MINIMISING RISK IN THE SUPPLY CHAIN & OPTIMISING VISIBILITY TO ENSURE FOOD SAFETY, AUTHENTICITY AND TRACEABILITY

RISK IN THE FOOD SUPPLY CHAIN

Shared Concerns

- **Globally 1 in 10 people affected and >420,000 die from foodborne illness every year (WHO, 2015[1])**
- **Food fraud costs UK food industry £12bn *pa*[2]**
- **Food recalls increasing[3]**
- **Food recall processes inefficient[4]**
- **Learnings rarely shared[4]**

[1] WHO estimates of the global burden of foodborne diseases. December 2015 ttps://www.who.int/foodsafety/publications/foodborne_disease/fergreport/en/
[2] Crowe Clarke Whitehill 'Minimising Fraud and Maximising Value in the UK Food and Drink Sector'. May 2017 https://www.croweclarkwhitehill.co.uk/uk-fooddrink-companies-losing-12-billion-annually-fraud/
[3] RASFF Reports https://ec.europa.eu/food/safety/rasff/reports_publications_en
[4] FSA 'Review Of The Food Withdrawal And Recall System In The UK Food Retail Sector' (FSA Board report FSA17/09/13)

RISK IN THE FOOD SUPPLY CHAIN

Shared Challenges

- Increasing dependence on a global supply chain to source raw materials/partially processed product
- Increasing food trade volume/pace
- Complexity of trade borders/barriers
- Varying country food safety standards and capability
- Food chain operators >95% SME

IFST FOOD RISK MANAGEMENT SYSTEMS GROUP

- **To examine the current reality and future needs in food risk management**
- **To identify opportunities, potential solutions, gaps and potential barriers to developing and implementing 'fit for the future' approaches to food risk management**

KEY QUESTIONS

SCOPE

- Integrity/Authenticity
- Food/Feed Safety
- Quality*

* Understanding that what is a quality issue to one stakeholder may be a food safety issue elsewhere in the supply chain

- **How can food industry best leverage existing and new technological opportunities for improved information and data handling and analysis?**
- **How can the flow of critical information from stakeholder to stakeholder be improved, both up and down the supply chain?**
- **Can we identify common principles / specifications to facilitate consistent application given the increase/divergence in technological solutions?**

FOOD SUPPLY CHAIN INFORMATION

Food Safety
Food safety management systems, Safe product design

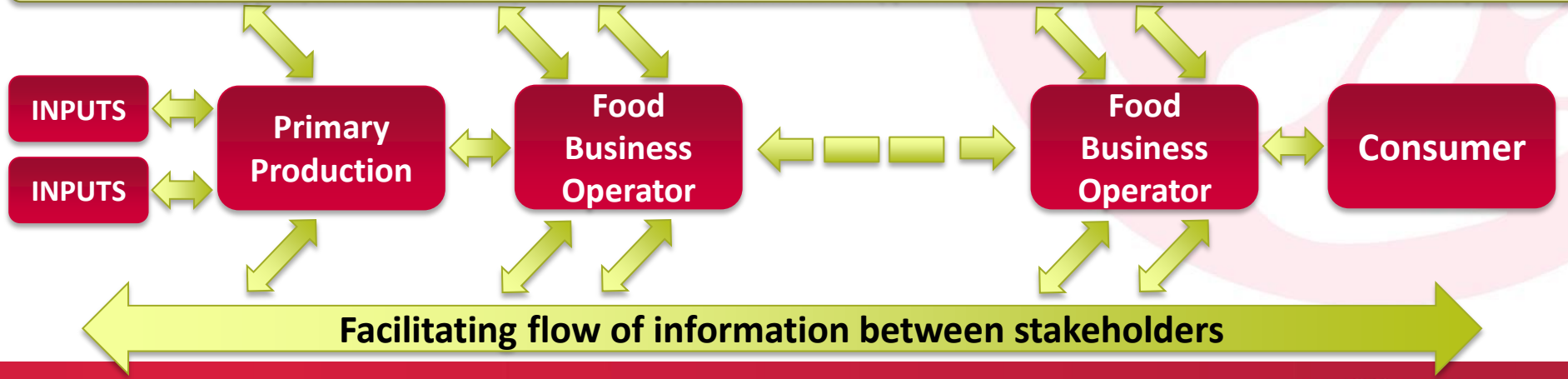
Compliance
Composition, Label, Claims, Source/Site/Batch certification

