



METROFOOD-RI: una rete di tecnologie innovative per il controllo di qualità nella filiera agroalimentare

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*Fast and fluo:
high processing flow cytometry techniques
for green biotech, the environment and the food chain*

15•04•2019 – Roma



METROFOOD

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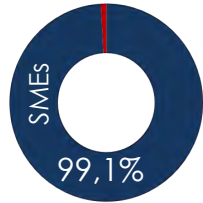
METROFOOD-RI “*Infrastructure for Promoting Metrology in Food and Nutrition*” (www.metrofood.eu) è un’Infrastruttura di Ricerca pan-Europea ([Roadmap ESFRI 2018](#) - dominio “Health and Food”) finalizzata a migliorare la qualità e l’affidabilità delle misure e rendere disponibili e condividere dati, informazioni e strumenti metrologici, al fine di promuovere l’eccellenza scientifica nel campo della qualità, sicurezza e rintracciabilità degli alimenti, favorendo la cooperazione e l’integrazione, consentendo un coordinamento su scala europea ed aprendo scenari anche su scala globale. Con un consorzio di 48 Istituti di 18 Paesi coordinato da ENEA (Italia, Belgio, Svizzera, Repubblica Ceca, Germania, Spagna, Finlandia, Francia, Grecia, Ungheria, Moldavia, Macedonia del Nord, Olanda, Norvegia, Portogallo, Romania, Slovenia, Turchia), METROFOOD-RI combina un’infrastruttura fisica ed un’infrastruttura elettronica. L’infrastruttura fisica è costituita da una rete di laboratori analitici e impianti per la produzione di Materiali di Riferimento (area “Metro”) ed una rete di campi e fattorie sperimentali, impianti tecnologici per la produzione e la trasformazione dei prodotti alimentari e cucine laboratorio (area “Food”). L’infrastruttura elettronica è costituita da una piattaforma web per la condivisione e l’integrazione di dati e informazioni sui tools metrologici (Materiali di Riferimento, Metodi ufficiali di analisi, *Proficiency Testings*) e dati relativi alla composizione, qualità e sicurezza alimentare, *markers* di origine e di processo, etc. Integrando competenze multidisciplinari ed applicando un approccio olistico al settore agroalimentare, METROFOOD-RI affronta in maniera integrata l’intera filiera - dalla produzione primaria fino al consumo finale - ed offre servizi dedicati a diverse tipologie di utenti: ricercatori, *policy makers* ed agenzie di ispezione e controllo, *food business operators*, consumatori/cittadini. Oltre a consentire lo sviluppo della ricerca e l’avanzamento delle conoscenze nei diversi ambiti disciplinari connessi al Sistema Agroalimentare, METROFOOD-RI potrà determinare il miglioramento della produzione e l’espansione dei mercati, promuovendo l’innovazione di prodotto e di processo e favorendo la competitività e la sostenibilità.

The challenge for the Agrifood Sector

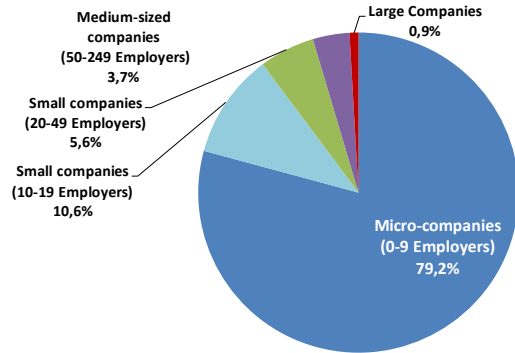
The EU food and drink industry is:

- The largest manufacturing sector in the EU (€ 1109 billion turnover and €110 billion of exports)
- The leading employer in the EU (4,57 million people employed)

