DIGITAL TECHNOLOGIES FOR IMPROVING PRODUCTIVITY IN FOOD MANUFACTURING

April 2, 2019 (9:30-14:30)

Hosted by,
Centre for Sustainable Manufacturing and Recycling Technologies (SMART)

• Established in 2004

• Part of the Wolfson School of Mechanical, Electrical and Manufacturing Engineering based at Loughborough University, UK

• Five areas of research:
  • Remanufacturing & Recycling
  • Servitization and Lowsumerism
  • Sustainable Design
  • Resource Efficiency
  • Eco-Intelligent Smart Manufacturing

http://www.centreforsmart.co.uk/
Internet of Food Things Network Plus

Investigating how AI, data analytics and emerging technologies can enhance and add values to the digitalisation of the UK food production chain

- Interdisciplinary network offering workshops, pilot project funding and an annual conference
- EPSRC-funded: May 2018 – April 2021
- Led by the University of Lincoln
  - with universities of Southampton, Exeter, East Anglia, and the Open University
- https://www.foodchain.ac.uk/
- @IoFTnetworkplus

- Creating a “data trust” to address the complexity of the digital food supply chain
- Developing a test bed to support our projects’ use of data, AI, IoT, robotics, logistics...
- Publishing thought leadership white papers on: tech, data-sharing and new biz models
SMART Real-time
Resource-efficient Production

David May
Senior Project Manager
Lincoln Institute of Agri-Food Technology

Mathew Simpson
Area Sales Manager – UK & Ireland
CSB-System
An EPSRC Network Plus
https://foodchain.ac.uk/
May 2018 – May 2021

Challenges in Food and Drink Manufacturing
David May, Lincoln Institute for Agri-food Technology (LIAT)
University of Lincoln
Loughborough University London
2 April 2019
Computer Science

Engineering

Geography

Chemistry

Life Sciences

Maths/Physics

NCFM
IoFT overview

The Internet of Food Things Network Plus

*Investigating how artificial intelligence, data analytics and emerging technologies can enhance and add values to the digitalisation of the UK food production chain*

- Led by the University of Lincoln
  - in partnership with universities of Southampton, Exeter, University of East Anglia, and the Open University
- Unites: agri-tech, data and computer scientists, chemists, economists, and more…

- Professor Simon Pearson, University of Lincoln (Principal Investigator)
- Professor Jeremy Frey, University of Southampton
- Professor Roger Maull, University of Surrey
- Professor Gerard Parr, University of East Anglia
- Professor Andrea Zisman, The Open University
- Professor Luc Bidaut, University of Lincoln
The need ....

Sector Productivity output per hour worked, ONS 2018

- Agriculture
- Food
- Automotive
- Couriers
- Food service
- Scientists
How is technology making food processing and manufacturing smarter?

Made Smarter Review

VALUE AT STAKE FOR THE FOOD AND DRINK INDUSTRY IS ESTIMATED TO BE £55.8BN BETWEEN 2017-2027

<table>
<thead>
<tr>
<th>VALUE LEVER DESCRIPTION</th>
<th>VALUE TO INDUSTRY (£ BN)</th>
<th>VALUE TO INDIVIDUALS</th>
<th>VALUE TO SOCIETY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue growth through new revenue streams</td>
<td>£3.2</td>
<td>• £2,266 saving per household due to improved waste management</td>
<td>• 32 million tCO2e reduction throughout the food supply chain in 2027, due to more efficient production processes and reduction of waste. This represents a 29% reduction in overall food emissions in the UK</td>
</tr>
<tr>
<td>Cost reduction through digitally enabled R&amp;D</td>
<td>£0.5</td>
<td>• 25% increase in product satisfaction related to customisation of products</td>
<td>• 17.6 mn tonnes of food waste reduced over the next decade</td>
</tr>
<tr>
<td>Cost reduction through digitally enabled manufacturing and asset maintenance</td>
<td>£13.2</td>
<td></td>
<td>• An estimated 27,370 injuries avoided over the next decade from implementation of digital technologies</td>
</tr>
<tr>
<td>Cost reduction through digitally enabled supply chain management</td>
<td>£1.1</td>
<td></td>
<td>• Potential to reduce the number of food poisoning cases by up to 4.5m through better traceability in the supply chain and monitoring of shelf life</td>
</tr>
<tr>
<td>Cost reduction through automation of labour</td>
<td>£24.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost reduction due to increase in resource efficiency</td>
<td>£13.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total value to industry</td>
<td>£55.8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Reduction of emissions is not presented as a cumulative figure, rather as the reduction saving potential in 2027
How can technology improve resource efficiency and reduce food waste?