Supply
Availability, Price, Approved suppliers

Operations
Capacity, Capability, Audit/Certification status

Markets
Demands, Trends, Regulatory requirements

Traceability
Name of supplier/business customer, Affected batch/lot identification (quantity, location, status), Date of transaction/delivery



FOOD RISK MANAGEMENT SYSTEMS

Challenges

- Complexity of supply chain
- Degradation of trust
- Increased regulatory intervention
- Skills in risk analysis
- Inaccuracy of information
- Poor/slow responsiveness
- Lack of technological capability
- Accessibility restricted
- Risk appetite/uncertainty
- Cost
- Misinterpretation or misuse of data

Advantages

- Consumer benefits
- Build trust
- Facilitate meeting legal obligations
- Foster best practice
- Efficiencies (speed, frictionless borders, waste)
- Avoid business disruptions
- Freedom to operate
- Earned recognition
- Accessible

FOOD RISK MANAGEMENT SYSTEM

General Principles

- Global - common best practice standard
- Accessible - to all food chain players, incl. micro & SME's
- Confidential and Secure
- Permits (open) flow of information
- Relevant to food chain needs/data formats
- Real-time batch/lot location in food chain – quantity, location, status
- Consumer visibility of information
- Build food safety culture

FOOD RISK MANAGEMENT SYSTEM

Technological Principles

- Interoperability across technologies
- Up and down the supply chain
- Security levels of disclosure (different actors)
- Open standard
- Immutable
- Affordable
- Independently verifiable

TECHNOLOGICAL DEVELOPMENTS

- Distributed ledger technology (Blockchain)
- Digital twin/simulation
- Secure cloud
- Smart contracts (payment on evidence of compliance)
- Internet of Things
- Big data analysis/modelling
- Smart manufacturing
- Tagging and tracking, holographic labels
- Sensors - temperature, modified atmosphere, fumigants
- In-line monitoring
- Handheld devices (“lab-on-a-chip”)
- Whole genome sequencing and DNA speciation / Stable isotope

OPPORTUNITIES

- **Upgraded data access capability**
  - **‘Full’ sight to source (traceability, supply mapping) with ‘live’ tracking (status, location)**
  - **Rapid access to compliance evidence and supply vs. demand status (incl. data held elsewhere)**
  - **Controlled, permissioned and secure data access**
  - **Options to independently formally verify data – frictionless borders, site/batch monitoring and approval**

- **Enhanced ‘sight’ to improve decision making**
  - **Operations planning and resource utilisation (water, energy, materials, transport, waste reduction and/or revalorisation)**
  - **Logistics, delivery acceptance and border crossings**
  - **Hold/release and Withdrawal/recall**

