



# FORMULATION 4.0

Putting Digital Into Formulation  
Burlington House, London  
13<sup>th</sup> December  
[www.formulation.org.uk/f4](http://www.formulation.org.uk/f4) #formulation4.0



## Formulation: More than Mixing...



- § Multicomponent and **multiphase** mixtures
- § Complex interactions across **multiple time and length scales**
- § **Properties** designed and balanced for different stages through the **product life-cycle**
- § Designed to **change physical form** - complex stability challenge to manage when compared with more conventional materials

- Formulated product= 3 – 100 times higher than the value of ingredients

Sector grouping	Subsector
1. Home, Industrial & Personal Care	Personal care – cosmetics, cleaning, well-being, perfumes
	Home care – cleaning, laundry, hygiene
	Industrial and Institutional cleaning
2. Pharma & Health Care	Pharmaceuticals – small molecule, biologics
	Healthcare – hygiene, skincare, pain relief, nutrition
	Medical Devices, Diagnostics, Imaging
3. Agro Technologies & Plant Protection	Crop Protection
	Agrichemicals
	Seed treatments
4. Coatings and Surfaces	Paints
	Inks and dyes
	Lubricants
	Adhesives
5. Food & Drink	Food – confectionary, processed foods, sauces, animal feed
	Drink – alcohol, soft drinks, coffee
6. Advanced materials	Composites, polymers, ceramics
	Catalysts
	Paper and packaging industry
	Additive manufacturing

- AceForm analysis focusses across 6 main sectors; selected based on:
  - Potential for economic and societal impact** (sector size, EU footprint, potential for growth)
  - Potential for cross sector collaborations and synergies** (ingredient/materials base; current capabilities; collaboration culture).
- This approach does not preclude engagement and applicability of AceForm outputs to other sectors



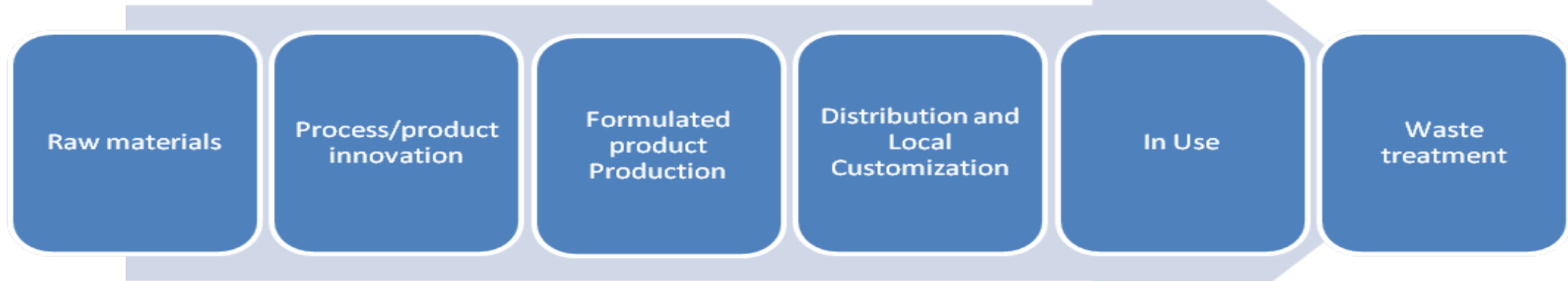
- **New Product and Process Development**
  - Faster Product lifecycles and product obsolescence
  - Radical effects and high performance
  - Faster time-to-market
  - Customisable and personalised products
- **Manufacturing and Supply Chain Performance**
  - Operating and maintenance costs of plants
  - Rejuvenating legacy assets to maintain and/or improve competitiveness.
  - End-to-end productivity of supply chains
  - Responsiveness of supply chains
  - New revenue generating business models (e.g. shift to service)
- **Sustainability and the Circular Economy**
  - Resource efficiency and the reuse across the whole supply chains
  - Renewable and/or bio-degradable ingredients
  - Rising awareness of human impact on the environment (ocean, air and land)
  - Rise of internet-empowered consumer



# Value Chain Collaborations

## Systems-based solutions for complex challenges

- A key recommendation from AceForm is to prioritise and enable collaborations that extend reach along and across value chains



- The big 21<sup>st</sup> century challenges/opportunities demand better sharing of:
  - Technical expertise, data and insights
    - *Much of which extends beyond formulation*
      - *E.g. chemical production, devices, packaging, env. remediation, process eng.*
  - Specification/Customer understanding
    - *including extend reach beyond tradition routes consumers / consumer groups*
  - Constraints
    - *e.g. cost base, supply base, regulations (sometimes conflicting across sectors)*

- **Action 2: Improve Formulation outreach (Inform, Connect)**
  - *Grow EU stakeholder value chain maps; reaching beyond 'business as usual' partner networks*
  - *Develop resources to do better job of selling value of formulation.*

