Fraunhofer Food Chain Management Alliance

The Food Security Challenge – Contribution of Modern Food Chain Management to Food Security

Dr. Mark Bücking
Fraunhofer IME

Schmallenberg / Berlin 2012

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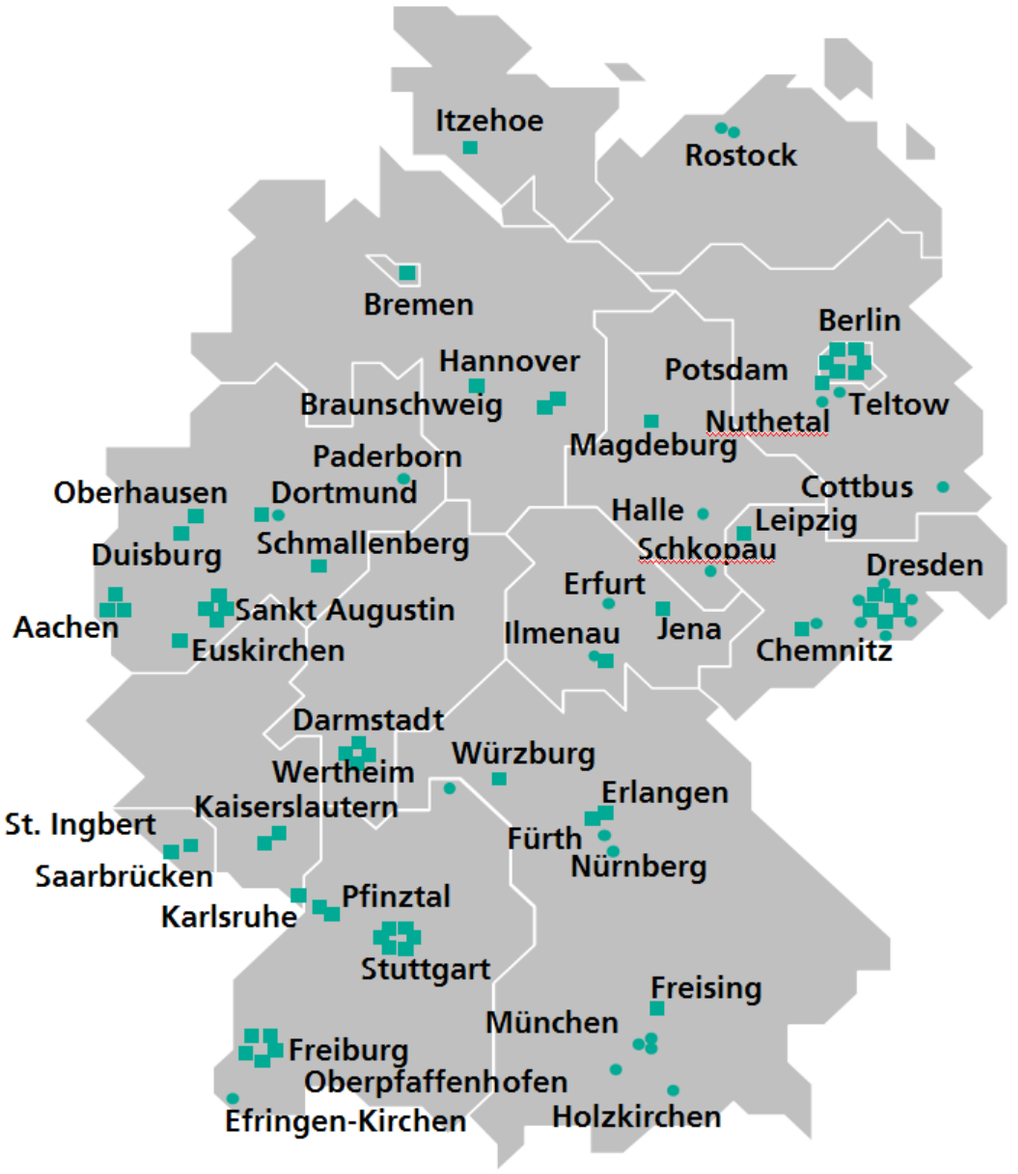
Fraunhofer-Gesellschaft Overview