IMS Business Overview

IMS’ integrated “edge-to-cloud” platform drives concrete business outcomes and value release across verticals

- Enterprise-level Systems
  - ERP, SCM, Finance, EAM, Field Service Mgmt
- Supply Chain Contractors
- Maintenance Contractors
- Machine / Device OEMs
- Market / WSP/Per Data
- ... And Others

Key Features

- Connects to any device (legacy & new / OEM independent)
- Integrates, maps, standardizes all kinds of device data protocols
- Creates digital twins of critical infrastructure
- Processes data at edge, and/or consolidates in the cloud
- Applies real-time data analytics with AI / ML capabilities
- Automates device control and processes / workflows, based on policies and rules
- Visualizes data for real-time customer monitoring
- Platform modules can be commercialized individually
- Flexible deployment options – on-premise / public / private cloud

Food refrigeration and IoT

(a) Total Compressor Power (Large Store)

- Power [kW]
- Time [seconds] 

Note: Device definition encompasses assets, sensors and modules.

Blockchain as a unifying platform?

Fig. 1. A schematic diagram demonstrating the flow of data within a food supply chain connected by distributed ledger technology

IoT and Tracking

- Internet of Things: “gives the opportunity for devices to communicate not only within close silos but across different networking types and creates a much more connected world.” Caroline Gorski, the head of IoT at Digital Catapult
  - Temperature control is critical to optimising shelf life and so reducing food waste
  - Data can be collected from devices via Wireless Sensor Networks, wired sensors, RFID, infra-red, data loggers etc.
  - Challenges: mobile coverage, costs, compatibility, legal, data sharing
Robotics

- Robotics appearing at all stages from field, to factory, to kitchen
- Robotic devices range from large scale to small
- Cost implications for business transformation
- Capital expenditure v. service models: new biz models = opportunities
- Robotics draws on other new tech: visualization, AI/ML, 3D printing…
The Role of Data Sharing?

- Industry 4.0: flexible multi-scale approach for food and drink
- Digitalisation: data, data science and cyber-security
- Linking to other data: satellite/weather, crop, health, economic
- Agri-food tech also linked to other globally important challenges such as land and water use, climate change, and health and well-being
Food is digitising...
To keep in touch....
please join.......
Smarten up Your Factory

Modules for the Smart Food Factory

Mathew Simpson – CSB-System
The Smart Food Factory is already developing step by step and progress is accelerating.

Entire supply chain is being connected – from consumer to pick and place robot

Sensor technology, image recognition and connectivity via the IIoT driving further automation

Automation brings greater efficiency, improved hygiene and more consistency

Digitalisation can secure your competitive advantage
In the Smart Food Factory, information will flow up and down the supply chain much faster.

- Orders placed by smartphone can be directly received into the retailer or manufacturer’s ERP system
- Production demand can be generated before retailer stock is even consumed

- Production lines can be controlled by the ERP software and machines can report their own service needs
- Finished products can be automatically booked and entered into the ERP system

In the Smart Food Factory double work is eliminated and supply is more accurately matched to demand
The technologies already exist to build your Smart Food Factory today…

- EDI for sales orders entry to significantly reduce manual entry and keying errors.
- Connect your scales to your ERP system. Directly confirm and record weights to the system via interfaced scales.
- Invest in vision systems to check seals or distinguish between good and bad products.
- Integrate your planning system. Planning is half the battle. Wastage, errors and stress are reduce with better planning.
- Install automatic temperature loggers and capture the data directly.
The nervous system of the Smart Food Factory is the ERP system. It connects the shop floor & the top floor and manages transactions between consumer and producer.
Biggest Obstacles to Digitisation:

- 3.07 Legal uncertainty
- 3.22 Missing norms and standards
- 3.24 Insufficient IT security
- 3.36 Missing digital infrastructure (broadband expansion)
- 3.41 Missing contacts to digital service providers (suppliers)
- 3.59 Missing knowledge about the purchasing behavior of consumers
- 3.64 Capital / other resources
- 3.77 Interfaces to customers and suppliers
- 4.02 Missing knowledge of the technical possibilities
- 4.10 Missing competences of your employees

So what’s stopping you?

(CSB Digitisation Survey, 2018)
A real smart food factory: EDEKA Südwest Fleisch in Rheinstetten is the largest and most advanced meat processing plant of Germany’s biggest supermarket group.

- Start of operations: July 2011
- Turnover: 635 million €
- Annual tonnage: 125,000 tons
- Customer base: approx. 1300
- Sales items: approx. 2500
- Employees: approx. 800
EDEKA relies on food specialist ERP software for planning, controlling and optimizing all resources at the facility in Rheinstetten.

### Highlights of the solution

**Control centers**

Perfect interplay of ERP & MES: Two CSB control stations permanently monitor 800 individual processes.

**Grading**

Fully automatic no-contact & absolutely hygienic grading of pork sides in Receiving.

**Planning**

Best-practice cutting & production planning for more than 20 lines.

**Inventory**

Automated management & control of inventory technology, weigh labeling & picking.
ProMessa: same production space, same staff, double output – Smart Food Factory.

Sales volume
> 70 million €

>175 employees

> 400 sku’s

1,000 stores per day
6 days a week

Deventer
Netherlands
Automated buffer storage warehouses allow de-coupling of production and labelling.

Fully automated inventory:

- Small quantity items in traditional single storage position high-bay storage
- Fast moving products are stored at the fast mover warehouse / portal gantry warehouse
- Automatic stock removal towards 4 WPL lines
ProMesssa applies the label at the last minute and can deliver a single SKU to a single store.

