Food safety assessment in the European and global context

Andreas Hensel
Challenges of globalisation

- Further growth of world population to 10.9 bn in 2100
- Changes in consumption behavior in developing countries and increase in purchasing power (China, India etc.)
- Competition of food and feed production with renewable resources and energy plants
- Development of supply, demand, and prices increase the trade in food of low quality and safety
- Systematic control of all commodities and science-based services at borders impossible
40 years in retrospect, 40 years ahead

World population / bn

World cereal production / bn t

World meat production / bn t

Source: FAOSTAT and TI
Animal products produced in different regions

**Milk**
- Europe: -16%
- North America: +47%
- South America: +150%
- Africa: +133%
- Asia: +277%
- Oceania: +100%

**Meat**
- Europe: +6%
- North America: +78%
- South America: +225%
- Africa: +129%
- Asia: +387%
- Oceania: +38%

**Fish and aquaculture**
- Europe: +15%
- North America: +40%
- South America: +124%
- Africa: +107%
- Asia: +232%
- Oceania: +330%

Source: FAOSTAT, TI
Globalization of food chains

Are we prepared for the global food chain network?
RASFF: Distribution of Galacto-Oligosaccharides (GOS)

Delivery from producer to importer/manufacturer of infant formulae

Onward sale to companies from ....

Sale of GOS / infant formulae to ....
Food chain management
Meeting the challenges of global food chains

A conceptual framework for supply chain collaboration:
Empirical evidence from the agri-food industry

Supply Chain Management 12(3):177-186 · May 2007
DOI: 10.1108/13598540710742491
Web Service: Food Chain-Lab

Visualisation and interactivity using web tools

(Currently planned project to monitor the spread of contaminations)
## Hazard and risk

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Risk</th>
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<tbody>
<tr>
<td>A negative health effect that is induced by a biological, chemical, or physical agent.</td>
<td>Describes the probability of health impairment by a certain amount / dose of a given substance.</td>
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Public Authorities

- Public agencies face similar problems all over the world.

- Solutions found elsewhere are often effective and acceptable in other countries.

- Interests of public authorities are not identical to the interests of food/feed enterprises.

- Interests of public authorities are not identical on national and global level.

- International networking benefits consumers in the home country.

- International networking benefits fair trade in the world.
Risk analysis framework

Risk management
Decisions of the executive

Risk assessment
Scientifically based

Risk communication
Interactive exchange of information and opinions concerning the risk

Application of Risk Analysis to Food Standards Issues, a Joint FAO/WHO Expert Consultation, Geneva, Switzerland, 13-17 March 1995

- 28.1.2002

- laying down the general principles and requirements of food law

- establishing the European Food Safety Authority

- laying down procedures in matters of food safety
Legal structures of agencies

- 130 public authorities to work on food safety
- Who does what in Europe?

www.bfr.bund.de/cm/364/eu-food-safety-almanac.pdf
Structure in the European Union

European Institutions in the field of food safety

European level
- European Commission (EC)
- Council of the European Union (CEU)
- European Parliament (EP)

Risk assessment
- European Food Safety Authority (EFSA)
- Food and Veterinary Office (FVO)

Risk management
- Comm. Ref. Laboratories (CRLs)

Analytics & diagnostics research

National level
- Parliaments, Ministries and Member State Authorities

Simplified depiction of the organisation structure
Present situation in Europe in food safety

- Member States have undertaken numerous reforms of their structures in order to bring their systems in line with the EU legislation.

- This has led to a network of public authorities and institutions linking the national and European levels.

- Smaller countries have difficulties in building up institutionally separate risk assessment units.

28 countries  28 different systems
## Risk Assessment Bodies

### Institutional separation of Risk Assessment and Risk Management

- Germany (BfR)
- France (ANSES)
- Denmark (DTU)
- Austria (AGES)
- Hungary (NÉBIH)
- Italy (ISS)
- Lithuania (NMVRVI)
- Poland (NIZP-PZH, PIWET)
- Slovakia (VÚP)

### Authorities responsible for Risk Assessment and Risk Management

- Belgium (FPS)
- Bulgaria (MZH)
- Cyprus (MOH)
- Czech Republic (MZE)
- Estonia (VTA)
- Finnland (Evira)
- Greece (EFET)
- Ireland (FSAI)
- Latvia (PVD)
- Luxemburg (OSQCA)
- Malta (MCCAA)
- Netherlands (VWA)
- Portugal (ASAE)
- Romania (ANSVSA)
- Spain (AESAN)
- Sweden (SLV)
- United Kingdom (FSA)
- Iceland (MAST)
Structure dependent on

- Population size (Malta: 0.4 m ≠ Germany: 81.8 m)
- Federal or centralised tradition of administration
- Scientific traditions
- Variety of institutions requesting risk assessments
- Actual necessities
Rights to protect by law

1. health
   - no harmful substances

2. freedom of choice
   - no wrongful information
   - no misleading information

3. health and freedom
   - basic needs in democratic societies

4. interdisciplinary approach
   - chemists, veterinarians, lawyers, journalists
How to protect the rights - how to influence the system