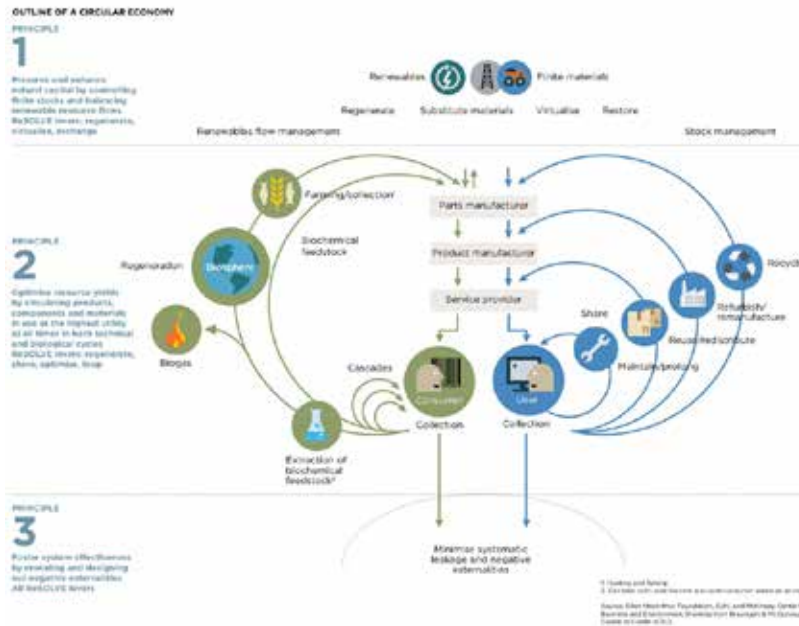


# 4.2 Circular Economy (CE) and Formulation Modelling the impact

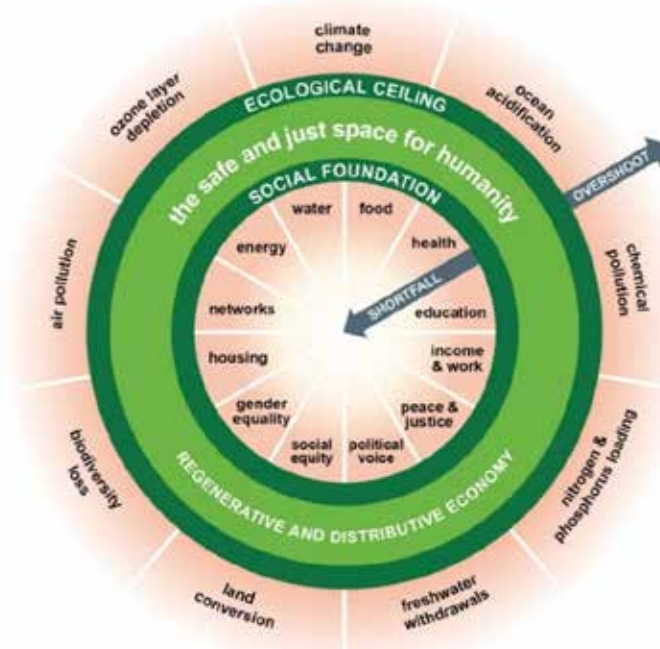


- Formulating Industries, particularly SMEs, are limited in their ability to exploit CE opportunities as there is poor access to (or at least awareness of) relevant collaborative tools for modelling impact.
  - Environmental impact – Full Life-Cycle Analysis; Quantitative; Complex systems
  - Societal impact – see donut economics thinking (schematic below)
  - Modelling value chains/cycle – to secure role and IP in future disruptive value chain/cycle
  - Modelling Business models – e.g. shift to service model; how to re-configure business

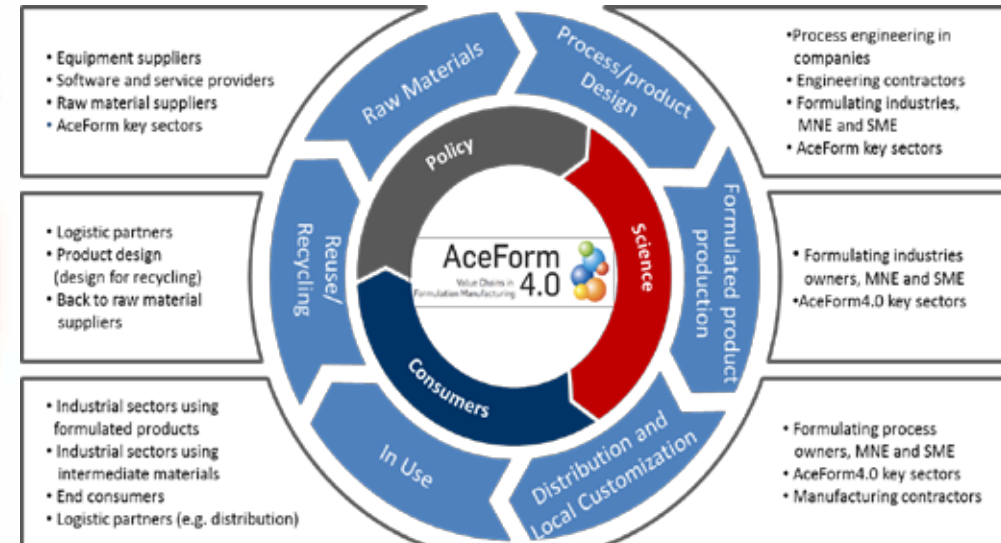
*Action 7: De-risk shift to CE by improving access to relevant collaborative tools to model impact (Access)*