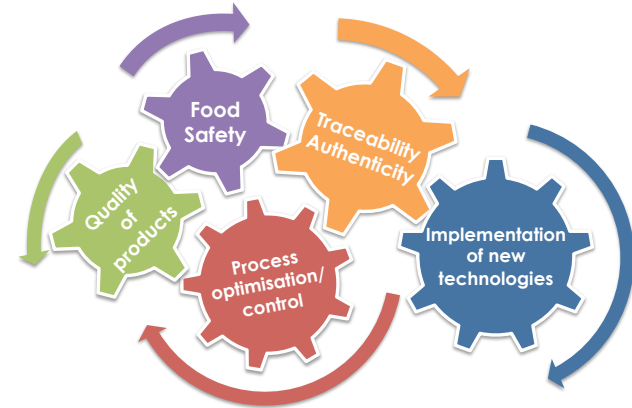
289.000 Companies



Large companies
0,9%



Source: FoodDrinkEurope, Oct.2018



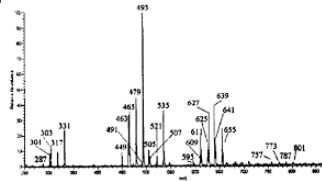
Digital revolution



Large dataset management



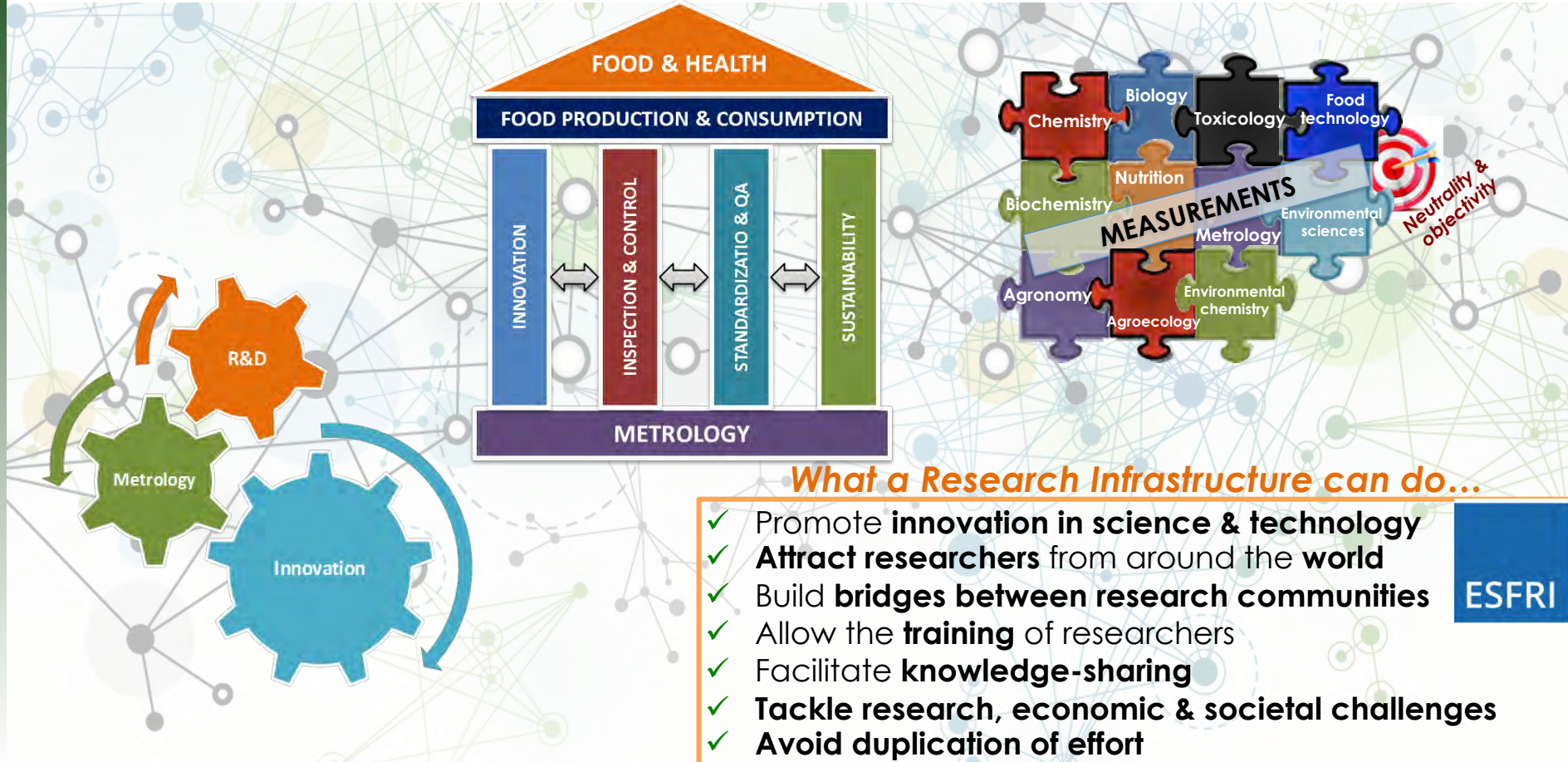
Advanced analytical systems



Food chain approach



Metrology & Food Quality&Safety



What a Research Infrastructure can do...