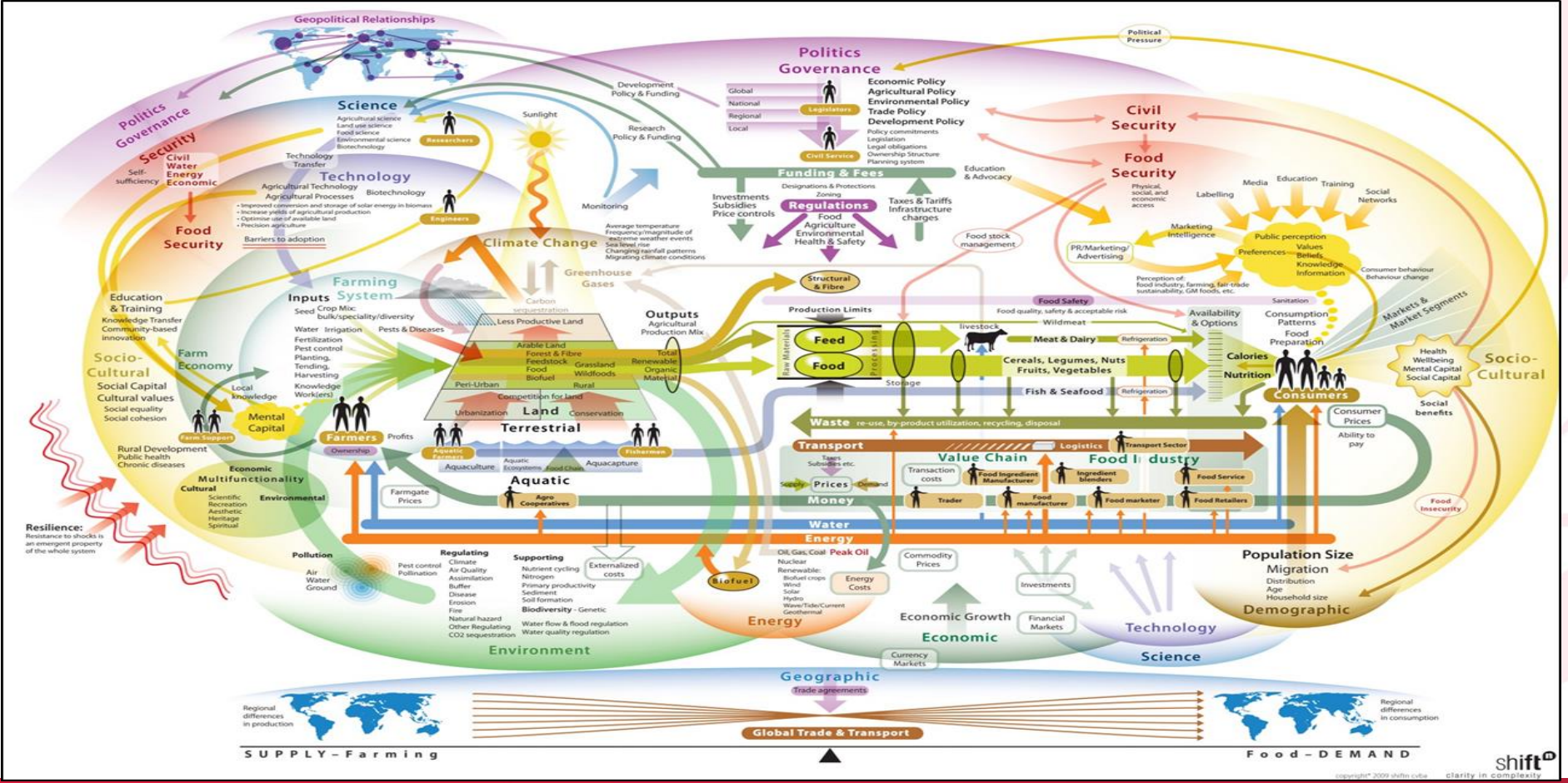
WATCH-OUTS / RISKS

Create Illusion of Control…
Where SME foundations of supply chain remain invisible / outside risk management system

