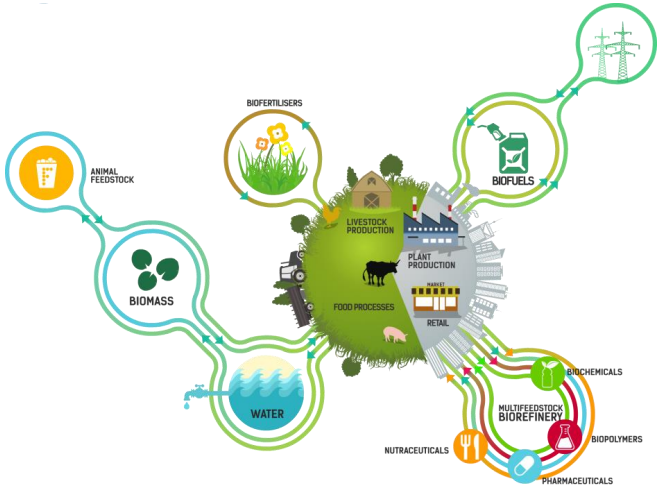
AGROCYCLE

for a circular economy

Co-ordinator: Professor Shane Ward

University College Dublin
Ireland



This project has received funding from the European Union's Horizon 2020 Research and Innovation programme under grant agreement No. 690142 in collaboration with the People's Republic of China and the Hong Kong Government

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The project

- Led by the School of Biosystems & Food Engineering, University College Dublin
- EC funded H2020 in collaboration with the Government of the People's Republic of China and the Hong Kong Government
- 3 year project, 26 partners: EU, China, Hong Kong
- Started June, 2016
- €7 million from EC plus ca. €1 million from Government of the People's Republic of China and the Hong Kong Government and direct resources inputs from the Chinese and HK partners (CAU, NJIT; and RESET Carbon from HK)

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Agrii

EKO KVARNER

UCD DUBLIN

UNITING BEET GROWERS since CIBE 1927

Consiglio Nazionale delle Ricerche

RESET Carbon

MANOR FARM IRISH CHICKEN

crea
Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria

NANJING TECH UNIVERSITY

axeb BIOTECH

exergy

iris advanced engineering

CHINA AGRICULTURAL UNIVERSITY 1905

CERTH
CENTRE FOR RESEARCH & TECHNOLOGY HELLAS

CPERI
Chemical Process and Energy Resources Institute

EUBIA

Fraunhofer IVV

UNIVERSITEIT GENT

Maynooth University
National University of Ireland Maynooth

sdewes

CEMA
European Agricultural Machinery

Harper Adams University

The Bioeconomy Consultants
NNFCC

INNOVATION for AGRICULTURE

INSTITUTO TECNOLÓGICO AGRARIO
Junta de Castilla y León
Consejería de Agricultura y Ganadería

HELLENIC AGRICULTURAL ORGANIZATION-"DEMETER"

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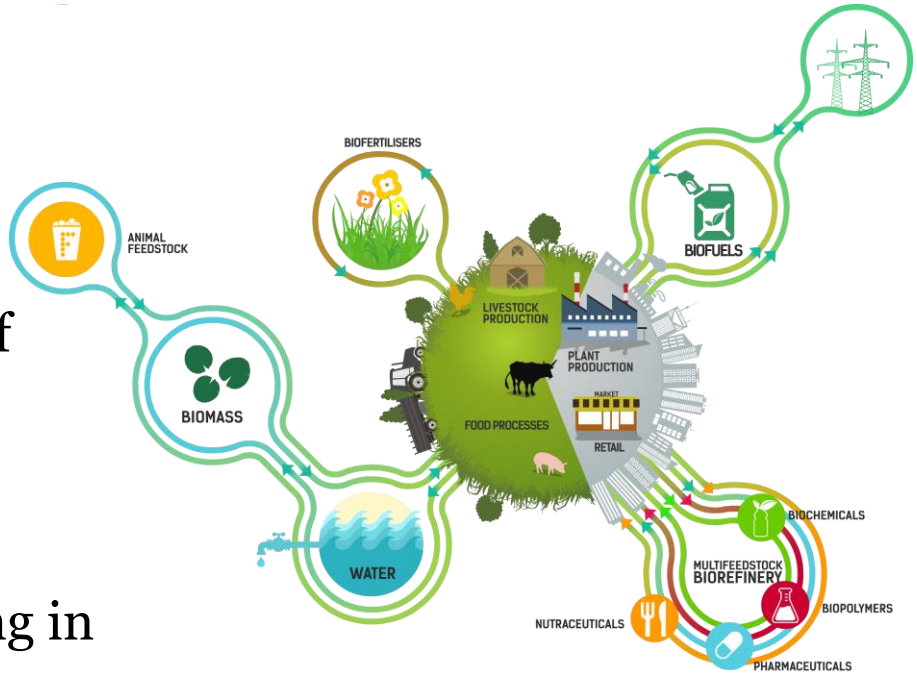
AgroCycle Objective

