

The Future Challenges of Sustainable Manufacturing

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Industry in 2050:

4 x output

0 x greenhouse gasses

0.5 x resources

Clean. Healthy. Equitable

Some mega-trends to 2050:

***Lean, globalization, more consumers,
digitalization***

***More consumers, more urban & connected,
digitalization,
constrained resources, disruptions,
big data, small factories***

What makes me angry

50% of edible food not eaten

33% of weight of building not used

1% of available chemical energy

The IEA estimates that

\$523 billion was used

to cut fossil fuel prices in 2011

27% load factor in UK trucks

...??...

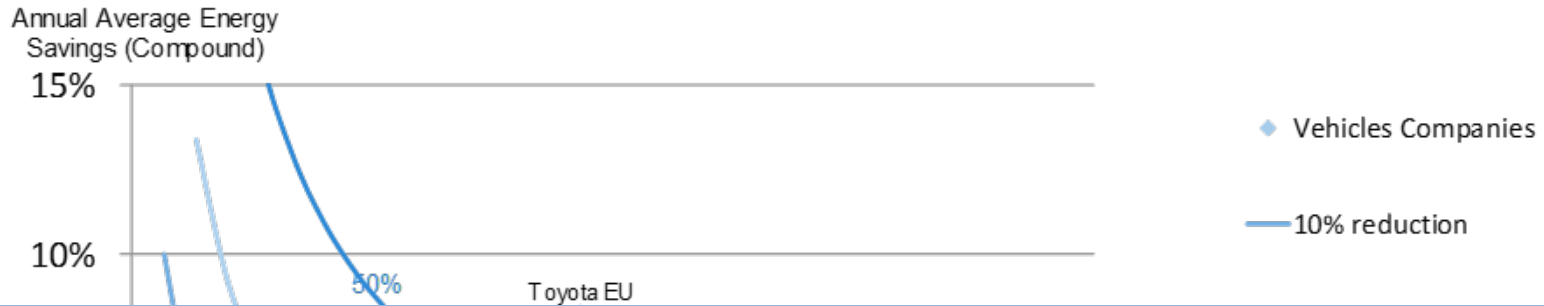
Efficiency

Value

Technology

System

Best in Europe?