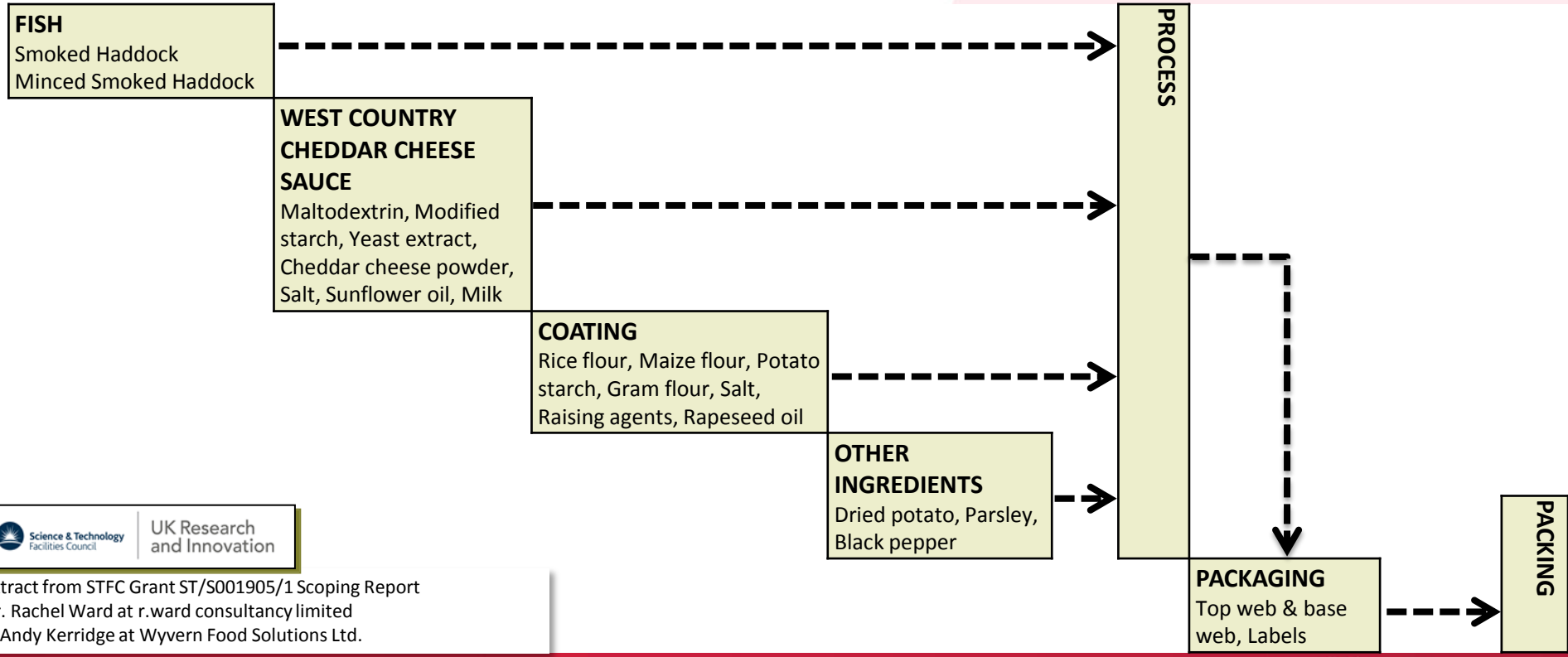
- **Value Proposition Unclear**
  - **Lack of understanding of technology capabilities**
  - **Potential to overlook low technology solutions**
  - **Cost/Benefit - Who pays? Need now or in future?**

- **Sufficient Adoption vs. Impact**
  - **Resistance to change**
  - **Trust issues - Security; Data sharing**
  - **Connectivity issues - Bandwidth availability esp. for remote/rural users**
  - **Barrier to market - For smaller operators**

IS FULL SUPPLY CHAIN VISIBILITY POSSIBLE FOR ALL PRODUCTS?


