2030 Roadmap for the European Formulation Industries

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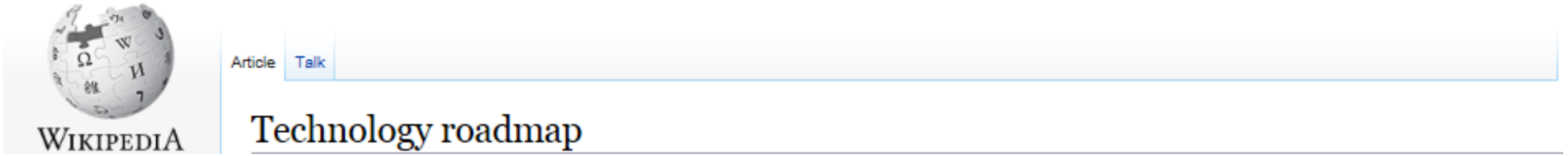

"A technology roadmap is a flexible planning technique to support strategic and long-range planning, by matching short-term and long-term goals with specific technology solutions. It is a plan that applies to a new product or process and may include using technology forecasting/technology scouting to identify suitable emerging technologies. "

- Why a roadmap for the European formulation industries?
- Who is behind the 2030 formulation roadmap?
- 2030 roadmap highlights
- How to engage, promote and/or align?

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Which are the formulation industries?

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1. Home, Industrial & Personal Care
2. Pharma & Health Care
3. Agro Technologies & Plant Protection
4. Coatings and Surfaces
5. Food & Drink
6. Advanced materials

- Key market **growth opportunities vary** greatly **by sector**
- **Common challenges and opportunities** do exist
- **Not enough understanding** of the shared challenges and opportunities
  - siloed thinking
- **Cross-sectorial formulation-related topics not clearly present in funding programmes**

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Common Vision for 2030

Europe will lead the global path in the ***innovation and commercialisation*** *of* ***sustainable formulated*** *products that deliver* ***radical effects*** *and* ***high-performance to*** *downstream industries, end-users and consumers whilst* ***optimising resource and energy efficiency*** *and minimising adverse impacts on* ***biodiversity and the environment****.*

Who is the roadmap addressed to?

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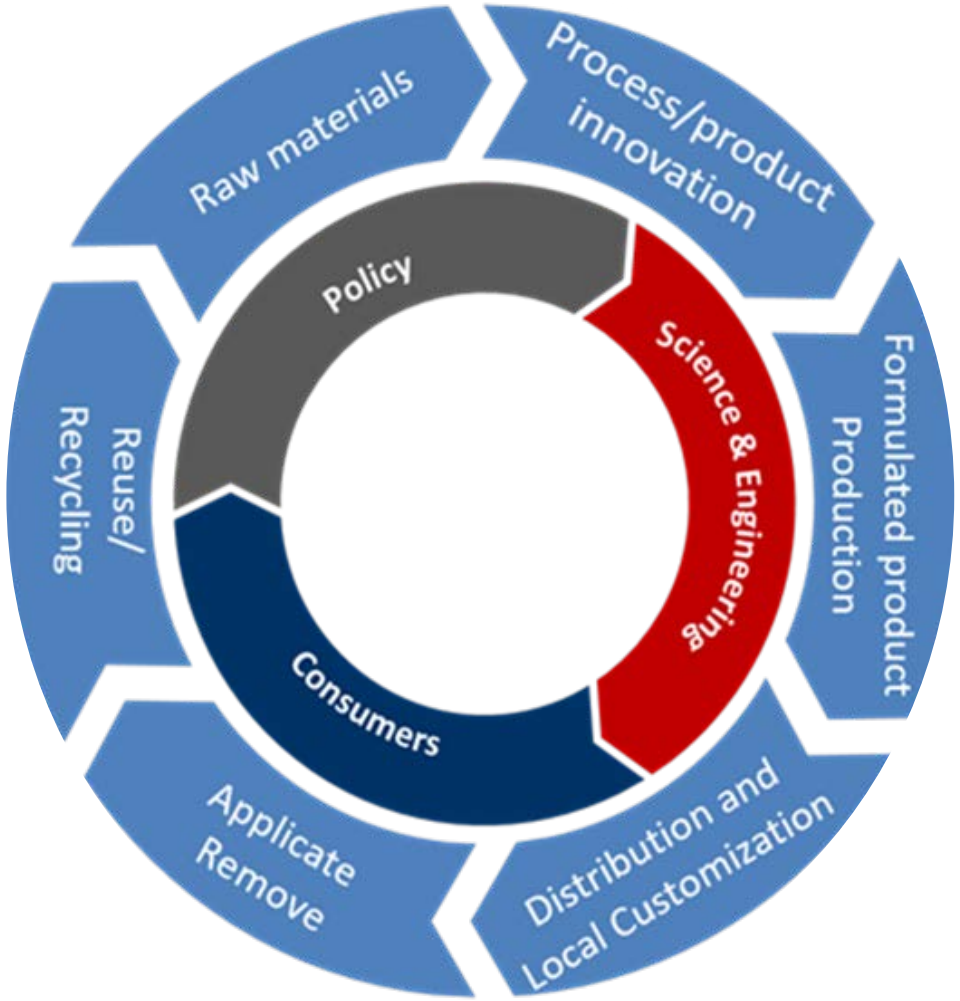
The formulation value chain