12% more profit
15% more jobs
4.5% less GHGs

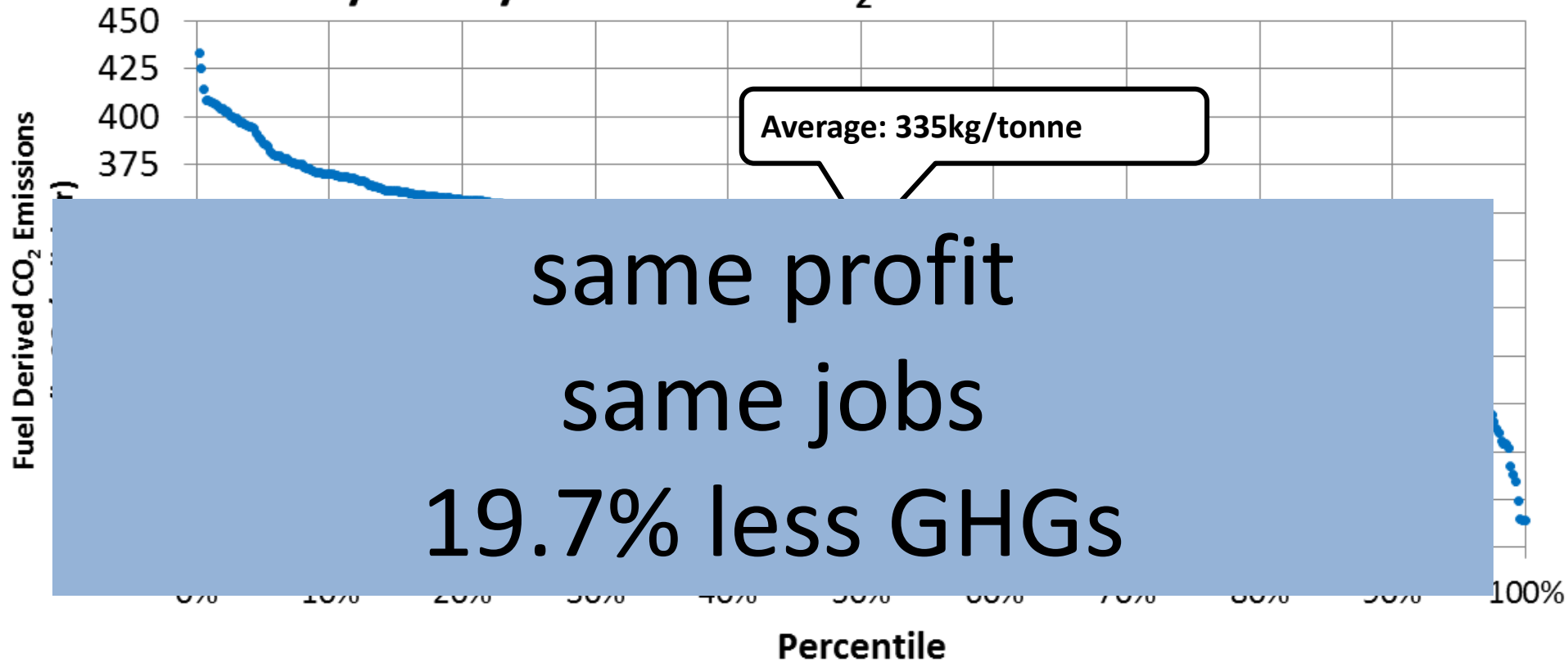
-10%

Note: Numbered data points are companies who provided data confidentially or are not named for other reasons; all named companies are plotted based on publicly available information.

Sources: Next Manufacturing Revolution Survey; Next Manufacturing Revolution literature review; Department of Energy and Climate Change, Energy Consumption UK 2010, 2012; Office of National Statistics, Detailed Indices of Production, 2011.

