Biomedical collaborations over National Research and Education Networks: success stories and best practices

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**The EU food and drink industry is:**

- The largest manufacturing sector in the EU (€ 1098 billion turnover and €102 billion)
- The leading employer in the EU (4,24 million people employed)

289,000 Companies

- Large companies 0,9%
- Micro-companies (0-9 Employers) 79,2%
- Small companies (10-19 Employers) 10,6%
- Small companies (20-49 Employers) 5,6%
- Medium-sized companies (50-249 Employers) 3,7%
- Large Companies 0,9%

Source: FoodDrinkEurope, 2018

**Why METROFOOD-RI?**

- Advanced analytical systems
- Digital revolution
- Large dataset management
- Food chain approach
- Large companies
- Micro-companies
- Small companies
- Medium-sized companies
- Large companies

Chemistry

Biology

Toxicology

Food technology

Biochemistry

Nutrition

Metrology

Environmental sciences

Agronomy

Agroecology

Environmental chemistry

Metrology

Food production & consumption

Innovation & control

Standardization & QA

Sustainability

Food & health

Primary production

Processing

Packaging

Storage and distribution

Retail

Preparation and domestic storage

Wastes

Final consumption

Metabolomics

Nutrigenomics

Food microbiology

Food technology
General objective: to enhance scientific excellence in the field of food quality & safety by promoting metrology in food and nutrition, allowing coordination on a European and increasingly on a Global scale.

**TIMELINE**
- **Roadmap Entry:** 2018
- **Design Phase:** 2015 - 2017
- **Preparation Phase:** 2018 - 2021
- **Implementation/Construction:** 2021 - 2024
- **Operation:** 2019-2043
Current Partnership

48 Partners from 18 Countries

- Research Institutes
- Universities
- National Metrology Institutes
- Institutes for Food Safety and Health Protection
- Laboratories for Food Analysis
- Private Companies
Positioning in the Landscape & Cooperations

Support from International Organisations

Cooperations at a Global level

Waste

Environmental Health
Biodiversity
Land Use
Climate Change
Pollution
Animal Welfare

Food Production
Farming
Processing
Transport
Retailer
Consumer

International Associations of Producers

Standarization Bodies

Nutrition, Health & Wellbeing
Healthy food culture
Environmentally-conscious society

e-Information Resources

Food Authenticity

Metrology

Eureqa

FOSFA

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FOSFA
Physical facilities: “METRO side”

Facilities for RM development & production

- customized RMs
- R&D activities (innovative RMs)

16 specialised distributed facilities

Analytical Labs.

chemical, physical, and (micro)biological analysis and testing (rheological, leaching, etc.) of foods and any other matrix of interest (e.g. environmental matrixes, packaging and FCMs)

Development of new devices, sensors and portable systems to check and evaluate food safety in situ (in field), during processing or retail, and at a domestic level (post-retail)

> 130 distributed facilities
Physical facilities: “FOOD side”

Field trials, greenhouses, grow chambers, experimental stables (controlled livestock production…) and experimental fisheries

Experimental Plants for food processing, packaging, storage and preparation

32 distributed experimental facilities

7 kitchen lab facilities

Food quality & safety studies along the value chain (post retail)

- Provision of **new data** on food (composition, contaminants, markers, etc.)
- Experimental studies for evaluating the **nutritional value** and **contaminant contents** of foods in relation to different influence parameters (geographic origin, technologies of production/process/storage/preparation)
- Experimental studies to evaluate **exposure through diet**
- Evaluation of **benefits and risks related to the application of new technologies** (i.e.: nanotechnologies) in food production and packaging
- Development of **best practices**
e-RI: Towards an integrated data platform

- find out the available information for standardizing and harmonizing food analyses
- collect, share, combine and use data on food contaminants, food markers, food composition, food production and processing
- disseminate information and training in the field of food quality, food safety, food traceability and authenticity, nutrition, and particularly metrology in food and nutrition
- collect information about the needs regarding metrology in food and nutrition.
Comprehensive approach to Food Quality & Safety

Collection of data on Food Quality and Safety in each step of the production chain

Geographic location
Environmental pollution
Soil quality
Farming Techniques

Raw materials and Additives
Technologies, Procedures
Water and Energy Sources

Materials and Technologies
Environmental condition

Food preparation and cooking
FCMs
Domestic Storage

Comparison between sites, technologies and environmental conditions
Evaluation of variables of influence

Improving **Nutritional** and Hygienic (**Safety**) Quality with a Holistic Approach

**Risk Assessment** all along the production chain

**HEALTH**
Architecture of METROFOOD e-RI

- Distributed architecture of data sources (nodes)
- Each node needs hardware and software
- Central platform offers services like data retrieval, data processing, e-learning and data exchange
- Nodes can be data source or tool providers.
**e-Needs and Quantification (ex.)**