- To deliver sustainable waste valorisation
- Address European policy target of reducing food waste
  - 50% by 2030
- Contribute to the change occurring in China in relation to sustainability



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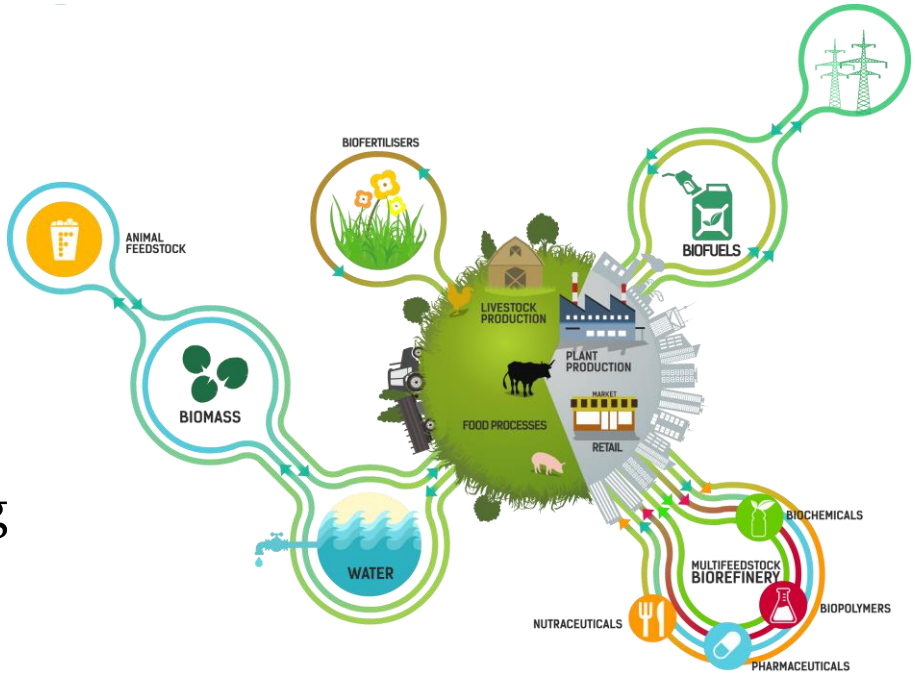
What is the circular economy in agriculture?

- Production of agricultural commodities using a minimal amount of external inputs
- Closing nutrient loops and reducing negative discharges to the environment
- Valorising agri-food wastes



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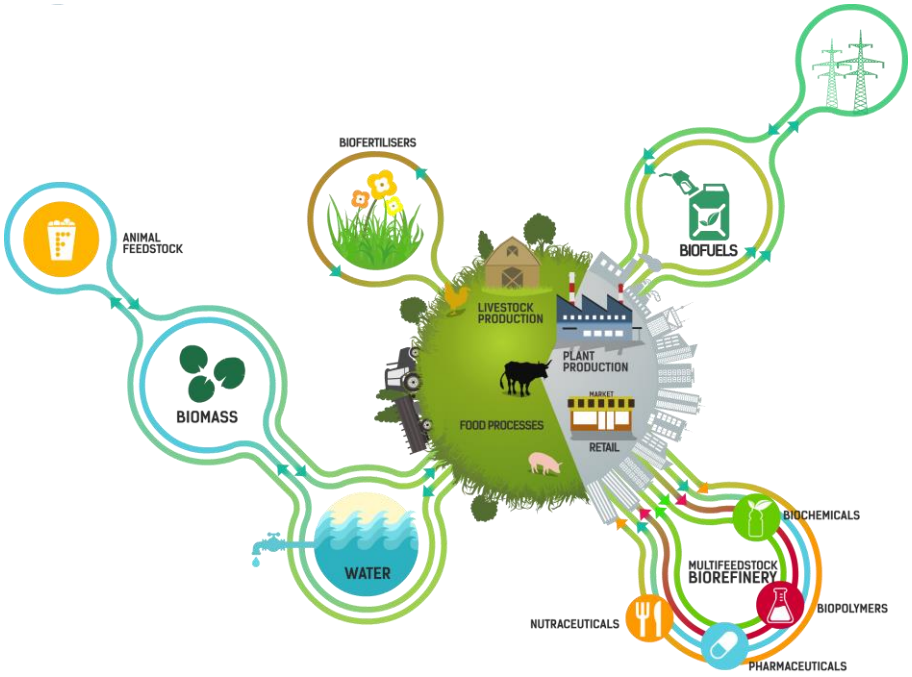
Population growth + lifestyle change