The stakeholders

The actions

Formulating Industries	• Engage • Lead • Apply
Formulation value chain	• Engage • Align
EC/Funding bodies/Policy maker	• Lead • Enable • Apply
Formulation-related communities/networks	• Engage • Align • Promote

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- Why a roadmap for the European formulation industries?
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Activating Value Chain for EU Leadership in Formulation Manufacturing 4.0

Start	Oct 2016
End	Sept 2018
Participants	6 partners from 5 different countries

Objectives

- Identify **common technical and industrial challenges** in context of **CIRCULAR ECONOMY & INDUSTRY4.0**
- Establish a **common vision and roadmap**
- Influence future call topics in the area
- Establish a **European Formulation Interest Group**

EC H2020 Contract: 723045

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2030 Roadmap for the European Formulation Industries
- Highlights-
-General recommendations-

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Cross-sectorial technical challenges

- **Performance/Quality**

23% Physical stability of the formulation (shelf-life)
18% Chemical stability of the actives/ingredients (shelf-life)
14% Robustness of the formulation

- **Production/manufacturing**

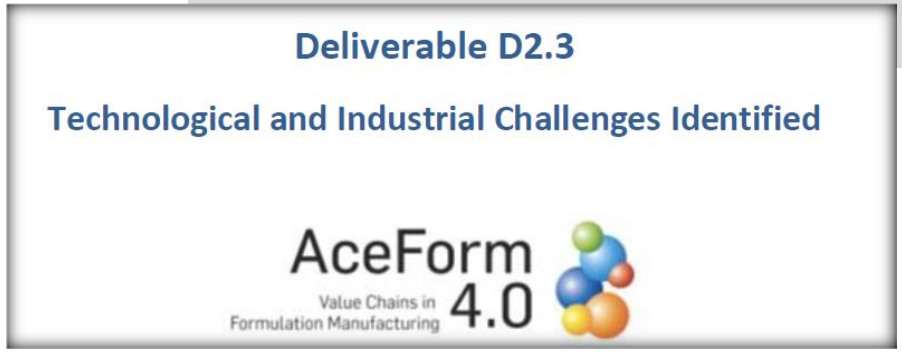
23% Scale-up (lab to pilot and pilot to full)
21% Robustness of the production process
18% Variations in raw material quality

- **Regulatory and safety compliance**

35% Toxicity levels of different ingredients
24% Ingredient traceability
24% Manufacturing process

Consultation Feb 2017- June 2017
web-based survey – 106 responses.
24 one-on-one interviews

