Turning waste problems into valuable opportunities across the agri-food chain

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Waste Management across the supply chain

On the farm / Post-farm gate / Customers and Consumers

The focus will be on the areas of:

- **Production**
  - **Energy**
  - **Water**

- **Nutrition**

The vital ingredient

Chemical science and engineering for sustainable food
January 2009

RSC | Advancing the Chemical Sciences

IChemE
Institution of Chemical Engineers

Challenges to us all:

- Entrepreneurial / innovative Industry
- Changing operating procedures
- Small Scale efficient and flexible processing
- Hygienic processing
- Ingredient functionality and security of supply
- Limited water
- Biomass refining
- Food product design and fabrication

- Developing quality food products
- Achieving sustainable food production
- Tailor-made foods to preference / acceptance / needs of consumers

European Technology Platform on Food for Life

Strategic Research Agenda 2007-2020

‘While the old title contained the term “manufacturing”, this was considered too narrow to define the field’……..
‘This approach encompasses the whole life-cycle of processed foods.’
‘The concept of farm to fork is too limited, and needs to be expanded to that of **from farm through digestion**.’

European Technology Platform “Food for Life”

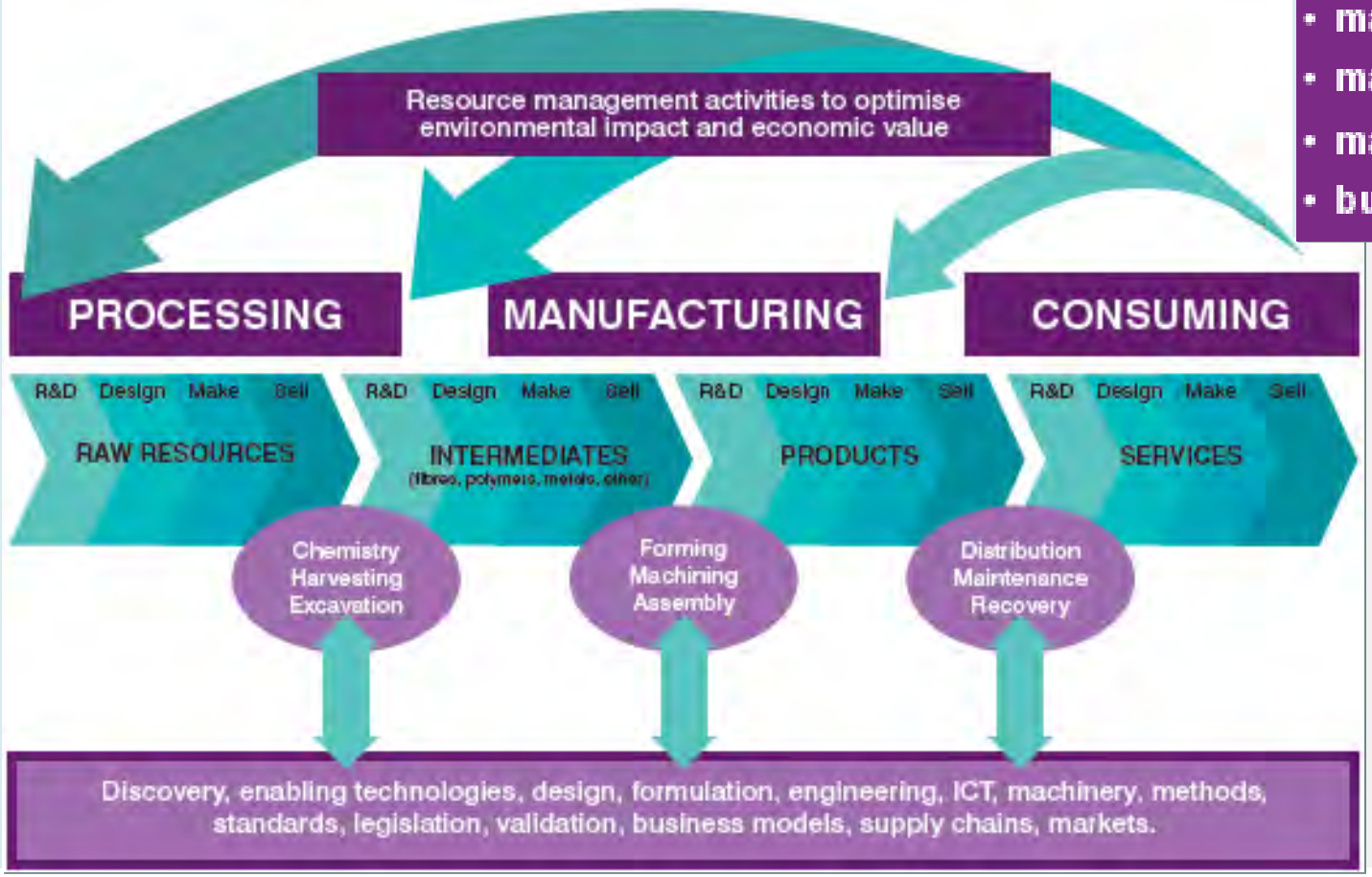
Strategic Research and Innovation Agenda
(2013-2020 and Beyond)