- The Fraunhofer-Gesellschaft is Europe's leading organization for applied research.
- It operates application-oriented research for enterprises and to the advance of society
- 60 Institutes
  - organized in 7 Groups
  - within 19 Alliances
- 20 000 Employees
- 40 different locations in Germany
- International collaboration through representative offices in Europe, the US, Asia and the Middle East



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Fraunhofer-Gesellschaft Financing

Annual Research Volume

- appr. 1.8 bn Euro

thereof

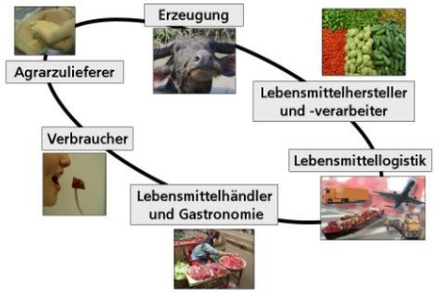
- appr. 1,4 bn Euro Contract Research

generated

- appr. two thirds profit from
  - projects in cooperation with industry and
  - public financed research projects
- appr. one third from the German government and the federal states for prospective research
- Cooperation with industry
  - Direct contract research
  - Joint research within public funding programs (e.g. EU, BMBF)
  - Fraunhofer spin outs (e.g. Concentrix)
  - Technology licensing (e.g. MP3)

Fraunhofer IME Applied Ecology: Business Fields

- plant protection
- product and chemical safety
- soil- and water protection
- environmental monitoring
- **food and feed safety**



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Fraunhofer IME – food & feed safety

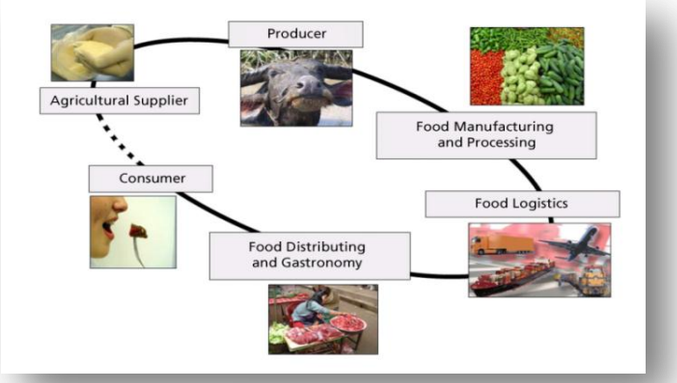
- Complex reference analysis

e.g. flavour, chemical contaminants / residues and their metabolites

- Bioanalytical research incl. L3 facilities

e.g. animal species differentiation / behavior of Prion proteins

- Fast detection methods
  - microorganisms
  - online detection of volatiles → Gas Sensors / Electronic Nose



- Food Chain Management

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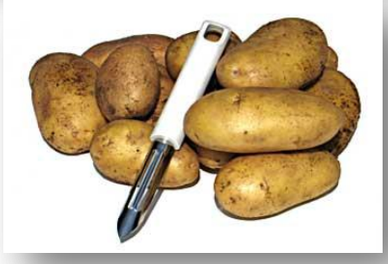
- Transgenic and non-transgenic approaches