2016 - 6 billion PRU
2030 - 12 billion PRU
2050 - > 20 billion PRU

- **The Challenge is bigger than you think!**
- > 6 billion people now
- Increase by 50% by 2050
- **The Western world lifestyle is the aspiration**!
- But, **this planet does not have the capacity to deliver Western standards to all, based on the current *modus operandi***



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Waste v. Resource

- Many agricultural wastes are unavoidable materials arising from food production systems, typically described as by-products, co-products or residues (e.g. manures, crop residues, leaves, peels).
- The **classification of material as 'wastes' or 'resources' influences how they are treated**
  - 'resource' highlighting a potential value (in comparison to waste which currently implies it has little or no value and an incurred cost)

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AgroCycle Approach

- A full systems approach
- Developing a 'Circular Economy' around the agri-food chain:
  - Pre- and post-farm gate
  - Food and agri-products processing sector
  - **Farmer-Retail-Consumer** – *partner Harper Adams University (UK)*
  - Waste processing – valorisation incl. bio-fuels, high value-added biopolymers, bio-fertilisers, waste waters, energy & micro fuel cells
  - **Early stage education –** *partner Maynooth University (Ireland)*

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Work Plan

- Completed an agricultural waste value chain assessment in Europe and China
- Biofuels production – initial AD trials on the use of poultry and bovine manure underway
- Fertiliser production
  - completed a report on N availability & stable organic carbon fraction from organic (crop) residues and new biofertilisers.
- Agricultural wastewater exploitation & treatment
  - Demonstration of a generic and modular process design for valorisation, treatment and recycling of agro-industrial wastewater and animal effluents
- Bio-waste valorisation into high value products
- Holistic Life Cycle Assessment – including Social LCA and Life Cycle Costing
- Knowledge/Stakeholder platform under construction & to be launched early 2018
- Sustainable value chains and business models
  - Reviewed current Value Chains and collated barriers and opportunities of novel value chains

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Tail wagging the dog!!

3. Low Mass and H

Secondary demand exists
output is valuable. As the
there is a risk that demand
generation of greater mas
class 4.

4. High Mass and High Value

Should not be considered as waste. As clear market value and driver to support generation of mass. If part of a waste system then there is significant upstream inefficiency to create the valuable substance. Indicative of sub-system optimisation. The Incentive to reduce is low.

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Value (€ / t or € / m³)

Mass (or volume)

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The role of Agriculture is to produce FOOD

- **It is NOT to produce WASTE for a bio-economy!**
- Efficient agricultural production is essential
- It is NOT to provide feedstock for a downstream processing industry
- It has to produce more from less!
- How do you ensure resource use is optimised?
- **Precision Agriculture**

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new Frontier that's fundamental to the CE

- Precision Agriculture
  - addresses the use of minimal levels of invested resources - essential to achieving sustainable agricultural production.
  - Many of the PA tools are there – the knowledge is not!
  - **BIG DATA in Agri-food is the new frontier!**