- Sustainable & Ethical Production
- Food Processing, Packaging & Quality
- Food Chain Management

Technology Strategy Board
Driving Innovation

High Value Manufacturing Strategy

- resource efficiency
- manufacturing systems
- materials integration
- manufacturing processes
- business models.



Identifying research questions to address the FULL FOOD SYSTEM relating to food consumed in the UK….with emphasis on the 'post-farm gate activities'.

Thus, the ways in which food is produced, processed, packaged, marketed and consumed not only all affect food affordability, safety and availability (for instance), but also the livelihoods of those working in the food system and the environmental footprint of the food system.

Current views / approaches:

Production

- **Reduce waste (through improved post-harvest technologies)**
- **New manufacturing paradigms** **Conversion**
- **New Material usage**
- **Improved Shelf-life** **Meeting Expectations**
- **Better packaging and material design**

Technology Strategy Board
Driving Innovation

Call - Food Processing and Manufacturing Efficiency
'Transforming wet perishable food waste streams for high value human consumption'

New-Food Innovation
End to End Solutions

The University of Nottingham
UNITED KINGDOM · CHINA · MALAYSIA

THE UNIVERSITY of York

BDC Biorenewables Development Centre
Plants · Processes · Products

Centre for Innovative Manufacturing in Food

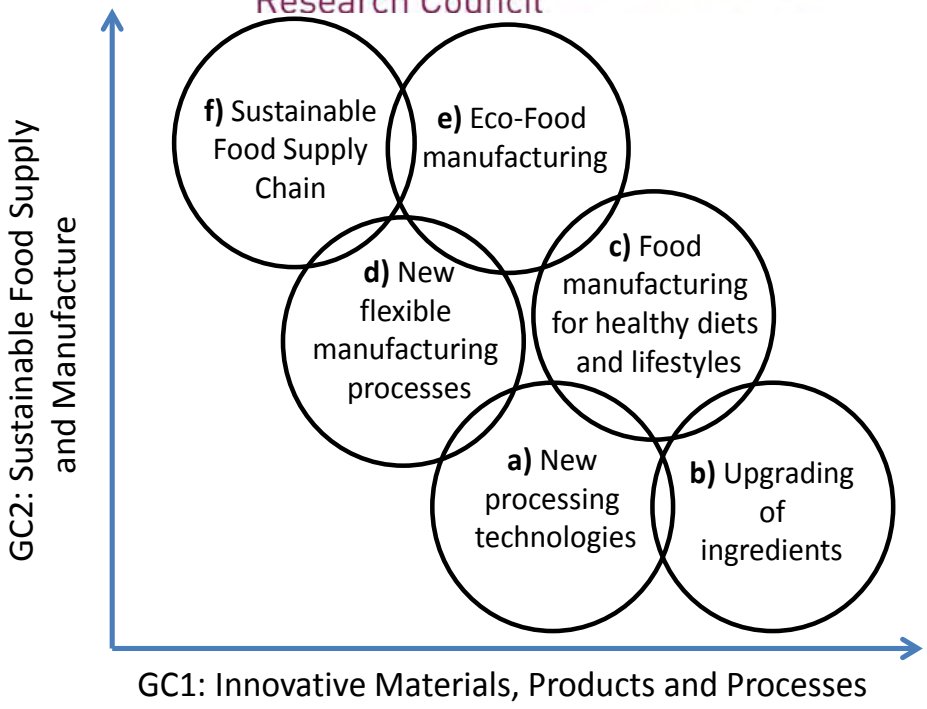
EPSRC
Engineering and Physical Sciences Research Council