**Storage**
- Size of datasets are estimated to be **2232.8 GB** in 5 years
- Clustering and sharding possible
- Total storage requirements are ≈ **35 TB**

**Computing**
- The distributed architecture requires computing resources at each data node

**Networking**
- 100 Mbit/s up-/download should be sufficient for most nodes
- Central platform 1000 Mbit/s

**Preservation of data**
- Each node: Regular backup of data in different places
- Possibility to have backup outside data owner: e.g. between owners, Metadata Directory, EUDAT, Zenodo (OpenAIRE and CERN)

**Collaboration/integration with other e-RI**
- Common data model (ontology) to exchange data
- APIs for communication
- Maybe caching, depends on the performance
- Data access and usage agreement is needed (terms and conditions)
- Will have influence on other E-Needs

**Usage of other e-RI**
- Networking like GEANT
- Computing and data like PRACE, EUDAT, GEANT etc.
- Tools and services
- Data sharing (Zenodo (OpenAIRE and CERN))

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**Component** | **Amount**
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Servers | 363
RAM | 11616 GB
Processors | 726
Number of cores | 5808

HPC/HTC  
ENEAGRID/CRESO  
- CRESCO3: ~ 16 TFlops  
- CRESCO4: ~100 TFlops  
- CRESCO5: ~ 25 TFlops
Collaborations with National Research and Education Networks

All the connectivity of the ENEA centers is ensured by the GARR. The same applies for the other Institutes of the Italian Node.

Collaborations with GARR are in place also in various research projects, working groups, etc.

Many services provided by GEANT are used, mostly through GARR and CESNET.
METROFOOD-RI - in full harmony with the RRI principles - will provide distributed services, acting on the real plan of measurement reliability and procedure harmonization and adopting the FAIR approach on data management.

NEW TOOLS TO OBTAIN RELIABLE MEASUREMENTS

MARKERS

ANALYSES

DATA SHARING & INTEGRATION

KNOWLEDGE SHARING & COMMUNICATION

EDUCATION & TRAINING

NEW TOOLS TO OBTAIN RELIABLE MEASUREMENTS
Services from METROFOOD-RI

By specific service
(e.g. RM development; PT management)

By technique (e.g. NMR; MS)

By specific application
(e.g. mycotoxin analysis, isotope analysis, NP characterisation, SCC)

By food chain (dataBases, thesauri, best practices, etc.; e.g. cereals and cereal-based products; milk and dairy products; etc.)
**METROFOOD-RI Potential Users & Access**

**User registration system**

- **welcome desk and customer (user) center** supporting users for service request, orientation to the most appropriate service(s), instructions for access, etc.; dedicated interfaces

**Different interfaces for the different user categories**

- **Physical**
- **Remote**
- **Virtual**

**Physical**

- Market-driven access

**Remote**

- Wide access

**Virtual**

- Responsible Research Society

**Stakeholder Forum**

- Eurachem
- EMPHASIS
- EuroFIR
- MoniQA
- OLEUM
- SAFE Consortium
- NMKL - NordVal Int.
- ICAR
- SPESEIE
- LifeWatch
- FNH-RI

**EU Level**

- Accredia (IT)
- CRUI (IT)
- SISSG (IT)
- Cluster Agrifood (IT)
- ASSITOL (IT)
- Federbrio (IT)
- Federconsumatori (IT)
- TFPI-SP/FIAB (ES)

**National Level**

- ELIKA (ES)
- ACTIA (FR)
- BFR (GE)
- EFOSZ (HU)
- OPM (MK)
- FVA (MK)
- MAP (MK)
- NVWA (NL)
- OdN (PT)
- OIKOS (PT)
- USAMV-FB (RO)
- TPF4L-RO (RO)
- INFOCONS (RO)
- SKM (SI)
Outputs & Impacts

Promotion of excellence & interoperability

- **Increase of the reliability** of quality agrifood products on the markets
- **Reduction of the vulnerability** of the production chain to frauds and tampering
- **Building competitiveness on objective bases**
- Promotion of **food defence**
- Strengthen of **internationalization**
- Development of **new products**
- Implementation of **new technologies**
- Development of innovative **integrated collaborative traceability systems**
- Enforcement of **consumers’ trust**
- Allowing **more conscious and reliable choices**
- **Best practices** all along the food chain
- **Food waste reduction**

Comprehensive approach to Food Quality & Safety

- Improvement of safety, healthiness and sustainability of productions

Towards convergent objectives...

Food security

Innovation

Sustainability

Competiveness of the Agri-food System

Alignment of research & innovation with the values, needs and expectations of the whole Society
Thank you for your attention!

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