50% formulation industries
13% academia
12% research institutes
8% speciality chemical suppliers



https://formulation-network.eu/

Value Chain Collaborations
Systems-based Solutions for Complex Challenges

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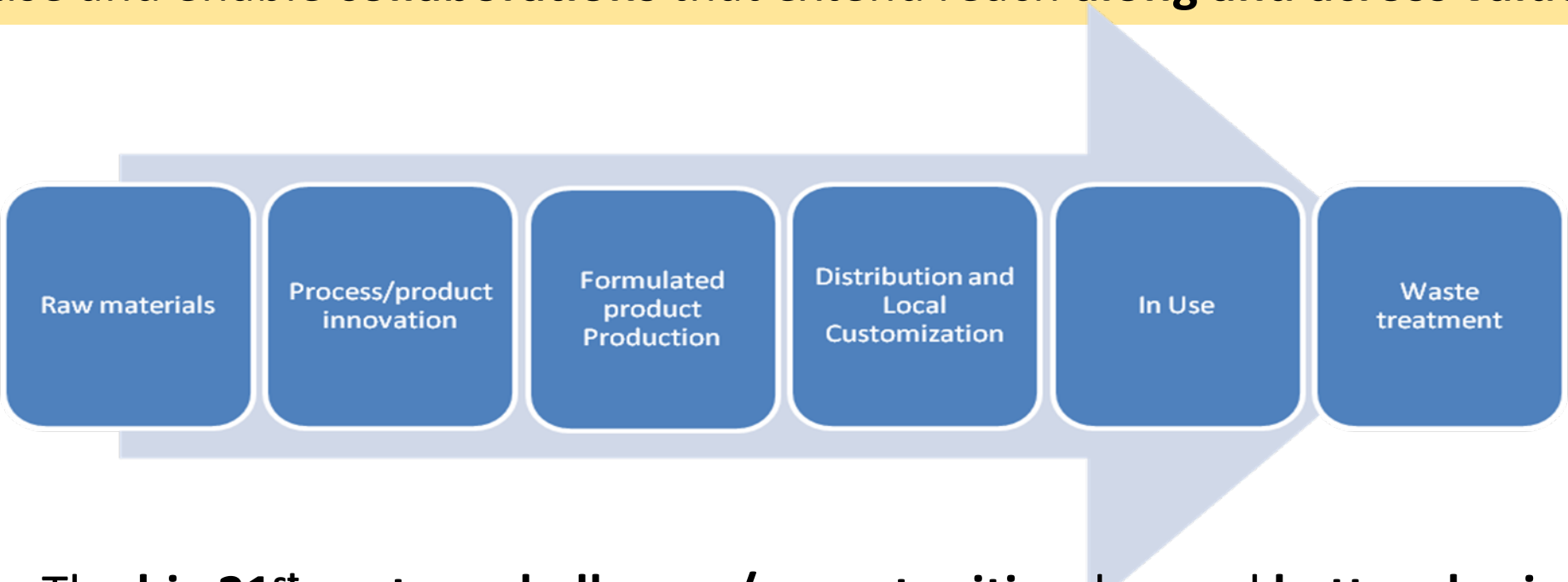
- **Key recommendation**

Prioritise and enable **collaborations** that extend reach **along and across value chains**



- The **big 21st century challenges/opportunities** demand **better sharing** of:
  - **Technical expertise, data** and insights
  - **Specification/Customer understanding**
  - **Constraints**

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Value Cycle Collaborations
Systems-based Solutions for Complex Challenges