The University of Nottingham
UNITED KINGDOM · CHINA · MALAYSIA

UNIVERSITY OF BIRMINGHAM

Loughborough University

EPSRC
Engineering and Physical Sciences Research Council



The Two Centre Grand Challenges and their Six Research Themes

Current and Future Research Areas

1°

- Plant and animal science and environmental engineering for optimised raw material production

2°

- Biomaterial processing
- Chemical engineering for improved process capabilities
- Water usage for purification or efficient use of waste water
- Energy delivery from waste streams in current manufacturing practices

Current and Future Research Areas

3°

- Fate of food during digestion for optimal nutrient delivery and impact on human health

Enabling

- Requiring multidisciplinary teams

- Food safety and spoilage and consumer understanding to minimise waste

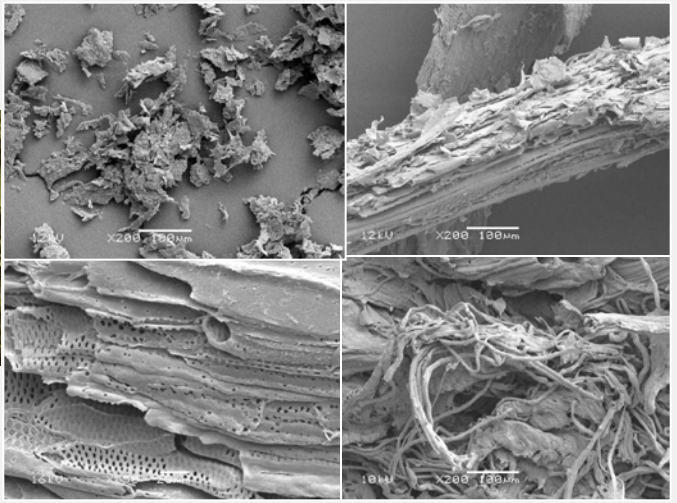
- Simulation and mathematical modelling may facilitate the chances of success in the complex areas

2° Use of Natural Resources

- Use of industrial waste streams
    - Anaerobic digestion
        - Fast composting turning waste into a liquid used for fuel
    - Biomaterial processing
        - for energy
        - for food
        - for new technologies
- VALUE ADDED MATERIALS FROM WASTE