- ✓ Promote **innovation in science & technology**
- ✓ **Attract researchers** from around the world
- ✓ Build **bridges between research communities**
- ✓ Allow the **training** of researchers
- ✓ Facilitate **knowledge-sharing**
- ✓ **Tackle research, economic & societal challenges**
- ✓ **Avoid duplication of effort**

ESFRI

Domain Health & Food

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

MISSION

To enhance quality and reliability of measurement results

To make available and share data, information and metrological tools

To enhance scientific excellence in the field of food quality & safety

To strengthen scientific knowledge, promoting scientific cooperation and integration



METROFOOD-RI Preparatory Phase

organise the legal entity that will manage the future RI

technically organise the RI as service-oriented organisation

define the long-term activities (on a strategic basis) for the future RI

ERIC

- **physical access** - use of food processing facilities c/o IBA (RO) – addressed to Food Business Operators
- **remote access** - remote use of electron microscopy c/o the SCIENSANO facility (BE) – addressed to researchers
- **wide/virtual access** - data use and integration

RMs (feasibility studies/
preparation)

Establish a landscape of first-class sustainable RIs and services open to researchers, industry, and other interested groups

Strengthen the technological development capacity and effectiveness, as well as the scientific performance, efficiency and attractiveness

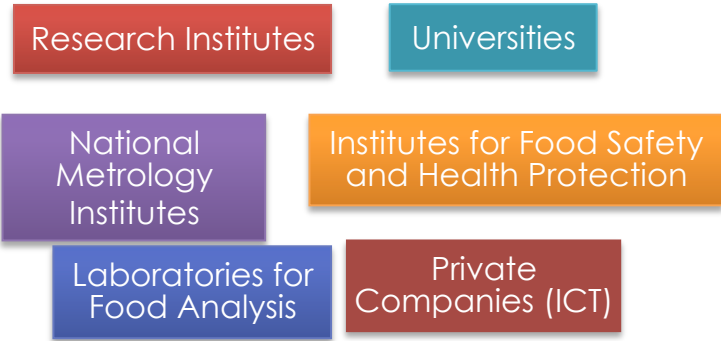
Develop synergies and complementarity between the new and existing RIs, contributing to the development of a consistent European RI ecosystem

Current Partnership



- IT - IT
- BE - BE
- CH - CH
- CZ - CZ
- DE - DE
- ES - ES
- FI - FI
- FR - FR
- GR - GR
- HU - HU
- MD - MD
- MK - MK
- NL - NL
- NO - NO
- PT - PT
- RO - RO
- SI - SI
- TR - TR

48 Partners from 18 Countries



The Italian JRU METROFOOD-IT



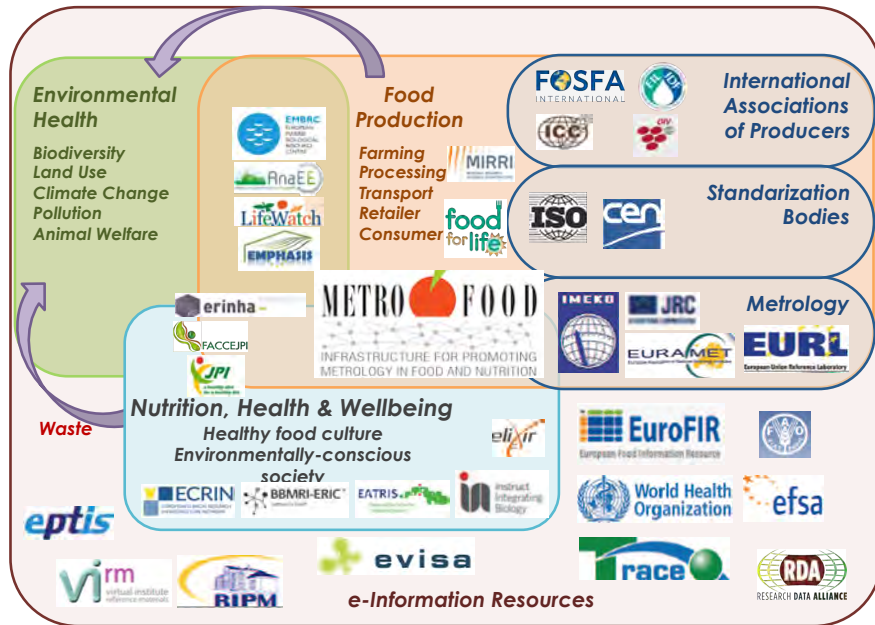
ENEA

Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile



SAPIENZA
UNIVERSITÀ DI ROMA

Positioning in the Landscape & Cooperations



Cooperating with:



www.foodauthenticity.uk

Support from International Organisations

 EUROPEAN COMMISSION European Commission, JRC, Directorate F-Health, Consumers and Reference Materials			 European Food Safety Authority
 A Network for the Food Chain and Agriculture			
 European Food Information Resource	 MoniQA Association	 the SAFE consortium	

Cooperation at a Global level

Brazil			
Argentina			
South Africa	 Consumer Monitoring Network of South Africa		
Australia			
China	 中国科学院 National Institute of Metrology, China		



Physical-RI



e-RI

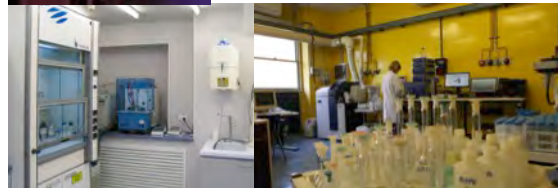
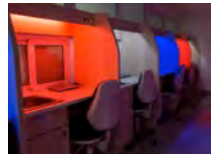
Metro

Plants and Labs for RM development

- RM Preparation
- Stability and homogeneity studies

Analytical Labs.

- Sampling, pretreatment and storage
- Food composition and characterization
- Inorganic contaminants
- Organic contaminants
- Chemical and biological markers and profiles
- Microbiological analysis
- Development of sensors and devices
- Environmental Analysis
- Testing (rheological, leaching, etc.)
- Other



Food

Experimental fields/farms

- Crop production
- Animal breedings
- Fish farms

Facilities for food processing and storage

- Industrial processing
- Packaging
- Supply chain and storage
- Food preparation



Software development

- development of new databases
- Integration of existing databases
- graphical interfaces development
- database maintenance and updating

Data collection

Data analysis

Management of Interlaboratory tests

Diffusion and Training

- Reference Materials
- Official and Reference Methods
- Reference Laboratories
- Vocabularies, Guidelines and procedures
- PTs Providers
- Food composition
- Contaminants in food
- Food markers
- Characteristics of production areas and technologies
- Food consumption



Physical facilities: “METRO side”

Facilities for RM development & production



16 specialised distributed facilities

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

RM preparation

Bottling

Sealing

Labelling

Packaging

Areas for storage



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)



> 130 distributed facilities

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

Analytical capacities and applications

FOOD SAFETY	Trace elements
	Chemical speciation
	Pesticides
	VOC
	Veterinary drugs
	Mycotoxins
	Other toxins (marine, fresh water, bacterial,...)
	Allergens
	Additives
	Food contact materials (migration)
	GMO
	Pathogenic microorganisms
	Nanomaterials
	Amines
	Biocides
	Hormones
Hydrocarbons	
Parasites	
Phenols	
Prions	
Radioactivity	
Other	

FOOD AUTHENTICITY/TRACEABILITY	Isotopes - light elements
	Isotopes - heavy elements
	Non target analysis
	Trace elements
	Sensory analysis
	REEs
	Elemental profiles
	Organic profiles
	Genetic markers
	Other

NUTRITION	Vitamins
	Carbohydrates
	Fatty acids
	Proteins and aminoacids
	Water
	Minerals
Other	

AGROECOSYSTEM CHARACTERIZATION	Surface & groundwater characterization
	Soils & sediments charact.
	Bio-availability studies
	Air pollution
	Wet & Dry depositions
	Bio-indicators
Other	

MATERIAL CHARACT.	Metallic materials
	Ceramic materials and composites
	Plastic materials
	Other

FOOD QUALITY	Organoleptic properties
	Physico-chemical analysis
	Bioactive compounds
	Biological analysis
	Microbiological analysis
	Adulteration
Other	

e.g. instrumentation for....