Geopolitical Relationships
Politics
Governance
Security
Civil
Water
Energy
Economic
Self-sufficiency
Food Security
Science
Agricultural science
Land use science
Food science
Environmental science
Biotechnology
Researchers
Technology Transfer
Technology
Agricultural Technology
Agricultural Processes
Biotechnology
Improved conversion and storage of solar energy in biomass
Increase yields of agricultural production
Optimise use of available land
Precision agriculture
Barriers to adoption
Engineers
Sunlight
Development Policy & Funding
Research Policy & Funding
Monitoring
Climate Change
Average temperature
Frequency/magnitude of extreme weather events
Sea level rise
Changing rainfall patterns
Migrating climate conditions
Greenhouse Gases
Carbon sequestration
Farming
Inputs
System
Seed
Crop Mix: bulk/speciality/diversity
Water
Irrigation
Pests & Diseases
Fertilization
Pest control
Planting, Tending, Harvesting
Knowledge Workers)
Education & Training
Knowledge Transfer
Community-based innovation
Socio-Cultural
Social Capital
Cultural values
Social equality
Social cohesion
Farm Economy
Local knowledge
Mental Capital
Farm Support
Farmers
Ownership
Profits
Rural Development
Public health
Chronic diseases
Economic
Multifunctionality
Cultural
Scientific
Recreation
Aesthetic
Heritage
Spiritual
Environmental
Resilience:
Resistance to shocks is an emergent property of the whole system
Less Productive Land
Arable Land
Forest & Fibre
Feedstock
Food
Biofuel
Grassland
Wildfoods
Peri-Urban
Rural
Competition for land
Urbanization
Land
Conservation
Terrestrial
Total Renewable Organic Material
Outputs
Agricultural Production Mix
Aquatic Farmers
Fishermen
Aquaculture
Aquatic Ecosystems
Food Chain
Aquacapture
Aquatic
Agro Cooperatives
Farmgate Prices
Pollution
Air
Water
Ground
Pest control
Pollination
Regulating
Climate
Air Quality
Assimilation
Buffer
Disease
Erosion
Fire
Natural hazard
Other Regulating
CO2 sequestration
Supporting
Nutrient cycling
Nitrogen
Primary productivity
Sediment
Soil formation
Biodiversity - Genetic
Water flow & flood regulation
Water quality regulation
Externalized costs
Environment
Politics
Governance
Global
National
Regional
Local
Legislators
Civil Service
Economic Policy
Agricultural Policy
Environmental Policy
Trade Policy
Development Policy
Policy commitments
Legislation
Legal obligations
Ownership Structure
Planning system
Funding & Fees
Investments
Subsidies
Price controls
Regulations
Food
Agriculture
Environmental
Health & Safety
Designations & Protections
Zoning
Taxes & Tariffs
Infrastructure charges
Education & Advocacy
Food stock management
Structural & Fibre
Production Limits
Raw Materials
Processing
Feed
Food
Storage
livestock
Wildmeat
Meat & Dairy
Refrigeration
Cereals, Legumes, Nuts
Fruits, Vegetables
Fish & Seafood
Refrigeration
Food Safety
Food quality, safety & acceptable risk
Availability & Options
Calories
Nutrition
Sanitation
Consumption Patterns
Food Preparation
Consumers
Waste re-use, by-product utilization, recycling, disposal
Transport
Logistics
Transport Sector
Value Chain
Food Industry
Transaction costs
Food Ingredient Manufacturer
Ingredient blenders
Food Service
Trader
Food manufacturer
Food marketer
Food Retailers
Taxes
Subsidies etc.
Supply
Prices
Demand
Money
Water
Energy
Oil, Gas, Coal Peak Oil
Nuclear
Renewable:
Biofuel crops
Wind
Solar
Hydro
Wave/Tide/Current
Geothermal
Biofuel
Energy Costs
Commodity Prices
Investments
Financial Markets
Currency Markets
Economic Growth
Economic
Technology
Science
Energy
Political Pressure
Civil Security
Food Security
Physical, social, and economic access
Labelling
Media
Education
Training
Social Networks
Marketing Intelligence
PR/Marketing/ Advertising
Public perception
Preferences
Values
Beliefs
Knowledge
Information
Consumer behaviour Behaviour change
Perception of: food industry, farming, fair-trade sustainability, GM foods, etc.
Markets & Market Segments
Consumption Patterns
Food Preparation
Health
Wellbeing
Mental Capital
Social Capital
Socio-Cultural
Social benefits
Consumer Prices
Ability to pay
Food Insecurity
Population Size
Migration
Distribution
Age
Household size
Demographic
Geographic
Trade agreements
Regional differences in production
Global Trade & Transport
Regional differences in consumption
SUPPLY – Farming
Food – DEMAND
shift
clarity in complexity

GLUTEN FREE SMOKED HADDOCK FISHCAKE WITH WEST COUNTRY CHEDDAR CHEESE SAUCE



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Extract from STFC Grant ST/S001905/1 Scoping Report
Dr. Rachel Ward at r.ward consultancy limited
& Andy Kerridge at Wyvern Food Solutions Ltd.