2° Biomaterial processing

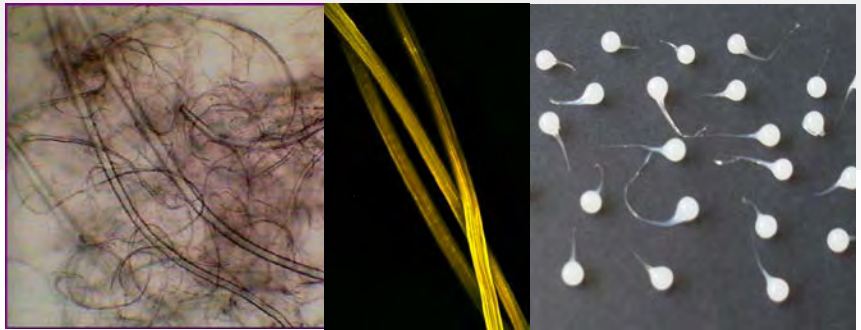
- for energy



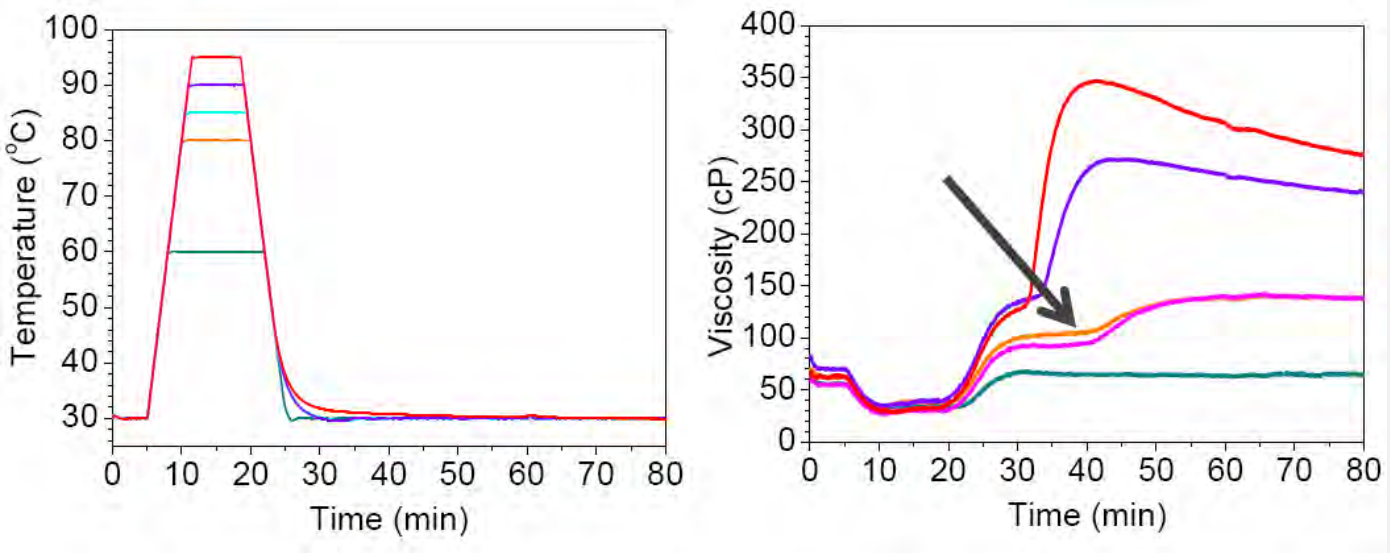
- for food

Manchester Metropolitan University

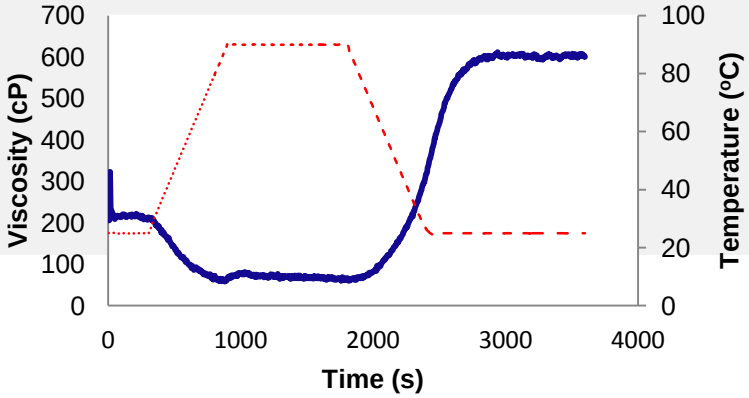
- for new technologies



2° Creating Starch-like viscosities from Cellulose



…and Straw!!