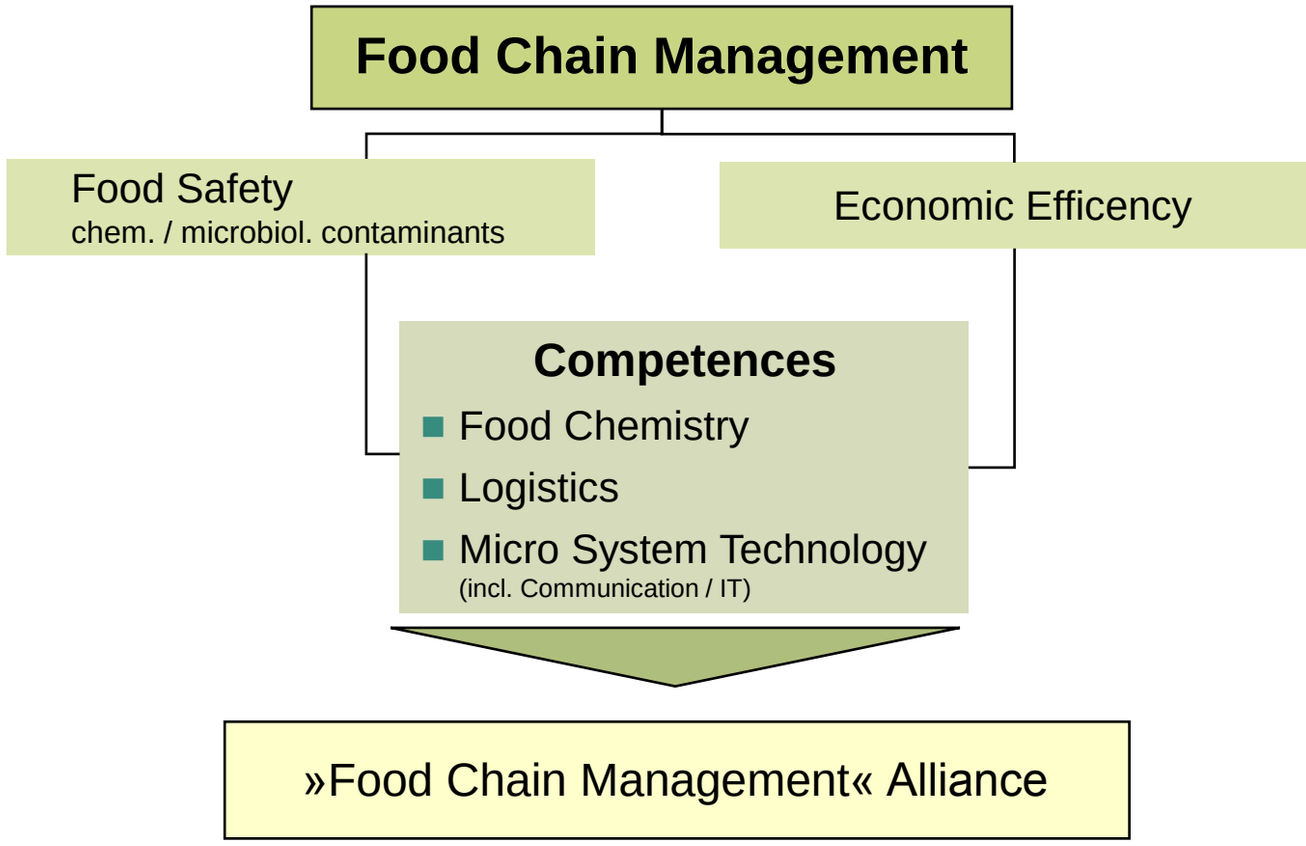
e.g. novel nutraceuticals / improved pathogen resistence



Fraunhofer Food Chain Management Alliance 10 Institutes

Competencies

- High complexity through a variety of participants with their specific demands and requirements
- Derivation of challenges:



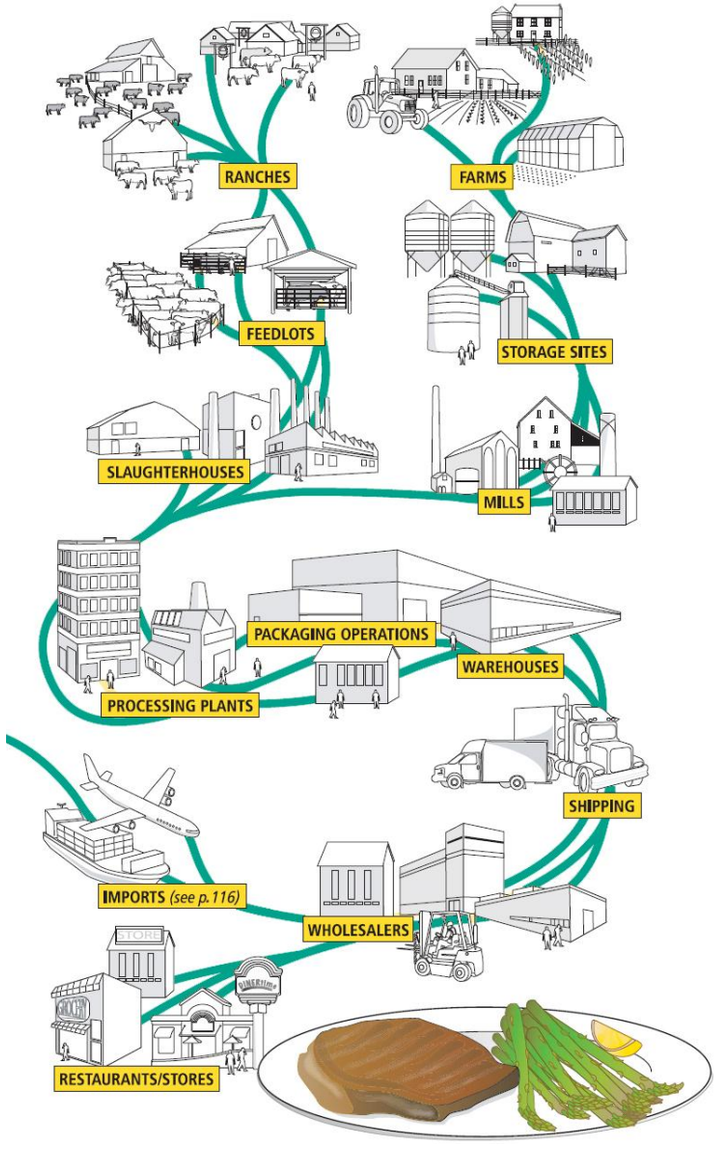
- Medium / Longtime Platform
- Introducing latest scientific know-how in new products and solutions of this field by means of mutual projects

➡ Input by general public **and** industry

Food Chain Management & Food Security

FCM: *…the resposibility for a secure, healthy and nutritious food must be shared by all involved parties (production, processing, retailer and consumer)…*

FS: *… Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life*



FAO: Food and Agriculture Organization

Preferences

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Same interest but still different Food Chains