INSTRUMENTATION FOR ISOTOPIC ANALYSIS				
IRMS	MC-ICP MS	ICP-MS/MS	TIMS	Other

INSTRUMENTATION FOR SPECIATION ANALYSIS							
HPLC-ICP-MS	HPLC-OES	HPLC-AFS	LC-MS	GC-ICP-MS	GC-MS	CE-ICP-MS	Electrochemistry

INSTRUMENTATION FOR BIOTECHNOLOGY						
PCR	RT-PCR	Sequencer	Other	Biological safety	Fume hood	Laminar flow clean bench

....

INSTRUMENTATION FOR MICROBIOLOGY											
Autoclave sterilizer	Antimicrobial susceptibility	(Automated) Gram Stainer	(Automated) liquid media	(Automated) Petri Dish	Colony counters	Cell culture media	CO2 Incubator /	Compound Microscope	Microbial Identification	Flow cytometry	Other

....

- Method development and validation
- Food/Feed/Material/Process characterisation
- (Integrated) monitoring studies
- Advanced platforms and skills networked, made available and accessible
- Integrated traceability systems
- Etc.

Facilities for microbiological analyses / Flow Cytometry



MICROBIOLOGY ●

IT	ENEA
	CNR
	CREA
	ISS
	UNINAFedII
	UNIPR
CZ	CULS
GR	AUTH
	AUA
	CIHEAM
MD	DAS
NO	NTNU
PT	INSA
RO	IBA
TR	TUBITAK
SI	JSI
	NIB

FLOW CYTOMETRY ○

IT	ENEA
	CNR
	ISS
GR	AUTH
	AUA
PT	INSA
RO	IBA

Physical facilities: “FOOD side”

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

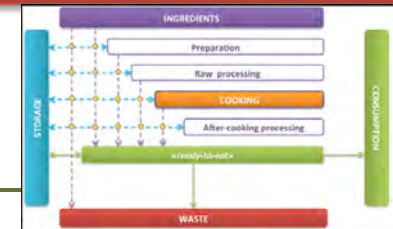
32 distributed experimental facilities



Experimental Plants for food processing, packaging, storage and preparation



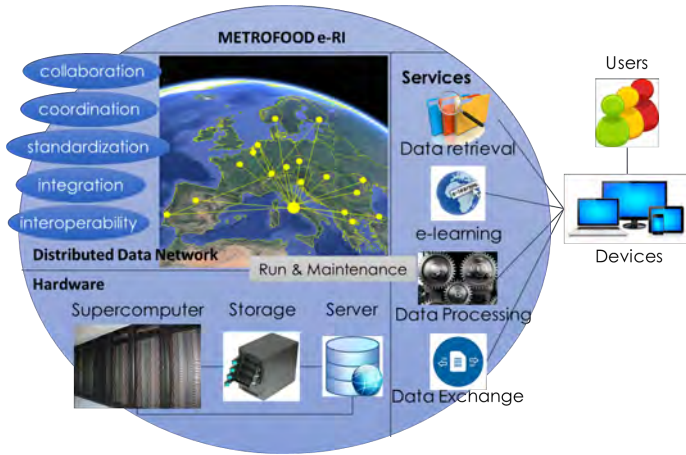
7 kitchen lab facilities



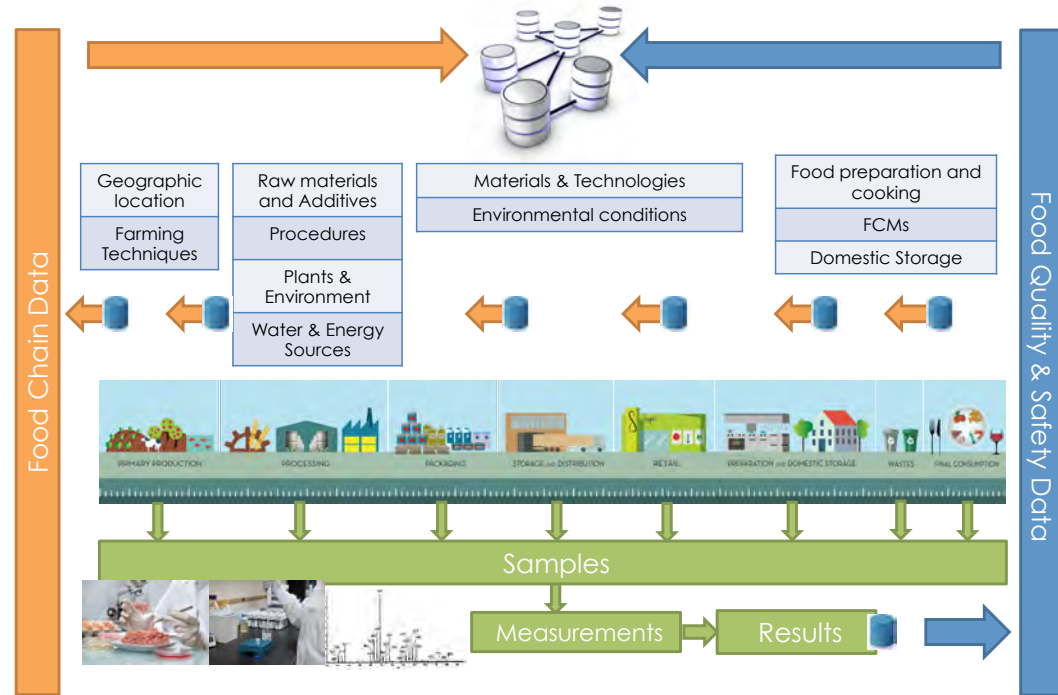
Food quality & safety studies along the value chain (post retail)

