

**Some Comments & Reactions**

to

**Suschem**

**The Vision for 2025 & Beyond**

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# The Key Issues?

## 1. What is "sustainability", so far as the CPI is concerned?

The CPI may need to re-invent itself ?

## 2. Excellence across the Life Cycle

From research to manufacturing

## 3. What about Enabling Tools - modelling & simulation in particular?

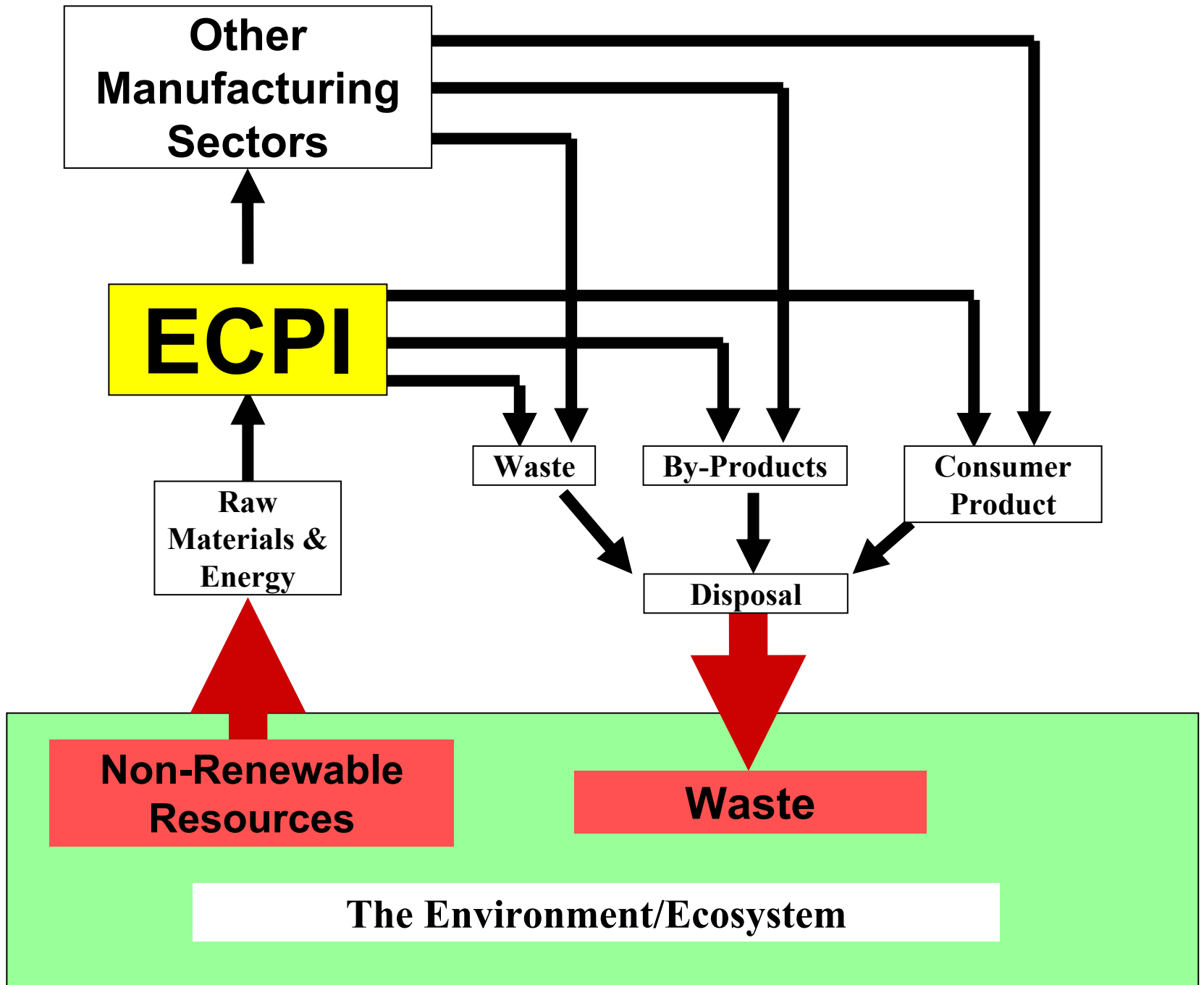
A "horizontal" issue, appearing in all SRAs?