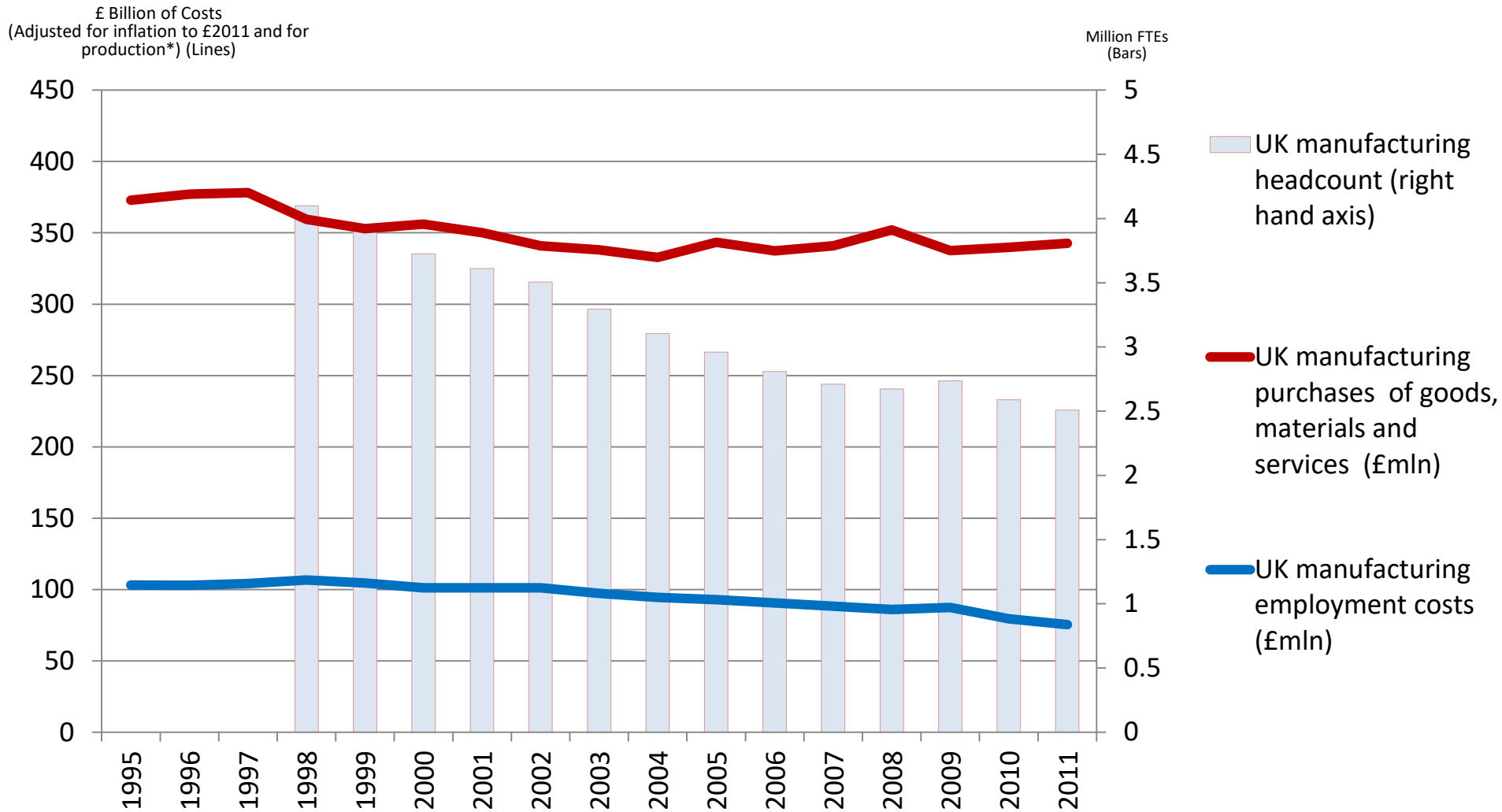
Best this year? CO_2 - Cement Factory

Day to Day Variation in CO_2 Emissions from Fuel



Why?