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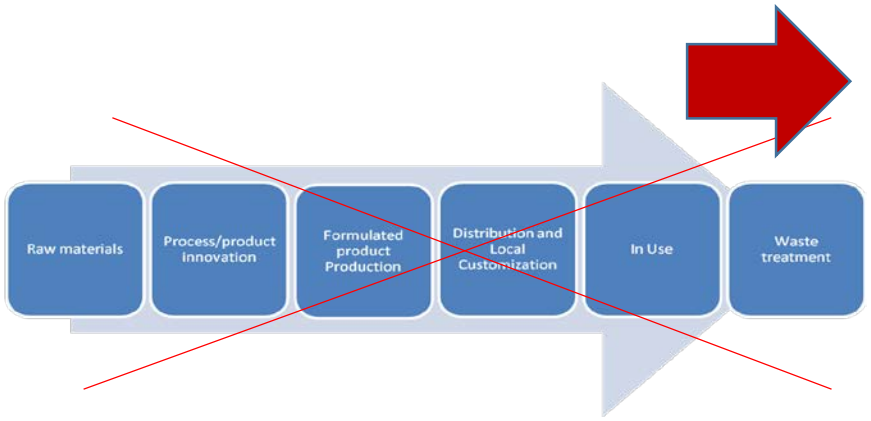
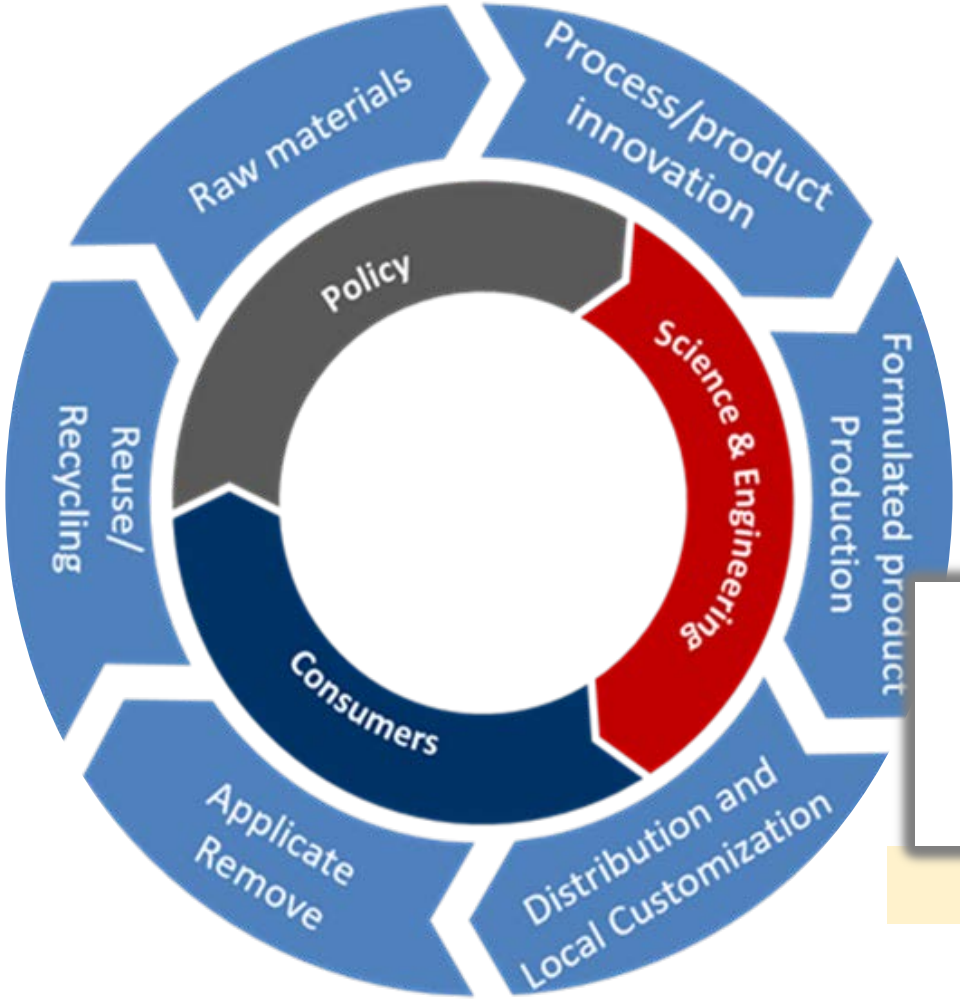
Key recommendation: Prioritise and enable collaborations that extend to **value cycle** thinking





Deliverable D4.1

Formulation community Value-Chain Maps

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2030 Roadmap for the European Formulation Industries
-Highlights-
-Circular Economy-

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Circular Economy: beyond natural, ”green” and sustainable?