- 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**

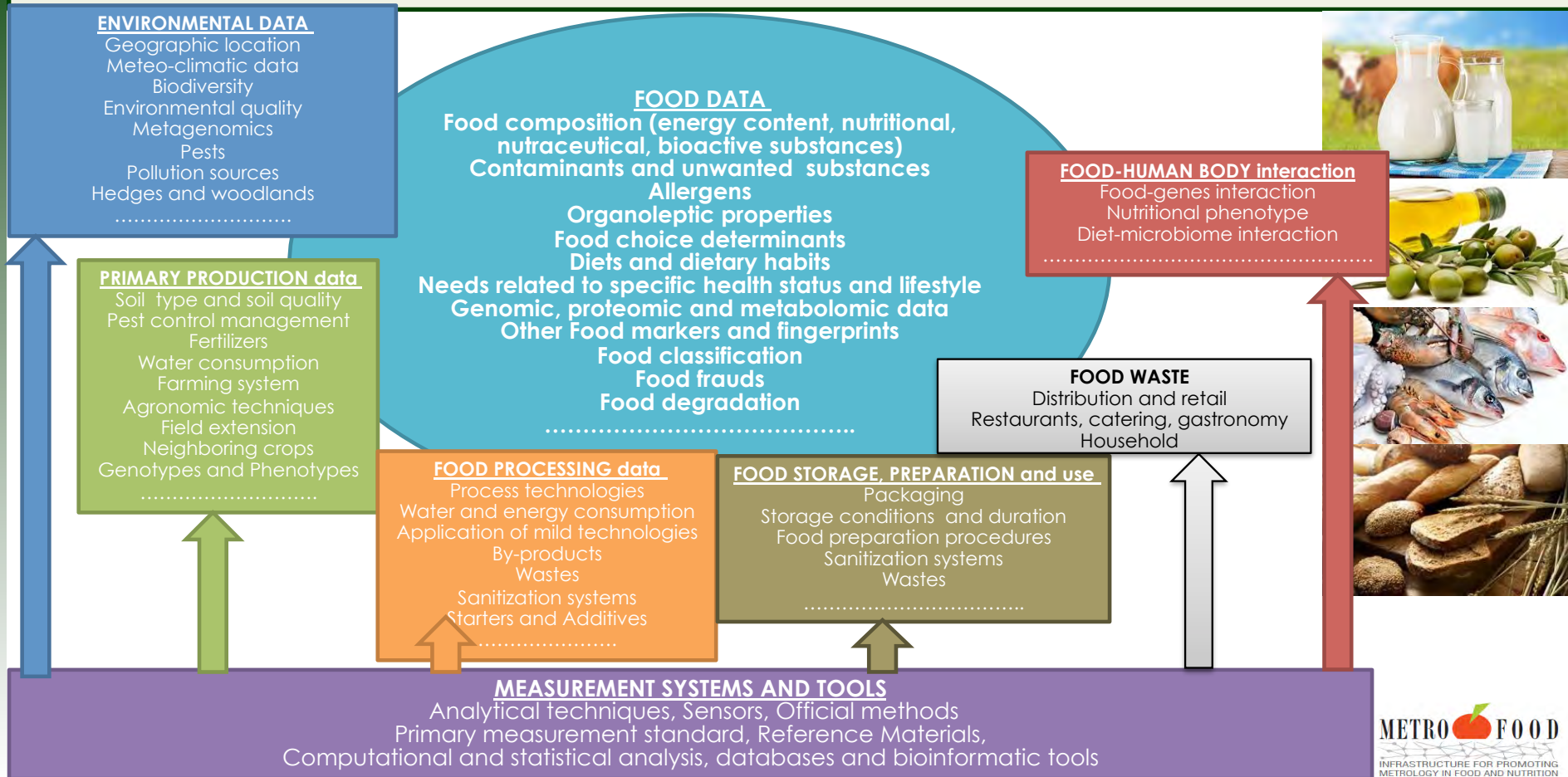
e-RI: Towards an integrated data platform