Learning from and delivering to parallel industries

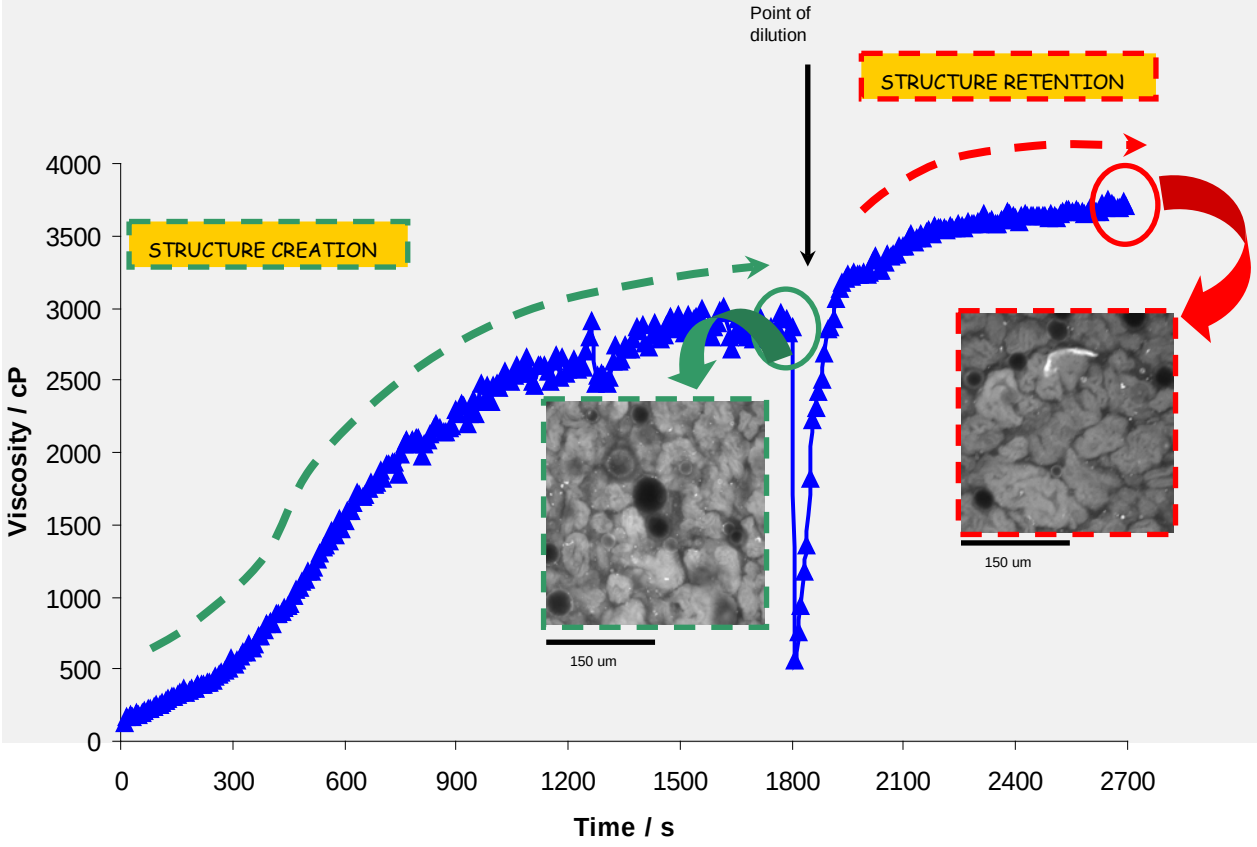
2° Energy and Water

- Utilisation of waste water
  - Use of Green Chemistry and membrane technology for water purification
  - Optimise CIP processes
  - Use of precursors in distributed manufacture

- INTEGRATED FACTORY DESIGN FOR ENERGY, WATER AND WASTE MINIMISATION

2° Use of precursors in distributed manufacture

- Complex food microstructures created by late stage customisation
- Requiring minimal energy input, and water addition at PoS / PoC