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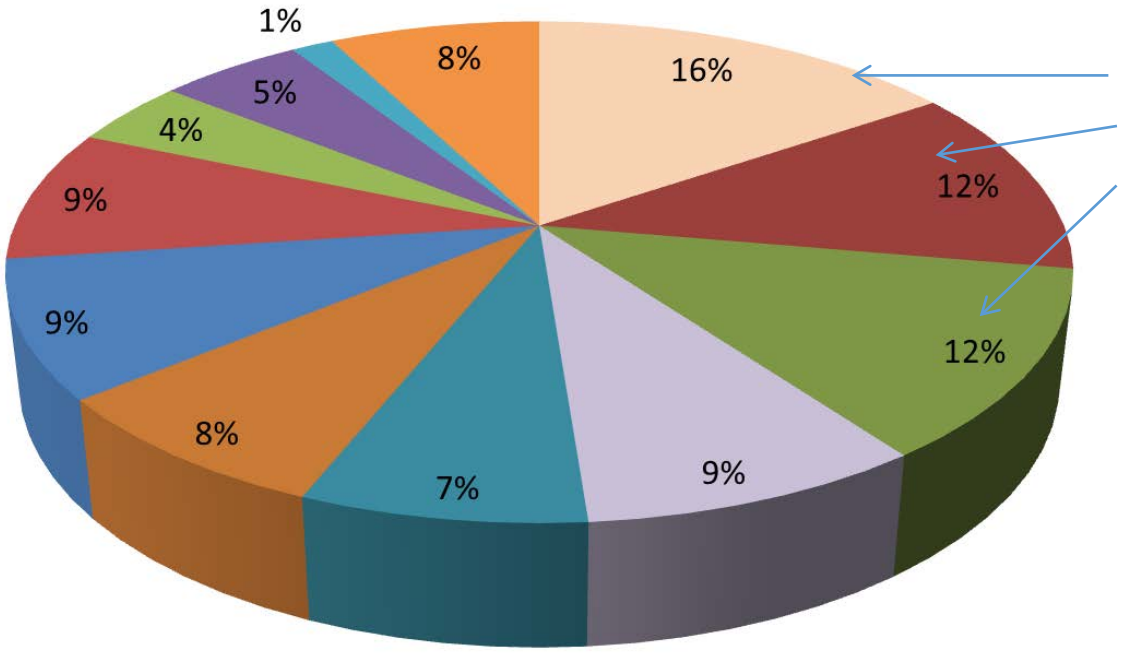
Please indicate what you consider are the most important areas related to Circular Economy that your company would benefit from growing stronger within the next 5-10 years?



1. Sourcing raw material from sustainable sources
2. Ingredient exchange to improve sustainability
3. Development of raw materials from sustainable biomass

Deliverable D2.3

Technological and Industrial Challenges Identified

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Circular Economy:
beyond natural, ”green” and sustainable?

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CIRCULAR ECONOMY

Maintaining the value of products, materials and resources in the economy for as long as possible, while minimizing the generation of waste.

EC´s 2015 implementation plan for Circular Economy*:

- Production design and process
- Consumption
- Waste management
- Waste to resources

SUSTAINABILITY

“Meeting the needs of the present generation without compromising the ability of the future generations to meet their needs”

Brundtland Commission 1987

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Circular Economy for Non-Consumable Formulations

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- Clear how **CE thinking** can be **applied directly to the product profile**
  - ***Example**: a long life coating, using as few materials as possible*
- More **scope for recover, recycling and remanufacture**
  - ***Example**: paints can be formulated to enable better recycling*
- **Formulated product part of a bigger system** –

  can enable bigger, indirect CE benefits
  - ***Example**: more efficient lubricants leads to more efficient wind turbines*

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Circular Economy for Consumable Formulations

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- **'Green' and 'Sustainability'** – association to **ingredients** and/or process **technologies**
- **Perception** that the **Circular Economy is less relevant** to them

  - Circular Economy principles can be applied (within reason)!
  - **Broader life cycle consideration** - **indirect opportunities for value creation** where better formulation is needed

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Circular Economy in Consumable Formulations-Example

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- Home and personal care- Shower gels and Washing liquids

- Often the major issue is the creation of **packaging waste**

- Opens up an **opportunity /need to reformulate** to **enable more efficient use of packaging** materials

concentrates -> smaller packs.