EXAMPLES ASSOCIATED DATA/EVIDENCE

FISH	CHEDDAR CHEESE SAUCE	COATING	OTHER INGREDIENTS	PROCESS	PACKAGING	FINISHED PRODUCT
Supplier certification	Supplier certification	Supplier certification	Supplier certification	Site certification	Supplier certification	Ingredient declaration
Source – Geography	Recipe - % cheese	Bulk ingredients	Traceability	Temperatures	Food contact/migration	Gluten free claim
Haddock – Species	Source, traceability	Gluten free claim	Purity / Authenticity	Process time	Right label	Visual
Traceability esp. minced fish	Substitution / Dilution	Substitution / Dilution	Origin	Cooking	Sealed	Taste
Sustainability status (MSC certification)	Fat content	Traceability	Contaminants e.g. mycotoxins, pesticides	Cleaning	Gluten cross-contamination – shared line/equipment	Shelf life
Time from catch to smoking?	Veterinary residues	Contaminants e.g. mycotoxins, pesticides	Microbiology esp. Salmonella	Gluten cross-contamination – shared line/equipment		Microbiology
Contaminants e.g. heavy metals, dioxins, PAHs	Microbiology	Microbiology esp. Salmonella	Size of herb flakes	Recipe		Effect of freezing

EXAMPLES INTERESTED PARTIES

FISH	CHEDDAR CHEESE SAUCE	COATING	OTHER INGREDIENTS	PROCESS	PACKAGING	FINISHED PRODUCT
Fishermen	Growers	Farmers	Growers	Equip. manufacturers	Manufacturers	Consumers
Vets	Agents	Agents	Driers	Laboratories	Laboratories	Retailers
Fish smokers	Brokers	Brokers	Processors	Laboratory supplies	Laboratory supplies	Wholesalers
Fish processors	Co-operatives	Co-operatives	Manufacturers	Lab. equipment	Lab. equipment	Foodservice
Laboratories	Wholesalers	Wholesalers	Agents	Trade Associations[1]	Transport	Distributors
Analytical equipment	Transport	Coating suppliers	Brokers	Certification Bodies[2]	Storage	Transport
Temp. monitoring equipment	Storage	Oil refiners	Wholesalers		Trade Associations[1]	Storage
Refrigeration engineers	Trade Associations[1]	Transport	Transport		Certification Bodies[2]	Temp. monitoring equipment
Transport (fish)	Certification Bodies[2]	Storage	Storage			Trade Associations[1]
Trade Associations		Trade Associations[1]	Trade Associations[1]			Certification Bodies[2]
Certification Bodies		Certification Bodies[2]	Certification Bodies[2]			FSA
Ports/Customs						
DEFRA & FSA						

[1] Trade associations exist representing the interests of each actor in the food supply chain as well as the affiliated industries.
[2] Certification Bodies certify primary producers, manufacturers, transport/distribution/storage organisations, calibration organisations and analytical testing laboratories.

IS FULL SUPPLY CHAIN VISIBILITY POSSIBLE FOR ALL PRODUCTS?

- **In principle – Yes**
- **In reality requires:**
  - **Cooperation across interested parties and stakeholders**
  - **Secure permissioned systems**
  - **Interoperable technology**

IMPLEMENTATION

- **Technology to improve food risk management systems is available now**
- **Effective implementation needs:**
  - **Collaboration - Multisector, multidisciplinary**
  - **Coordination - To ensure interoperability, harmonization, standardization**
  - **Development - Methods for validation, review and scrutiny; Data standards**
  - **Support for Adoption - Tools; SME accessibility**
  - **Independent Governance - To support transparency and trust**

IFST FOOD RISK MANAGEMENT SYSTEMS GROUP

IFST Role

- Independent charity with members from across the food sector.
- Can play a role in trusted governance, as well as provide 'guiding' insights and recommendations

Next Steps

- Prepare and publish peer-reviewed articles to build upon thinking and provide recommendations
- Any IFST member is welcome to contribute
- Contact info@ifst.org

THANK YOU FOR YOUR ATTENTION!