http://www.time.com/time/photogallery/0,29307,1667690_1456259,00.html

http://www.time.com/time/photogallery/0,29307,1667690_1456207,00.html

Food Security Topics

Demand for food / starvation

Resource efficiency of land use / soils / water

Sustainable food production and supply

Overexploitation of fisheries

Stop the food waste

Improve the situation of farmers

No competition between energy and food

Promote investments and innovations

Adapted from I. Aigner / BMELV / Anuga 2011

Food Security Challenges

9 Billion people in 2050

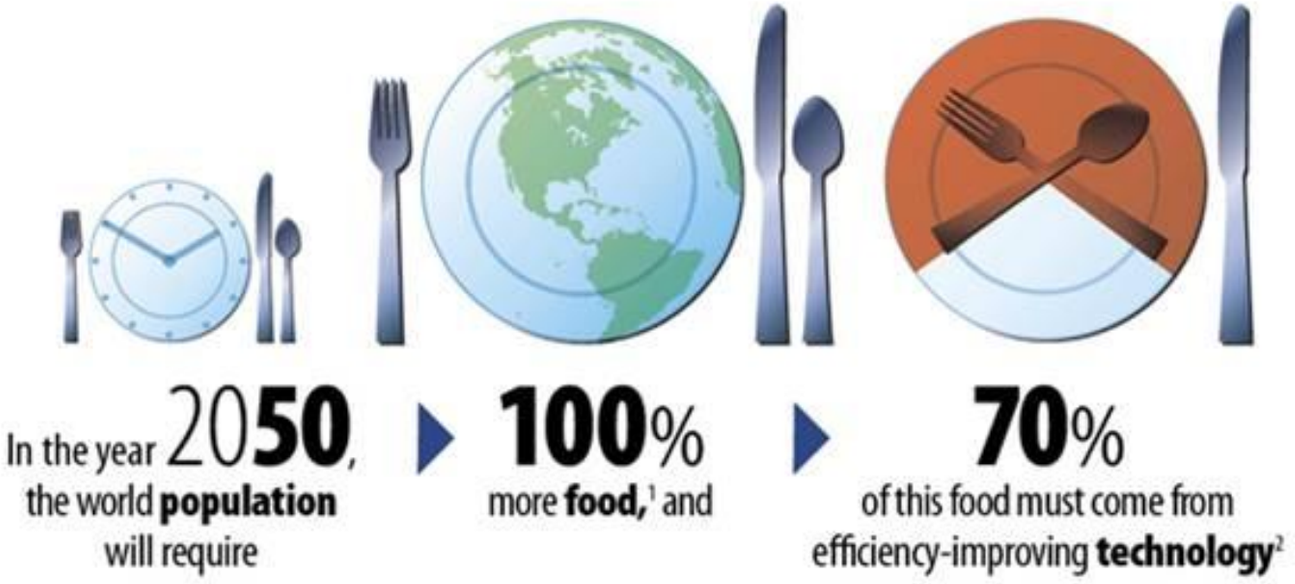
→ we will need much more food in 2050

(from 1960 to 2010 food production already increased by 300%)