Source: Ellen MacArthur Foundation



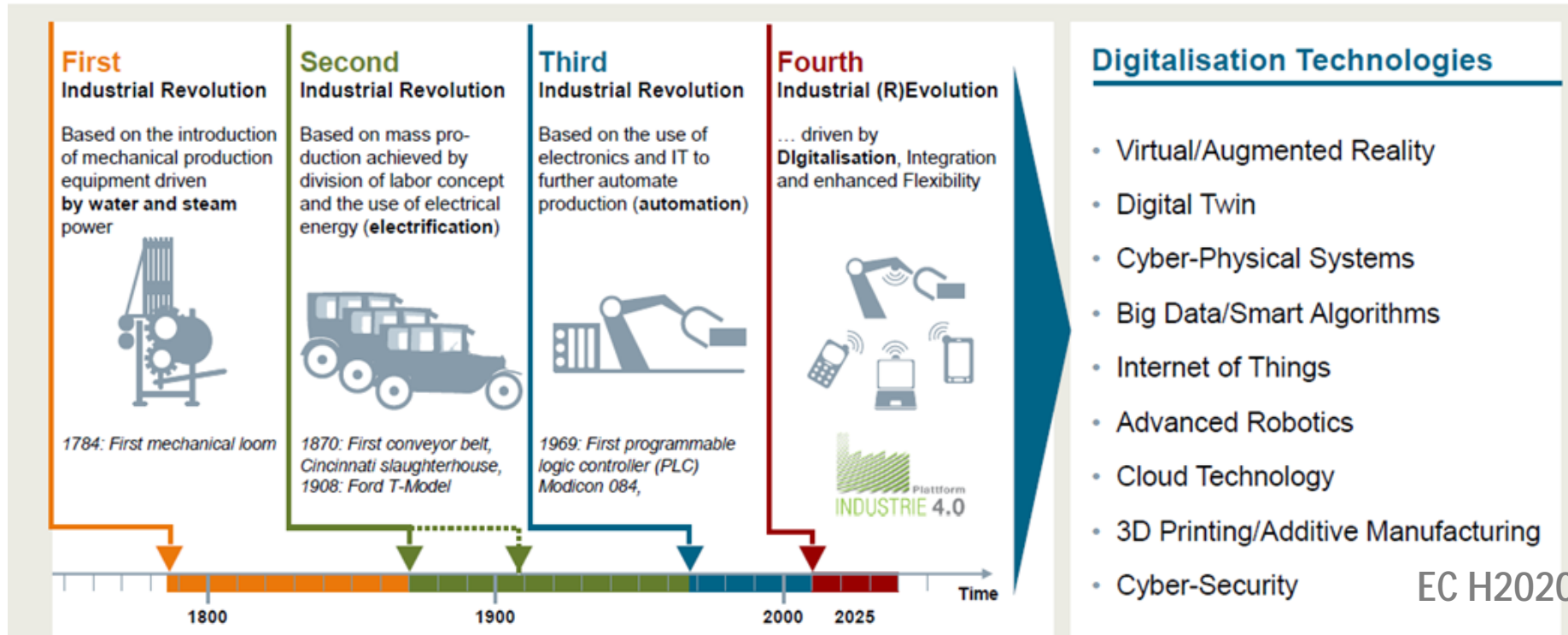
Source: Donut Economics (Kate Raworth)



EC H2020 Contract: 723045

### AceForm Definition

Industry 4.0 is the integration of various digitalisation technologies (existing and emerging) to enable advanced capabilities to **connect**, **model** and **automate** design, manufacturing and supply chains systems.  
=> delivering products, processes and services faster, more efficiently and more flexibly.





**FORMULATION 4.0**  
Putting Digital Into Formulation  
Burlington House, London  
13<sup>th</sup> December  
[www.formulation.org.uk/f4](http://www.formulation.org.uk/f4) #formulation4.0