1. administrative law: the traditional way
   - setting up regulations (health and information standards)
   - controlling the standards on the market
   - taking forbidden food from the market

2. penal law
   - punishing breach of law

3. civil law:
   - The first responsibility lies with the businesses!
   - fair-trade problems
   - product liability problems
Encouraging self-regulatory mechanisms: the „new approach“

- norms and standards, **not** made by parliament or ministries, e. g. EN/ISO norms, Dt. Lebensmittelbuch, Stiftung Warentest

- associations, trade partners, enterprises become motivated by government and authorities to fulfil the requirements, e. g. QS in Germany

- strengthening competition

- risk communication and participation
Requirements for risk assessments

• starting point: the legal provision, the scientific question

• define the state of appropriate science

• scientifically sound (intramural scientists, external experts)

• wording: regarding scientific and legal terminology, understandable for the audiences

• harmonising risk assessments leads to harmonised risk management decisions
Risk management options

• no action needed
• legislation for some products
• ban of dangerous products
• withdrawal of a charge of a product
• (rapid) alert
• recommendation by the competent authority
• even raising awareness may reduce a risk remarkably
Safe food in an era of global trade?

Challenge: Dynamic Reality

Objective: Strategies to improve

✓ food safety

✓ communication of risks arising from food
Challenge: Dynamic Reality

• New technologies and new products (novel foods)
• New contaminants
• Product piracy and food fraud
• Packaging materials
• New substances, additives, technical aids (pesticides, veterinary drugs, flavourings etc.)
• Process contaminants (acrylamide, 3-MCPD, furan, glycidol fatty esters etc.)
• Higher standards in using alternative methods of animal experiments
Predictable Trends – Emerging Challenges

• Climate change, global warming
• Increasing world population
• Globalisation in production, trade, and consumption
• New markets
• Demographic trends
• New energy policies
Consequences of global trends

• New strategies for agricultural production
• New technologies (nanotechnology, genetic engineering)
• Traceability to fight fraud and product piracy
• Problems from recycling processes
• Increase of aquaculture production
• Active packaging
• Import controls
• Bioethanol production
• New feeding stuffs
Risk Assessment: What is needed

• New analytical strategies
• Global harmonisation of standards, methods, and data interpretation
• Global quality assurance and traceability systems
• Science-based approach
• Harmonisation of risk assessment procedures (assessment criteria, uniform terminology)
• Joint risk assessment
• Transparent and target group-oriented risk communication that integrates public’s risk perception
Professional risk assessment – a rational factor in consumer safety

• Less subjectivity - more objectivity

• Less undercover influence of stakeholders, more transparency

• Less prejudice, scientific and other

• Better reasons and arguments
  ➢ for interpreting existing law
    target groups: authorities, food business, law courts
  ➢ for changing / not changing existing law
    target groups: politicians, associations, parliament
Standards are influencing Food Safety/Security, Food Fraud, and Freedom of Choice.
Challenge: Analytics

Challenge: Traceability
**Definition Traceability**

Codex Alimentarius: **Traceability / product tracing:**

the **ability** to follow the movement of a food through specified stages of production, processing and distribution.

Regulation (EC) No 178/2002 §3 p 15

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**Traceability - Approaches**

- Labeling
- Documentation
- Database

**Verification with analytical methods**

**Traceability systems trace and track food packaging**
Authenticity of food

Motivation

<table>
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<tr>
<th>Food Quality</th>
<th>Food Fraud I(^1)</th>
<th>Gain: Economic</th>
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<tr>
<td>Food Safety</td>
<td>Food Fraud II</td>
<td>Harm: Public Health, Economic or Terror</td>
</tr>
<tr>
<td>Unintentional</td>
<td>Intentional</td>
<td></td>
</tr>
</tbody>
</table>

\(^1\) Includes economically motivated adulteration and food counterfeiting

J Spink, DC Moyer; J Food Sci; 76(9): 157-163; 2011
Integrated traceability systems are being developed for the food industry that can verify:

- Geographical origin
- Production origin
- Species origin
Benefits of traceability

for the **consumer:**

- Food safety
- More targeted recalls
- Access to all food properties
- More informed choice when buying

for the **food industry:**

- Meet legislation and commercial requirements, including certification
- Labour and cost reduction, rationalisation, better control
- Satisfy needs of buyers and consumers
- Competitive advantage

for the **authorities:**

- Effective control
- More targeted recalls
Stable Isotope Ratios: Origin of Pistachios

Heier, 2006, PhD thesis
Blending of Olive Oil

Detection of blending with hazelnut oil

Discriminant Analysis

\[ ^1H-NMR \text{ measurements} \]

Hazelnut oil

Olive oil

Sunflower oil
Example: Determination of melamine

- Investigation of different milk powders (bought in 2008)
- Analysis using $^1$H-NMR (400 MHz)
- Identification of melamine via exogenous signal at 5.93 ppm ($\text{NH}_2$ groups)

![Diagram showing lactose, melamine, and other compounds with chemical shifts]

Non-targeted analysis
Thank you for your attention

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