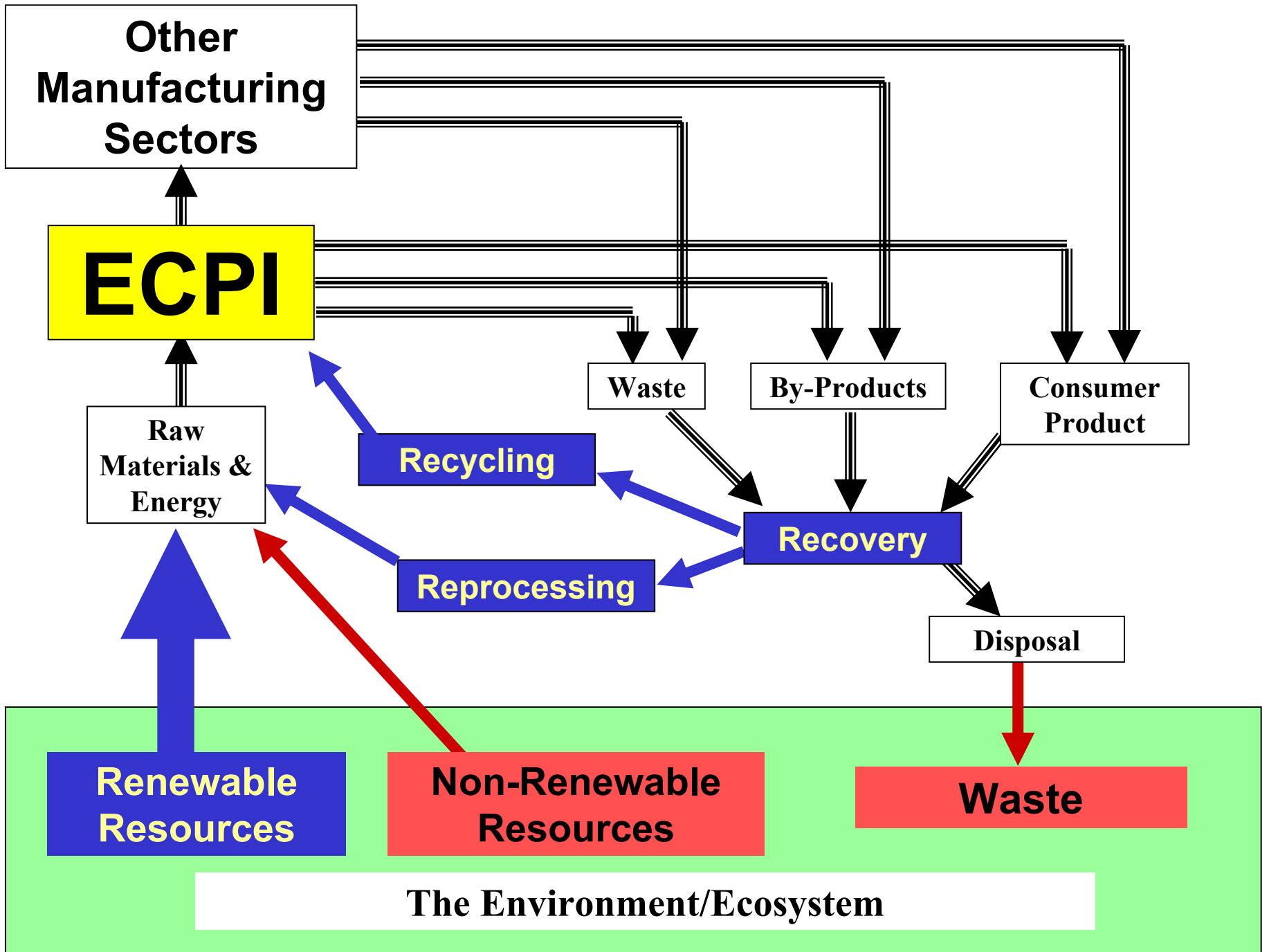
What might such a "layer" look like - building on CAPE.NET, PURE, etc?