- 4 WPL lines with connected goods-to-person picking sorters
- Production and storage are based on forecasts, without order reference
- Customer-specific labeling only during picking

**Advantages:**
- Optimized batch sizes in production
- Low logistics costs per unit
- Reduced storage quantities, reduced shortages
Digital Technologies for Better Food Processing

Mathew Simpson
mathew.simpson@csb.com
Tel. +44 (0)20 3151 0414

CSB-System AG
An Fürthenrode 9-15
52511 Geilenkirchen
Germany
Telephone: +49 2451 625-350
E-Mail: info@csb.com
www.csb.com
Digitalised Tools to Build a Resilient and Productive Food Supply Chain

John Titmuss
Director
Inflexion Point

Keston Williams
Technical Director
Barfoots Limited
Food & The Digital Supply Chain

• The connected supply chain

• An example of ‘digital’ in practice.

• Policy considerations
The Connected Supply Chain
An Example
Policy Considerations

- Knowledge
- Strategy Development
- Training & Tailored Support
- Funding
- Setting the environment

www.madesmarter.uk
www.gov.uk/government/collections/business-basics-programme
Barfoots global supply

**Peru**
Asparagus / Squash
Butternut / Legumes

**Spain**
Sweetcorn / Courgette / Legumes, TSB
Sweet Potatoes / Squash

**Senegal**
Sweetcorn / Courgette / Legumes
Squash / Sweet Potato / Chillies

**UK**
Sweetcorn / Courgette / Legumes, Asparagus / Squash / TSB / Chillies
Products

- Asparagus
- Baby Corn
- Beans
- Chillies & Chilli Plants
- Courgette
- Peas
- Rhubarb
- Squash & Pumpkins
- Sweetcorn
- Sweet Potatoes
- Tenderstem®

Prepared
### The Food and Drink Sector Council

#### Purpose
- To act as the Sector Council representing the farm-to-fork food chain in partnership with Government

#### Objective
- To improve the productivity and sustainability of the industry

#### Ways of working
- Providing a mechanism to develop industry-led solutions
- Strengthening partnerships between UK Government and industry
- Engaging relevant Government departments and organisations
7 Work Streams

- Innovation Working Group
- Agriculture Productivity
- Nutrition
- Workforce & Skills
- Logistics
- Packaging & Waste
- Exports (& Imports)
The Role of the Innovation Working Group

- Transformative innovation
- Joining Up the Value Chain within the Sector
- Cross Sector Council Opportunities

Exporting our expertise, technology and attracting inward investment
What we have done to date...

Transformative innovation across food supply chains to improve decision-making

National Geospatial Strategy

The Big Idea
Digitalised Technologies to Serve and Retain Consumers

David Sprent
Global Supply Chain Executive

Marc Jansen
Data Scientist
Gousto
Digital Technologies to Improve Productivity in Food Production

David Sprent
2nd April 2019
Supply Chain Challenges

- Greater Focus on Value Chain
- Fragmentation of customers and new channels
- Proliferation of Products
- Scrutinization of Supply
- Sustainability and reduction of waste
Supply Chain Design Criteria

- Customer Focused/Demand Driven
- Collaboration across the Value chain
- Development of Talent in “Digital”
- Greater use of Analytics and Information
- Balancing Local focus and Global scale
Digital Technology Opportunities

- Machine Learning capability to analyse customer data to define, design and operate a segmented supply chain

- Advanced analytics to understand and automate demand sensing for improved supply chain agility

- Use of Sensors(IoT) to collect data to optimise and automate processes(eg traceability, temperature, tracking)
gousto

Good food all round
Fueling family life through good food with zero waste

Simple model, zero food waste by design

- You pick your recipes from our menu
- We deliver a box of wholesome ingredients in exact proportions with step-by-step recipe cards
- No planning, no supermarkets, no waste

Leading proposition

- Most choice (40 recipes per week)
- Most delivery options
- From £2.98 per portion
Gousto has a unique AI position

Most choice (40+ recipes) +
Every customer sees their own, personalised menu
Shifting demand through personalisation

- >40% of recipes ordered on a weekly basis follow data-driven recommendations
Supercharging material flow with demand patterns

- Leveraging consistent customer order patterns helps streamline slotting and routing in our fulfilment centre
- Shorter paths mean higher throughput: +90% in 18 months through AI alone
Marc Jansen
Data Scientist
@marcchristiaan
gousto
Good food all round
Briefing Document

* Completed and distributed to all attendees in June. For questions or comments regarding the event or the briefing document please contact either of the coordinating organizations.

**Centre for SMART**
Wolfson School of Mechanical, Electrical & Manufacturing Engineering
Loughborough University
+44 (0)1509 22540
smart@lboro.ac.uk

**Internet of Food Things (IoFT) Network Plus**
University of Lincoln
Riseholme Park
Lincoln
+44 (0) 1522 882000
sbrewer@Lincoln.ac.uk