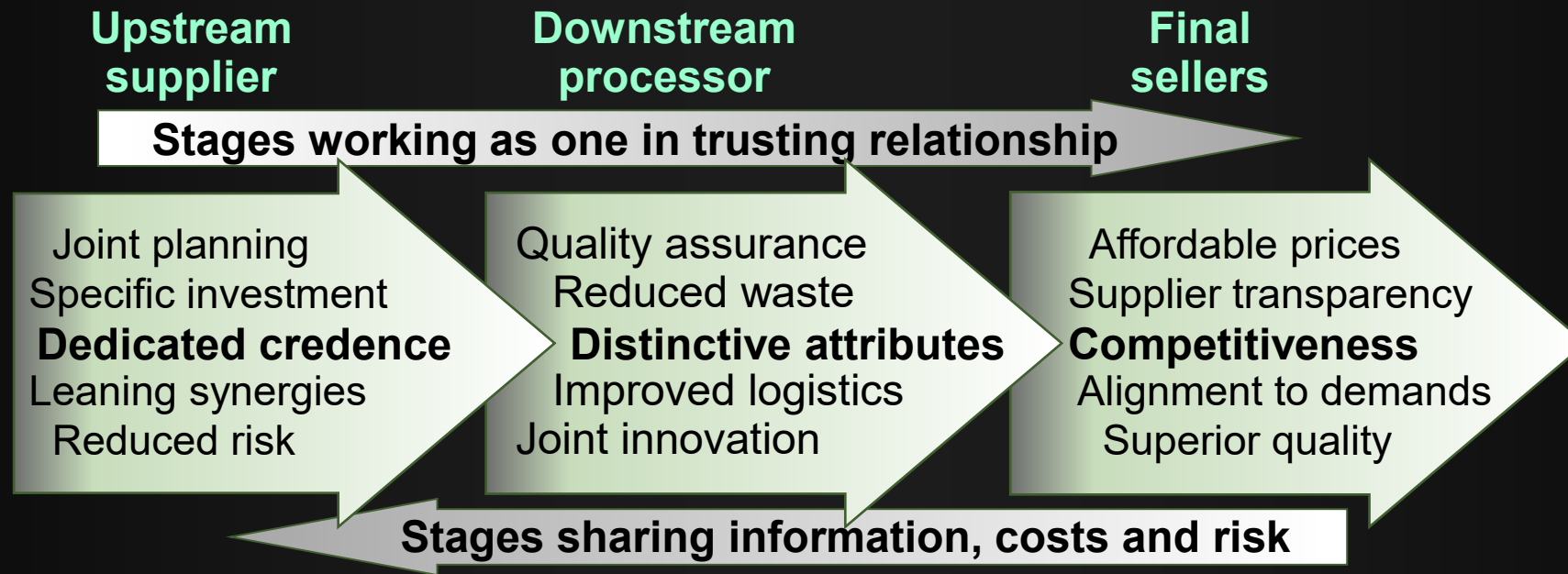
FARM BASED

Credence attributes are concentrated at the farm level suggesting that the global competitiveness of the UK food industry will increasingly depend on collaborative vertical agri-food chain relationships

The contribution of credence attributes to competitiveness reinforces the need for VERTICAL PARTNERSHIPS

Vertical partnerships ...

All supply chain relationships consist of a **competitive** and an **interdependent** element and collaborative vertical partnerships exist when the interdependent element is dominant i.e., the strategic importance of the intermediate product is critical



Collaborative relationships are founded on trust involving an alignment of attitudes, capabilities and strategic outlook within hierarchies for decision making, performance metrics and a fair sharing of rewards

Concluding thoughts ...

Government implicitly

supports the adoption of Agriculture 4.0 technologies but UK lacks a strategy for increasing agricultural production despite the 'Global Britain' imperative that the agri-food chain must become more internationally competitive;

Agriculture 4.0 technologies

will enable precision agriculture to reach unbelievable levels of sophistication to deliver the economic and environmental benefits of sustainable intensification i.e., joint delivery of affordability and credence attributes, to solve agriculture's trilemma;

International competitiveness

for the world's burgeoning middle classes flows from sustainable intensification so the agri-food chain should credibly exploit UK agriculture's credence attributes to differentiate its food products – necessitating collaborative vertical relationships;

The emphasis of policy

must shift the bulk of resources to the development and take-up of Agriculture 4.0 technologies plus the development of the skills and attitudes necessary for successful collaboration e.g., data management and emotional intelligence;

Time for a more balanced public debate

Until recently the issue of affordability has not been emphasised in UK public debate, but it remains the priority and responsible bodies should be more open to considering the benefits of a high-tech agricultural industry in solving agriculture's trilemma.

**AGRICULTURE'S TRILEMMA:
An Opportunity for UK
Agriculture**

Any Questions?

Dr Séan Rickard
www.seanrickard.co.uk
sean@seanrickardltd.co.uk