# The Sustainability Challenge

restructure the CPI's product/manufacturing network to enable a dramatic reduction in

- abstraction of raw materials & energy from the ecosystem (eg. oil, water, oxygen)
- rejection/disposal into it (eg. by landfill, incineration, river/ocean discharge)





# The ECPI must evolve towards :

- a range of **products** which are inherently more capable of recovery, recycling and reprocessing (for example, polymers which can be "unzipped" into their raw materials)  
  
whilst simultaneously maintaining or enhancing both the capabilities delivered to the end-user (whether industry or end-consumer) and the global competitiveness/profitability of the industry itself
- develop a range of **processing capabilities** to recover, recycle and reprocess both its own products and those of other sectors
- efficiently and effectively **design, build and operate** plants to implement these new products & capabilities, which are safe, clean, efficient, flexible, ....!

# How can this be achieved?

In order to deliver these objectives whilst remaining globally competitive, the ECPI has got to "re-invent itself" and deliver excellence across the LC

**Excellence in research**

**Excellence in engineering**

**Excellence in manufacturing**

**Excellence in Research alone is not enough!**

**But first, some miscellaneous remarks:**

- **Innovation:** what's changed since the Industrial Revolution - Europe's "Golden Age" of Innovation??
- We must not forget the **“installed base”** - it will take 10-20 years (or more) to replace it!
- The CPI needs to adopt a more pro-active collaboration with the **media**, aimed at mass audiences.

Proposed developments in nano-technology & bio-technologies will raise a lot of new SHE and image issues ("PM 0.1"s, implied GM?), which the industry itself must address more determinedly or the media will destroy any chance of progress - influencing the technical press and the politicians is entirely irrelevant it is ultimately “the man in the street” who will decide!

- CPI "processes" are dominated by fluids and are **not covered in manufacturing initiatives** such as FACTORY, MANUFUTURE, etc (which are oriented towards fabrication & assembly "processes")
- CPI-specific technologies are **"a bit thin" in FP7!** Sciences, yes, but not engineering & production technologies.

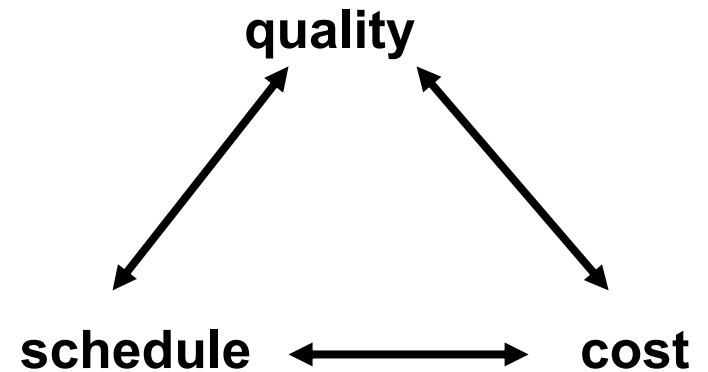
# Excellence in Product & Process Research

- **Product innovation & differentiation - inherent recycle-ability**
  - (eg.) "unzippable" polymers
- **Radically improved new unit processes:** innovative integration of kinetics, thermodynamics & fluid dynamics and of micro-scale phenomena & sub-processes
  - (eg.) multi-functional units, intensification, miniaturisation, low-energy
- **More integrated/concurrent development of products & processes:** enhanced interaction between chemistry, bio-chemistry, physics & engineering
  - (eg.) improved understanding of property/process-history interactions; improved reactors & separators, more effective catalysts; integrated bio-processes
- **Closer integration between modelling and experimentation**
  - (eg.) improved experimental design and measurement analysis
- **Capture & build knowledge & understanding**
  - (eg.) "Knowledge Warehouse"

# Excellence in Engineering

A critical issue is the "infernal triangle":

We can only "break" this if we change the way we do things - eg. concurrency!