One possible root cause



Externalities

Everywhere

Efficiency

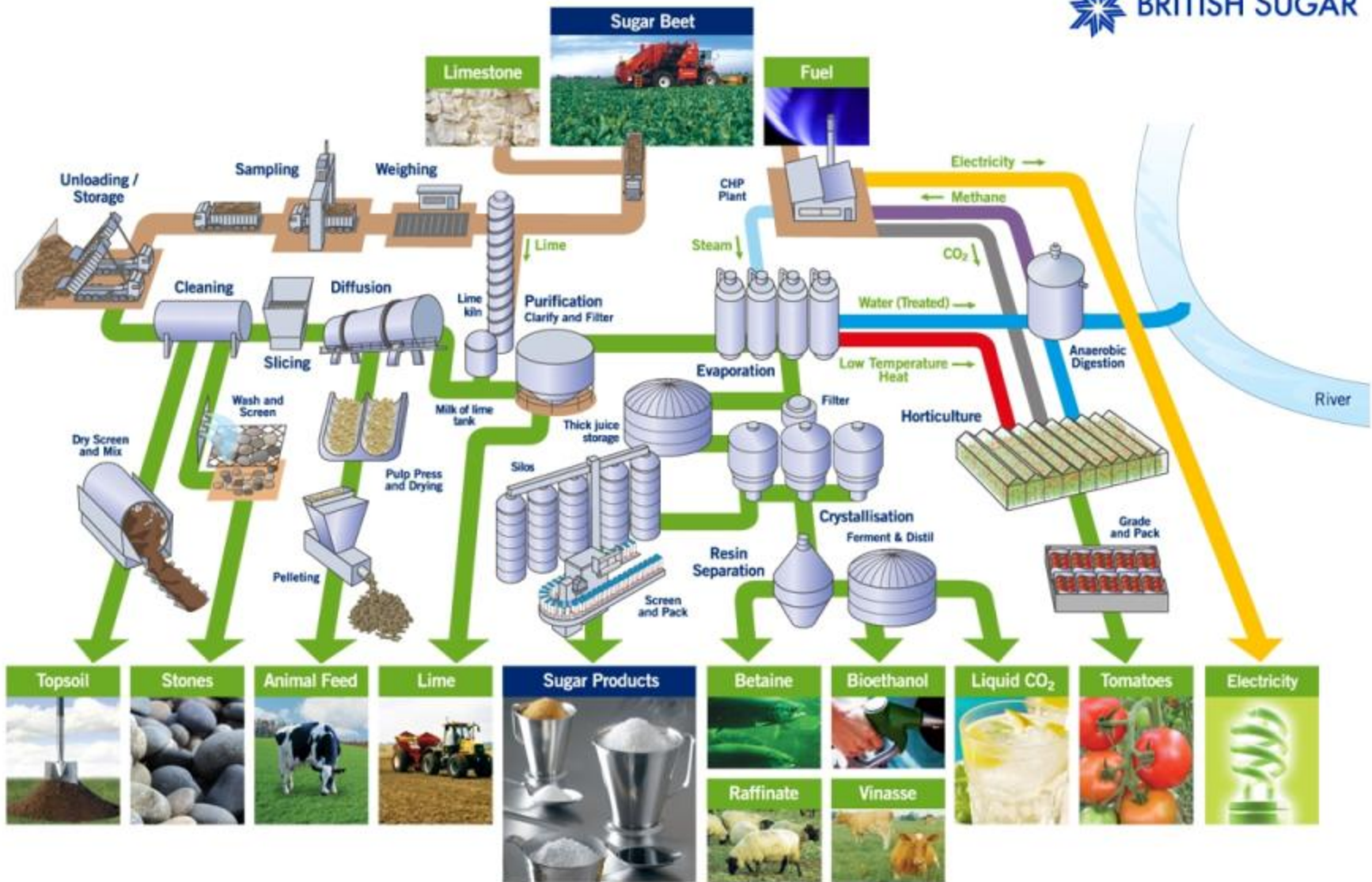
Value

Technology

System



ELVIS & KRESSE



Capturing value from biology

- PV self-consumption
- Peak-shifting (up to 20% peak-cut²)



2. Japan's Journey on Smart Community, METI (2015)

- Frequency response
- Renewable integration



2030 = powering HK for 1.1 hours

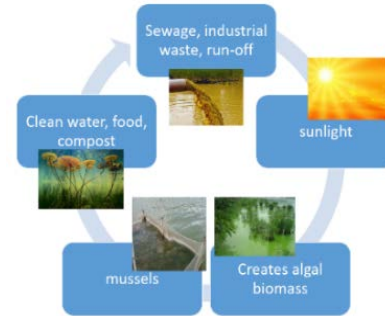
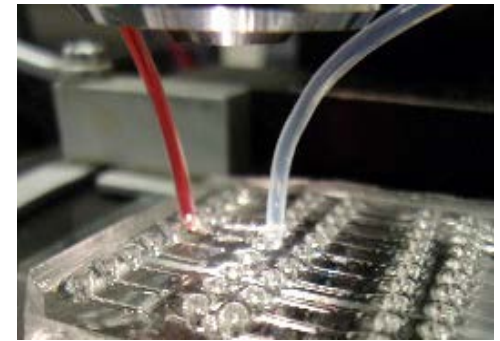
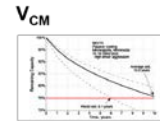
Total Energy Value

- Smart appliances
- Up to 20% energy savings³



3. Current thinking on building management systems, Energy Institute (2011)

Cell lifetime extension



Efficiency

Value

Technology

System

Some early experiments

Innovating system *in Fast Fashion*

(less raw material, longevity, circular)