Image source: www.splosh.com

*Credit: https://**www.forumforthefuture.org**/project/circular-economy-business-model-toolkit/overview*

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Circular Economy – Key Recommendations

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Key Recommendation:
Improve awareness of formulation related CE case studies (Inform)
-removing barriers to **'understanding the relevance'**

Key Recommendation:
De-risk shift to CE by improving access to relevant collaborative tools to **model impact**

- *Bio-based, renewable, non-toxic, natural, fewer* ***ingredients***
- *Resource efficient* ***processing***
- *Circular formulation* ***design****- for* ***long-life, recovery, recycle, remanufacture, waste valorisation***
- *Formulation design to enable* ***reduction in plastic pollution***
- *Formulation enabling* ***low water/energy in –use***
- *Formulation enabling* ***wider industrial decarbonisation***

e.g. light-weighting, energy storage, lubricants, coolants

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2030 Roadmap for the European Formulation Industries
-Highlights-
-Industry 4.0-

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What is Industry 4.0?

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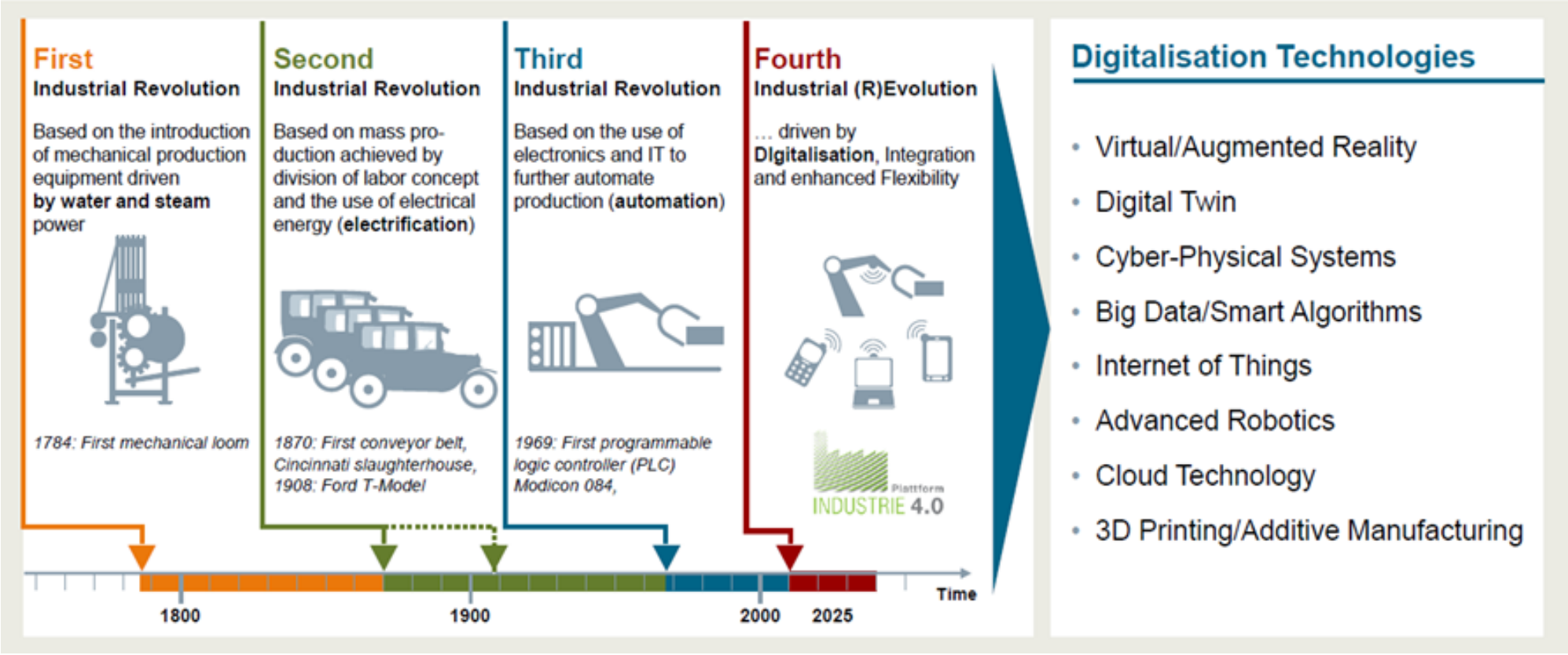
AceForm Definition

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



Source: Siemens AG

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Industry 4.0:
Enabling Radical Product and Process Design