→ high demand on high quality food

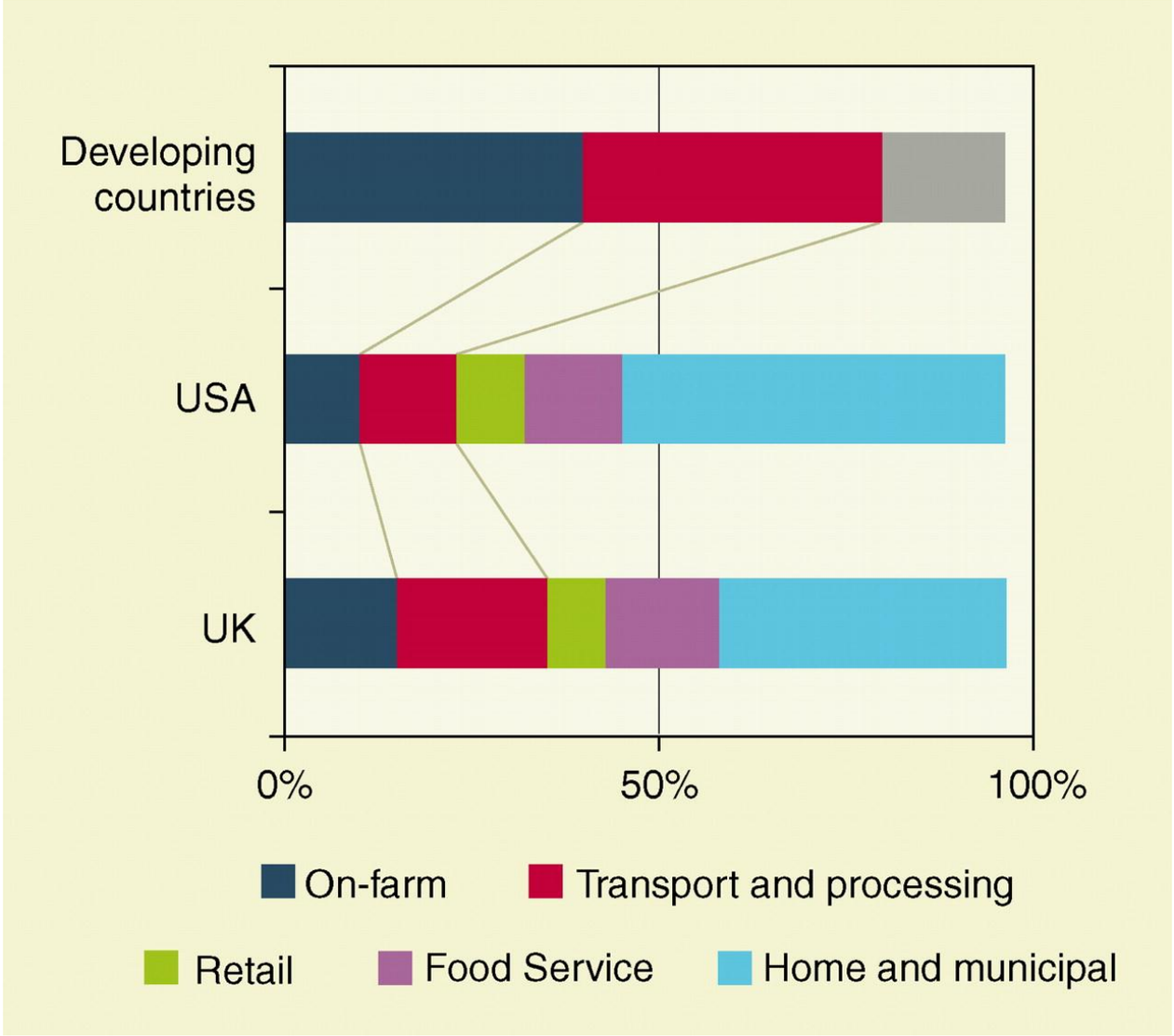
→ Climate change will decrease farmland and increase pests and diseases

→ Global and regional solutions have similar importance



Adapted from I. Aigner / BMELV / Anuga 2011
http://www.biotech-now.org/wp-content/uploads/2011/04/50-100-70-plates.jpg

Food Waste: Makeup of total food waste in developed and developing countries



From a global point of view: 30% of produced food ends as food waste

H C J Godfray et al. Science 2010;327:812-818

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Egypt fisheries: negative impact of climate change

The Nile Delta → rising level of the Mediterranean Sea

- this will lead to higher salinity and groundwater levels in agricultural lands.

- the salinity of the freshwater lakes in the north will also increase, and this will lead to:

  - the loss of areas of fertile agricultural land
  - the fall of plant and animal production
  - a change in the species and mix of fish, which is the primary source of non-animal protein in Egypt, and an important and inexpensive source of nutrition for the poor

Source: Egypt's National Strategy for Adaptation to Climate Change and Disaster Risk Reduction

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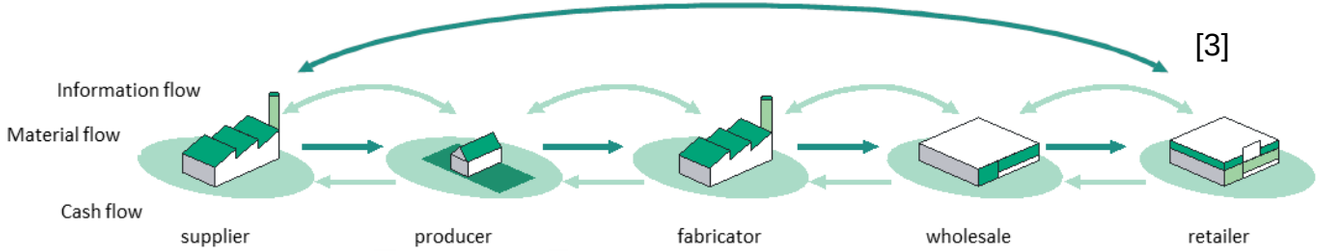
Competencies