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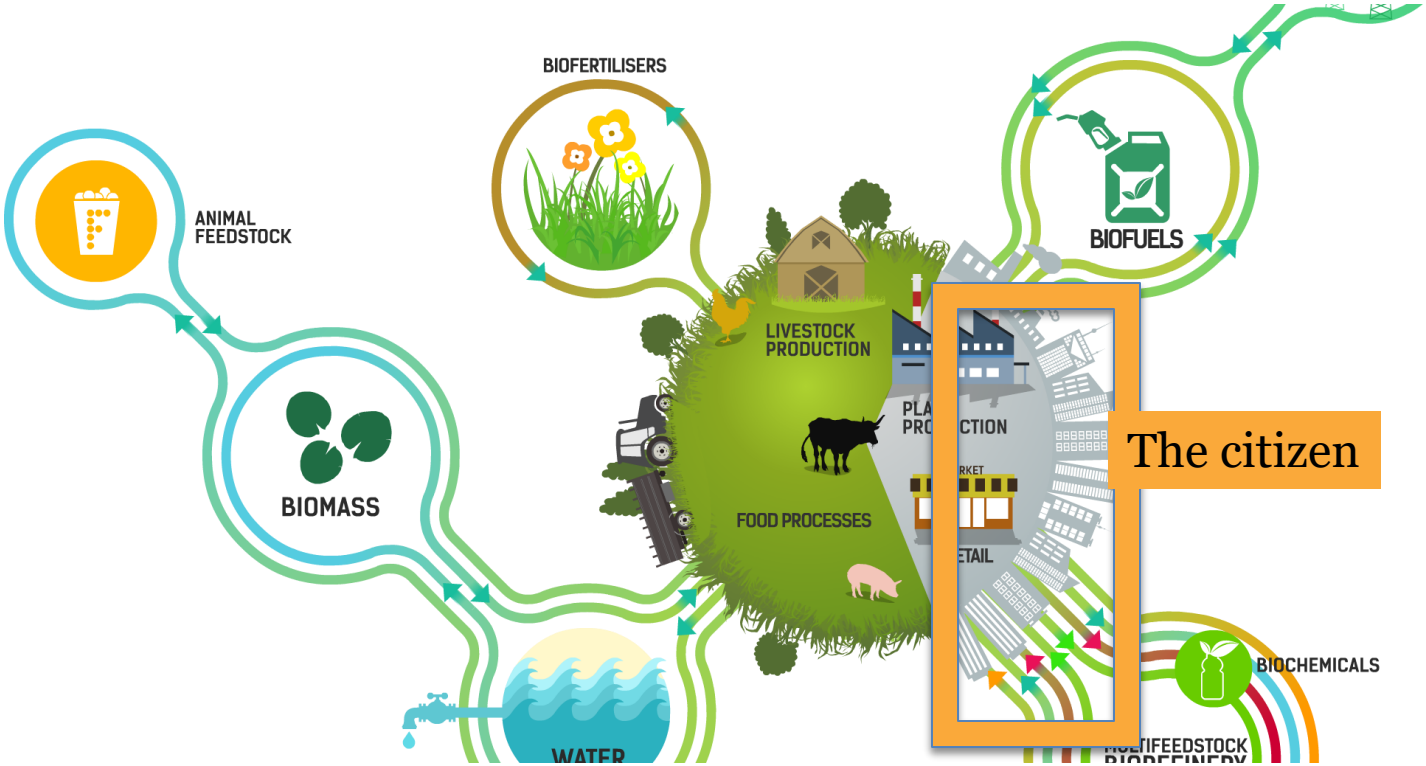
System efficiency … hampered by consumer choice!



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farmer-retailer-consumer (FRC) nexus …

- Harper Adams University (UK) leading the research on understanding the FRC (ihuang@harper-adams.ac.uk)
- Understanding the dynamics of the supply chain, and how this affects food waste
  - impact of supply contracts (e.g. quality threshold, returns policy, etc)
  - consumer deman fluctions v. existing supply contracts
  - special offers at retail level and impact on waste (e.g. 2 for price of 1)
  - how corporate policy impacts on food waste
- The consumer is the key driver of food supply dynamics

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Educating the citizen … lifestyle … awareness

- Early Stage Education
- Maynooth University (maire.nicanbhaird@mu.ie)
- Development of bespoke curriculum compatible with current curricula
- Curriculum that will be piloted in 10 schools in Ireland (300 students) and extended to elsewhere in Europe
  - focus on understanding the role of agri-food in daily life, global impacts, humanitarian concerns, lifestyle, health, etc.
- Delivered by *e-leathanach* into 1000 primary schools in Ireland

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