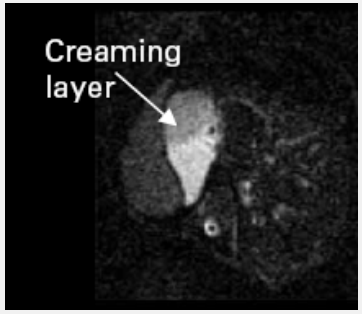
3° Optimal nutrient delivery and impact on health

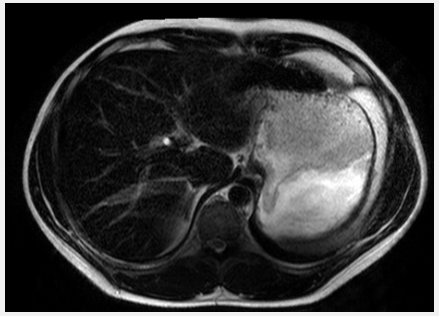
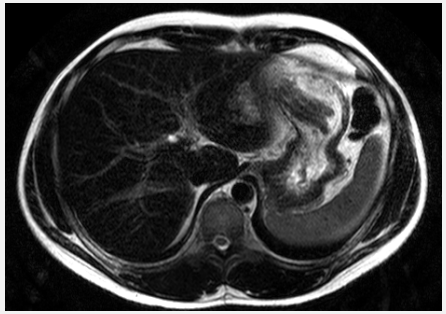
- Tracking Nutrition through the ages




Scientific understanding of the impact of nutrients – at the biochemical, psychological and sociological levels - Translate nutrition research into benefits for Public Health

- Fate of Food During Digestion

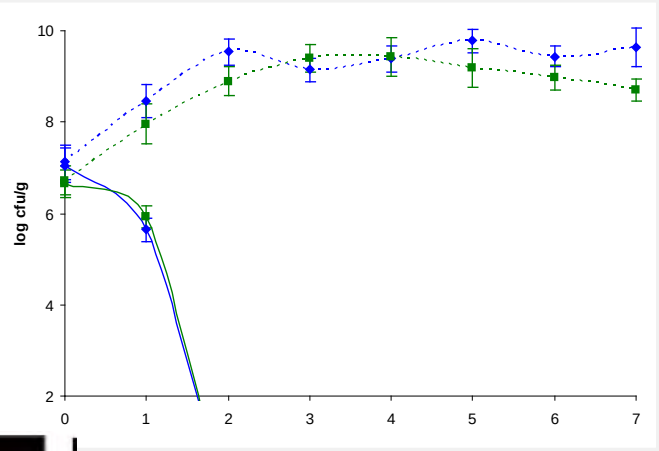


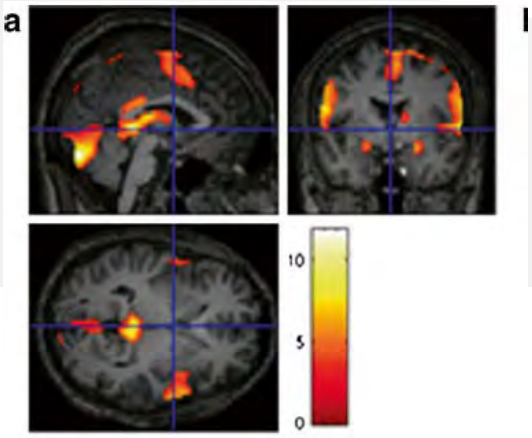
Emulsion and gel design to influence feelings of satiety and body hydration

Enablers

- Safety and Spoilage
  - Lactic Acid Bacteria / Phage and Probiotic technology to prevent growth of microorganisms which spoil food, while ensuring good bacteria remain



- Consumer Awareness
  - Consumer preferences
  - Over fastidious
  - Portion size



Developing Solutions

- Uptake of new ideas in developed societies

- Implementation of infrastructure in developing ones

- The wasteful practices of manufacturing operations and consumer excess and expectation must be addressed

- Innovation of new ideas and practises must be given the opportunity to succeed in order to produce the environmental benefits which will provide Food Security for the future.

Thank you for your attention