- Food Science [1]
- Packaging Technology [2]
- Logistics [3]
- Radio Frequency Identification (RFID) [4]

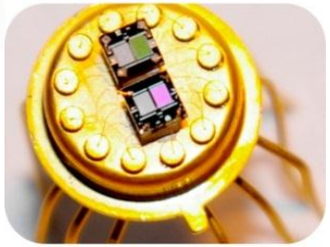
[3]

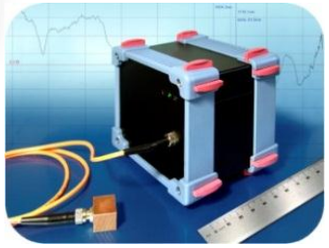


[2]

[4]

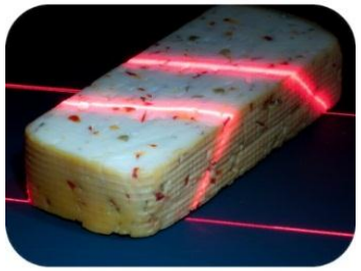
[1]





[9]

[6]



[5]

[8]

[7]

- Networks
- Optical Analysis [6; 9]
- Sensoric und Micro System Technology [1; 5; 7]
- Bio Chip Technology und Lab-On-Chip [8]
- Services

Examples:

[1] Gas Sensor - IME, IPM
[2] UV Filter in Package - IVV
[3] Transparency in Food Chains - SCS
[4] AutoID - IML
[5] Color Detector - EMFT
[6] 3D Sheet of Light Imaging - IIS
[7] Mobile Scanner FreshScan - IZM
[8] Bio Chip Detection Plattform - ISIT
[9] Miniaturized IR Spectrometer - IPMS

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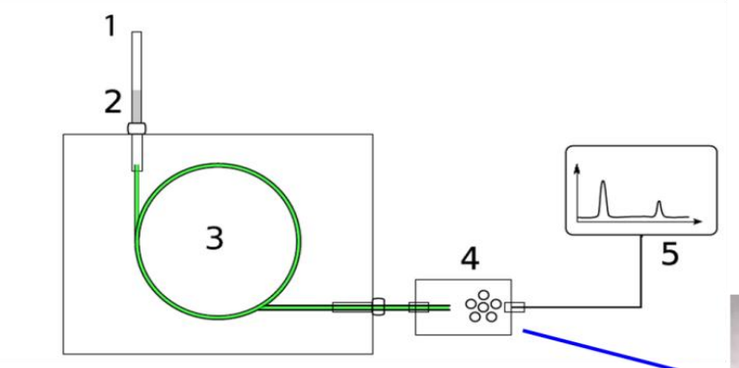
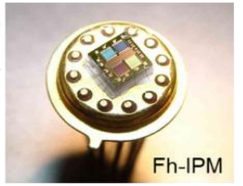
Quality measurement by a fast gas sensor detection – a cost effectively tool

Measurement system



Setup

1 Sampling
2 Drying agent
3 GC column
4 Gas sensor array
5 Data evaluation



Advantages

→ very sensitive
→ reproducible
→ selective
→ cheap
→ fast
→ easy handling
→ sensitive as GC/MS

(ca. < 1€ per measurement compared to Lab GC/MS measurement: 100 – 200€)