- **Greater concurrency in Front-End Engineering:**
  - radically improved integration between processes and their control, safety, environmental and utility systems
  - radically improved "whole process" structures, with inherently desirable behaviour characteristics and thus inherently capable of delivering manufacturing excellence
  - improved change control: reduced recycling of design
  - greater responsiveness to market opportunities: better, more balanced designs, faster
- **Extend & Exploit the "Knowledge Warehouse"**
  - capture and sharing of knowledge and design information, rationale, decisions, models, etc, and their incorporation into the audit trail

# Excellence in Manufacturing

Manufacturing is "where it all actually happens": **use**  
**the knowledge warehouse that we've built up:**

- Advanced measurement (incl. soft sensors); automation; optimising/adaptive control
- Condition monitoring; fault detection & diagnosis; alarm management; maintenance prediction
- Enhanced operator support: advisory systems; planning & scheduling
- Flexible & responsive campaign operations: improved integration with supply-chain dynamics; improved start-up/shut-down trajectories
- Improved reliability, availability, occupancy & resilience
- Safer & cleaner operations
- Keep building & re-using the Knowledge Warehouse: improved feedback to research & engineering; "continuous improvement"

Now, having set the background requirements, what about enabling tools, such as

# Modelling & Simulation

## across the Life Cycle?

Modelling & simulation of various kinds is now ubiquitous and will be a CRITICAL ENABLER to delivering just about all of the technical aspects of the vision (ie. all the SRAs)

**"*in silico* is a horizontal issue"** (Sommer, Barcelona)  
(but it's qualitatively different from the other horizontal issues)

Also note that ICT issues (especially M&S) appear just about all over ChemicalsVision2020 (a major US initiative, involving around 80 companies & \$100m/yr) and are explicitly recognised as an Enabling Technology

**May I therefore suggest a revision to the Suschem organogram:**

Board

Horizontal  
Issues  
Group

Platform  
Secretariat

Industrial  
Bio-  
technology

Materials  
Technology

Reaction  
& Process  
Design

**Manufact  
uring**

## **Enabling Technologies**

(eg. modelling & simulation, information & knowledge management, decision support, collaborative working environments, .....

Member States' Mirror Groups

Industry Steering Group

# What might an "M&S Layer" look like?

Topics that keep coming up include:

- ***ab initio* modelling of materials & mixtures**

Molecular dynamics: materials design, property/structure relationships, catalysis, ....

*(bio equivalent?)*

- **more accurate modelling of multi-component, multi-phase fluids**

"a new CFD" to help deliver intensification, multi-functional units, miniaturisation, enhanced catalysis, etc

- **"multi-scale" models:** models of systems where the overall behaviour can only be understood/predicted as an aggregate of all the behaviours at smaller scales

particulates, bio-systems, waste processing, complex reactor configurations, ...

- **models for manufacturing**

- **integration & management of information, models & knowledge**

- **advisory systems: DSS**

We can build upon earlier "visioneering" work, such as:

**(EU) CAPE.NET**

**(EU) PURE**

**(CEFIC) SUSTECH/CAPRI**

**(EUREKA) CAPE-21**

(and, of course, ChemicalsVision 2020, which will be evolving)

## **The Grand Vision:**

**a suite of tools & working environments to facilitate:**

- The development of comprehensive high-performance multi-scale models, constructed on a rigorous fundamental basis and incorporating appropriate knowledge, experience & expertise
- Their effective deployment across the life cycle, from research to manufacturing
- The capture, management & sharing of knowledge, experience, data, information, models, ...
- Effective support for teams & decision-making



## In closing:

- This has been a personal view (and will hopefully provoke a discussion!)
- I have drawn on materials prepared during initiatives such as CAPE.NET, PURE, CAPE-21, etc, several of which were WP initiatives (more details can be found on the web)
- WP members have been involved in at least 1euro-worth of visioneering, involving more than 100 organisations in several CPI sectors
- We'd like to contribute this to help Suschem's SRA development

**So, let's brew a plan together!**