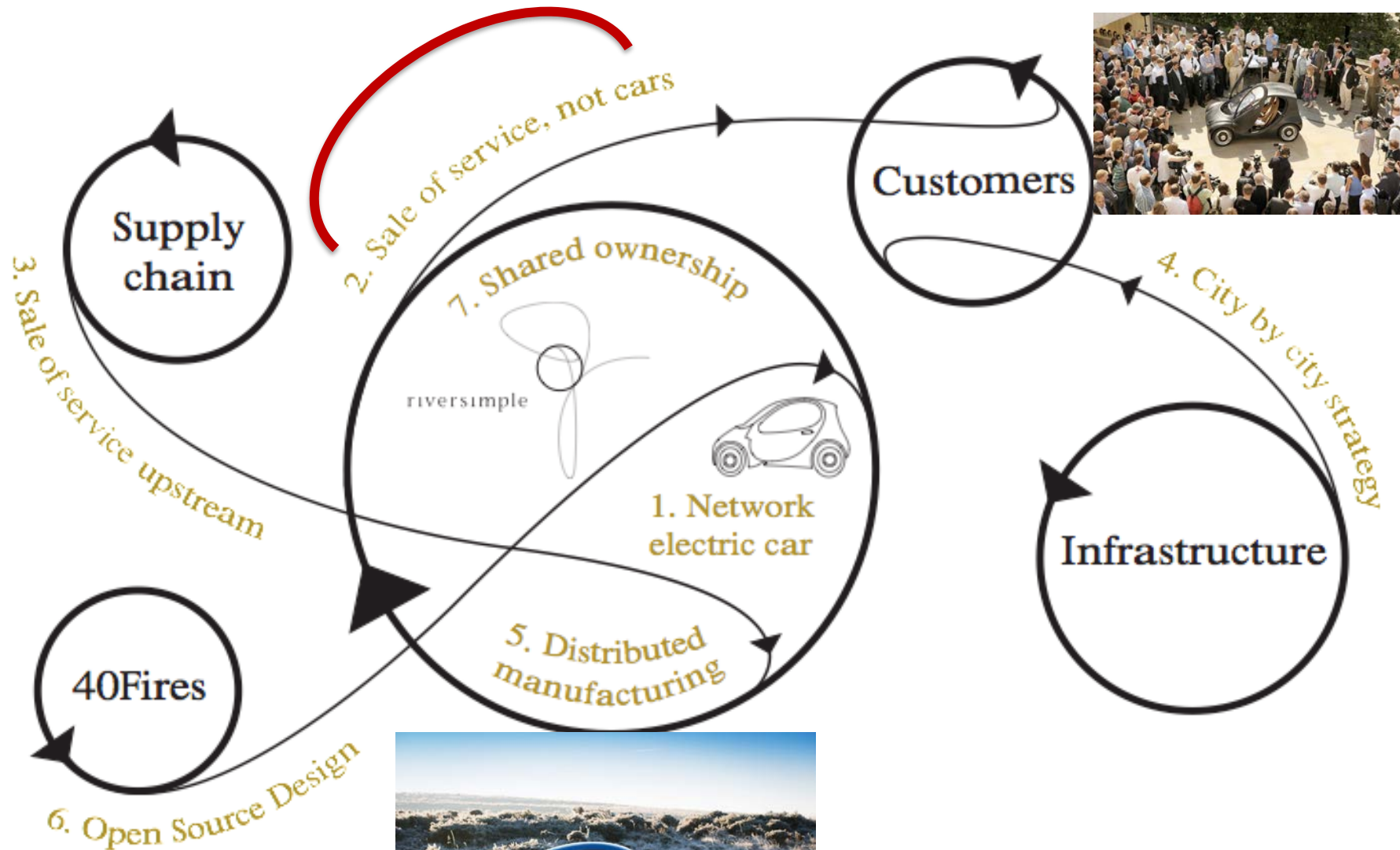
20



1 l/100kms

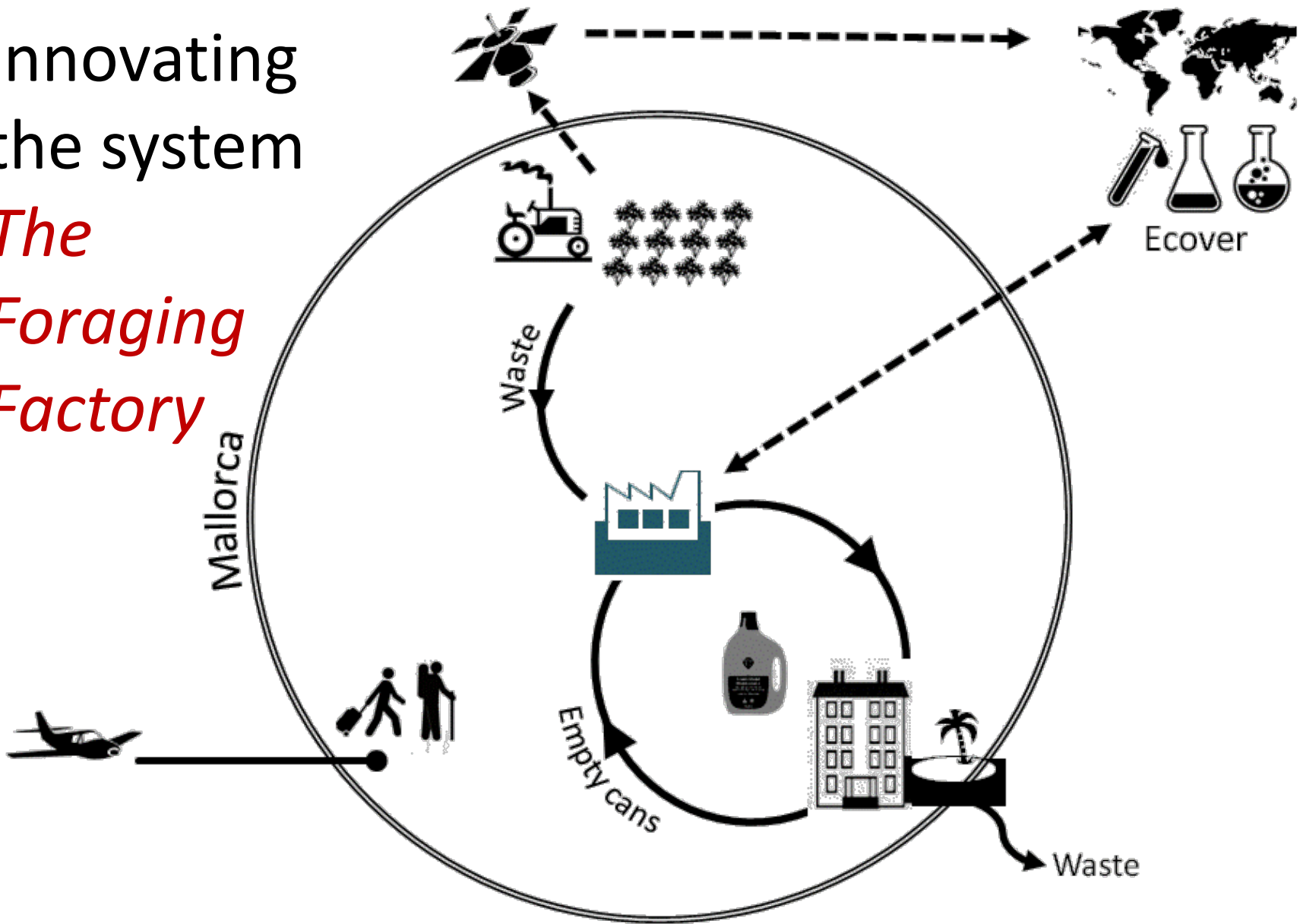
cheaper than a Ford Focus

> \$10k profit



Innovating
the system

*The
Foraging
Factory*



Key Influences to 2030



Business as usual, focus on efficiency, hoping for a growing market

Location decisions change
Strong focus on efficiency
Increased information content