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- **Industry 4.0 can unlock a more collaborative, dynamic approach to product and process design**
  - Breaking barriers between lab, factory and field
  - Enabling new Value Chains/Cycles and Circular Economy collaborative opportunities

e.g. Resource Efficient Formulations for the Smart Farm

e.g. Digital Preventative Healthcare

e.g. Tailored Engine Oil; 'mobility as a Service'

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Industry 4.0 Technical Challenges: The Formulation Industries Perspective

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Universal Industrial Challenges

- **Data–sharing** - A step-change is required for greater access and sharing of data currently segmented across a risk adverse supply chain.
- **Integration** - many digital systems, many functional business needs, many legacy capital assets
- **Digital skills** – retraining for tools of the future

Formulation Specific Technical Challenges

- **Digital Twins** - are not easily created for Formulations
  - performance/failure mechanisms are not well understood
  - i4.0 may create more data and levers, but without any underpinning insights as to how/when to use them.
- **Formulations are inherently unstable**. 'Good' is only a point in time. As such, stability / performance / quality assessments over can be unreliable over short periods of time.
- **Standards** for describing formulations or structuring data don't exist. This limits the ability to apply novel data approaches and codify knowledge.
- **Target properties -** are generally difficult to reduce to a discrete measure/physical attribute; as such it will continue to be difficult to make a meaningful quality measurement.

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Getting started?
Digital Formulation Capability Benchmarking and Roadmapping

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Against Four themes

1. **Quantification**
2. **Connection**
3. **Embed multiscale modelling**
4. **Embed intelligence**

Across six stage of Formulation life-cycle

1. **Ingredients**
2. **Mixture** (e.g. formulation)
3. **Process –** including recovery/recycle
4. **Delivery** - Storage/transportation/device
5. **Application** e.g. wetting, delivery, heat transfer
6. **Subject** e.g. skin, leaf, engine

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Industry 4.0: Key recommendations

Key recommendation:
Improve awareness of resources and networks that promote the value of Industry 4.0

Key recommnedation
Influence wider Industry4.0/digitalisation calls; maximising relevance to formulating industries (Fund)

Key Rocommendation
Raise awareness and build on projects already seeking to resolve these issues (Connect)

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Activating Value Chain for EU Leadership in Formulation Manufacturing 4.0

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European Formulation Network EU FormNet

LinkedIn

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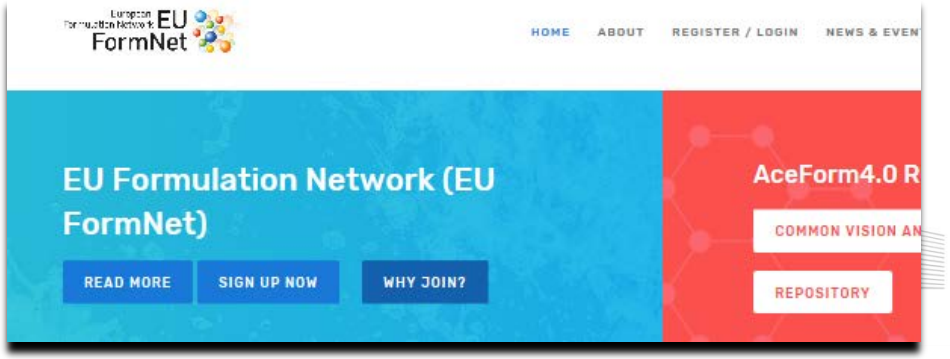

AceForm Workshop

Formula X

Tuesday 25th June 17:00 - 18:30

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Applisurf Project
Cross-sectorial: Yes

POPFREE- Promotion of PFAS-free alternatives

NECOMADA - Nano-Enabled COnducting Materials Accelerating Device Applicability
High-Thro

PROSPECT CL
Cross-sectorial: Yes
Cross-value chain: Yes
Circular Economy related: Yes
By creating models across scales, the prospect Cl rig facilitates the understanding of the process properties of liquid formulations at pilot and full scale – at bench scale. It is an economic system aimed at minimising waste and making the most of raw material and energy resources.
Industry 4.0 related: Yes
Fully digitally enabled process rig with software package (SIPAT/PharmaMV) and advanced instrumentation; development of process control models (MPC), multivariate data analysis, SPC

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Thank you for your attention!

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