Required research

1 Starting Point → Detection of volatile compounds

→ Method: Headspace – Gas Chromatography – Mass spectrometry

→ Correlation between volatile measurements and food quality

2 Adaptation of Headspace Measurements towards the sensors

→ Measurements with 'Fraunhofer System' under Lab-conditions

3 Adaptation of 'Fraunhofer- System' towards the needs

→ e.g. Implementation of the system at the plantation / food processing

Quality measurements:
Alternatives / other possibilities

Biochip systems for the detection

→ of microorganism (fungi, bacteria, virus)

→ plant diseases

Kit Features

→ Cost-effective
→ Antibody-based detection system
→ Can be applied on-site
→ adaptable to different microorganism

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Competencies: Holistic Approach for Transparency in the Food Chain

Internal Fraunhofer project; 6 Institutes ; Volume 2,5 Mio €

Aims

- To show quality demands and necessary information for the whole value chain
- Development of technology platforms and the requirement profile for optimal controlling possibilities of the food chain
- Design of an user-friendly application system for the specific demands and for the regulation of required information
- Securing the traceability of food back to the manufacturer / origin

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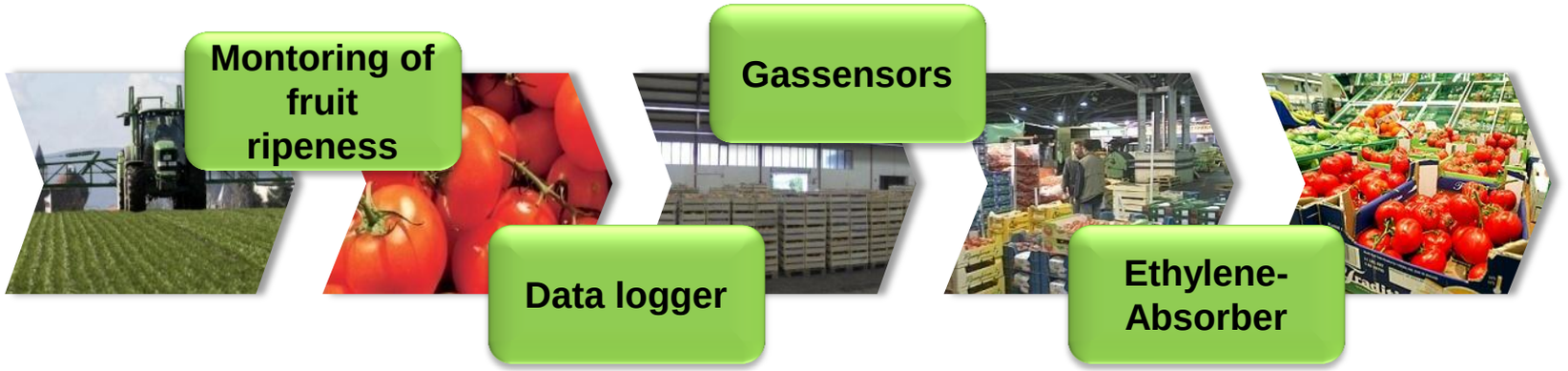
Fraunhofer Food Chain Management Alliance
Competencies: Holistic approach for the food chain

Process Chain Beef



Process Chain Tomato

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Conclusions

There are scientific and technological innovations in Food Chain Management and Food Security

They can give benefit to global and regional challenges

Interdisciplinary research is crucial

But some difficult decisions have to be made today

Scientific innovation needs support

“The goal is no longer simply to maximize productivity, but to optimize across a far more complex landscape of production, environmental, and social justice outcomes”

H C J Godfray et al. Science 2010;327:812-818

THANK YOU

Dr. Mark Bücking
Fraunhofer IME

Auf dem Aberg 1
57392 Schmallenberg-Grafschaft
Germany

Tel.: ++49 2972 / 302 304
Fax: ++49 2972 / 302 319
Mobile: ++49 172 825 77 33
Email: mark.buecking@ime.fraunhofer.de
http://www.ime.fraunhofer.de
http://www.foodresearch.de

Fraunhofer Food Chain Management Alliance
http://www.fcm.fraunhofer.de