Disruption, experimentation, radical technology

Multiple **disruptions**
food-water-energy *politics*

New structures & governance

Longer & faster
Specific & informing
Biology & biological

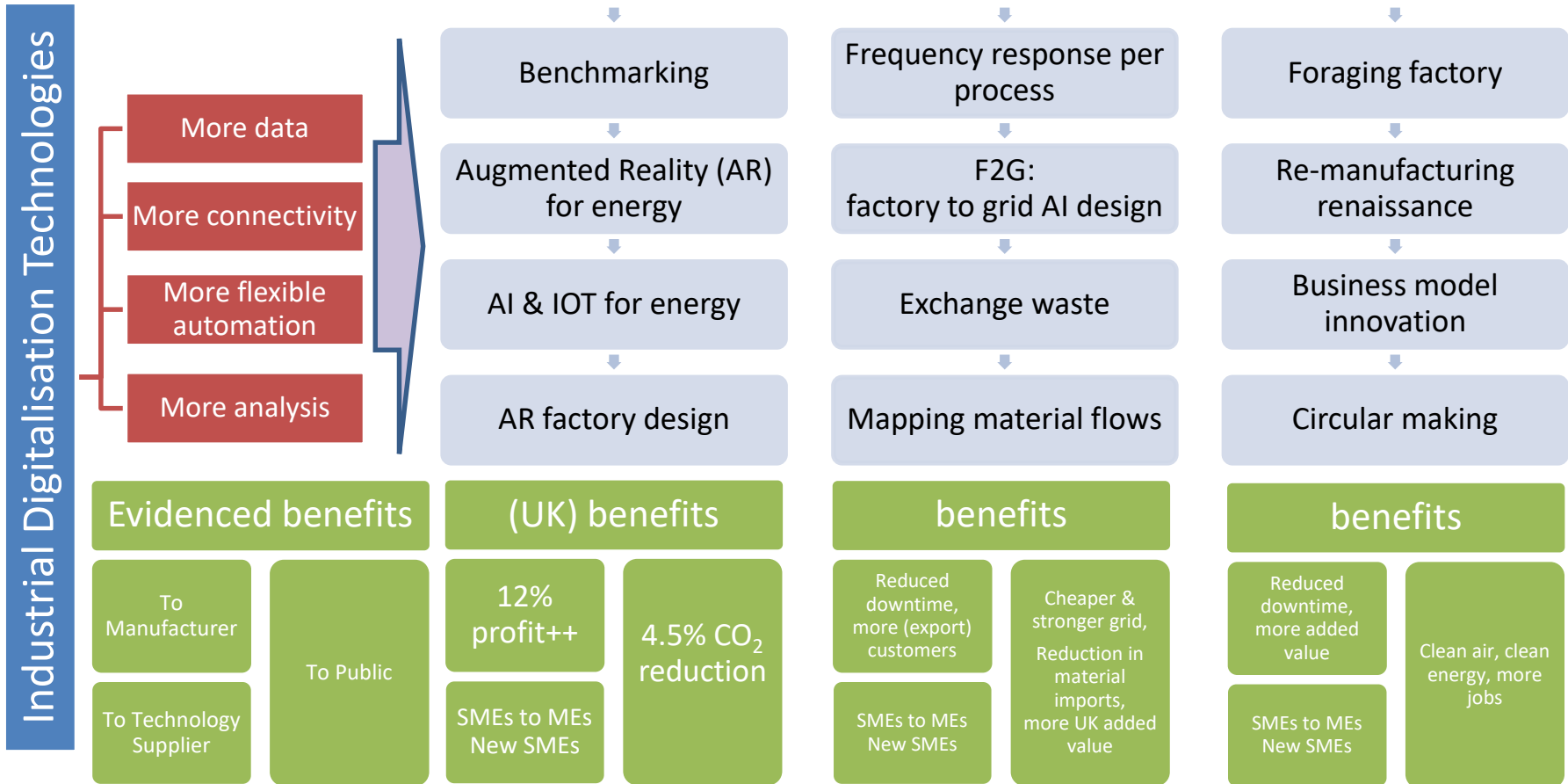
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Se
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Gentani (actual limits)

Business Leadership
Well-being as business goal

Circular economy
Information replaces materials
Lightweight, complex materials
Bio-materials
Experiments everywhere

New forms of **governance**
Base of pyramid fully engaged
Business Leadership++

Industrial Digitalisation & Sustainability





experiments

Experiments

Everywhere