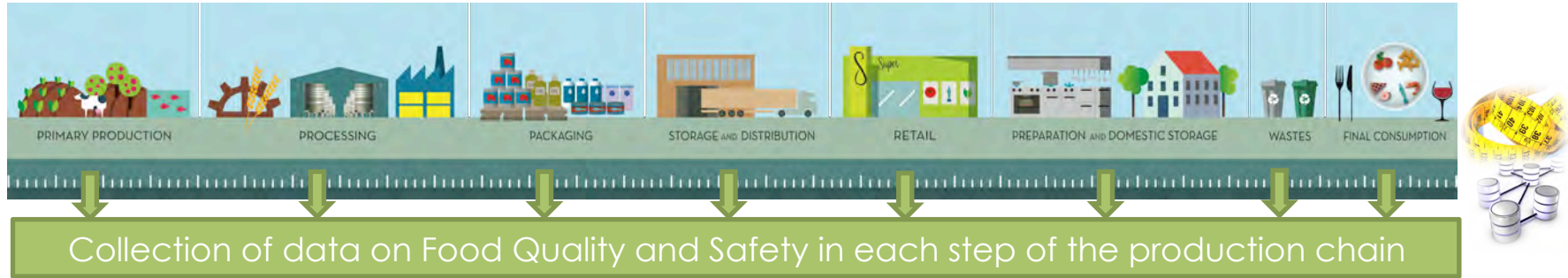
- find out the available information for standardizing and harmonizing food analyses
- collect, share, combine and use data on food contaminants, food markers, food composition, food production and processing
- disseminate information and training in the field of food quality, food safety, food traceability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



Data integration and interoperability



Comprehensive approach to Food Quality & Safety



Geographic location	Raw materials and Additives	Materials and Technologies Environmental condition	Food preparation and cooking
Environmental pollution	Technologies, Procedures		FCMs
Soil quality	Water and Energy Sources		Domestic Storage
Farming Techniques			

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

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

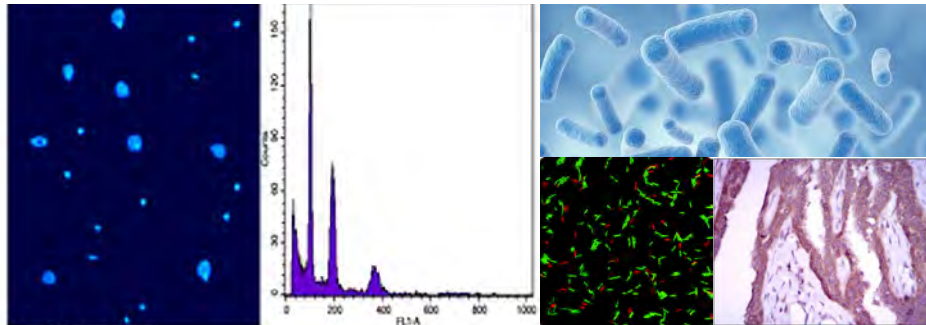
Risk Assessment all along the production chain

Critical points

Cost / Benefit

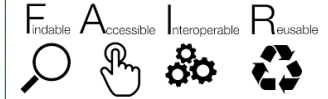
METROFOOD-RI & Flow Cytometry

- Development of new RMs
- Development of procedures for measurement uncertainty evaluation
- Development and validation of new methods and devices
- Management of PT schemes
- Characterisation of food and environmental matrixes
- Data sharing and integration
- Training



Services from METROFOOD-RI

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



Services from METROFOOD-RI

By specific service

(e.g. RM development; PT management)



By technique (e.g. NMR; MS)



Metrological and Standardisation Services

Agro-ecosystem characterisation, Food analysis, food packaging testing and characterisation

Services related to the improvement of Food Production and Consumption

e-services

Integrated services

By specific application

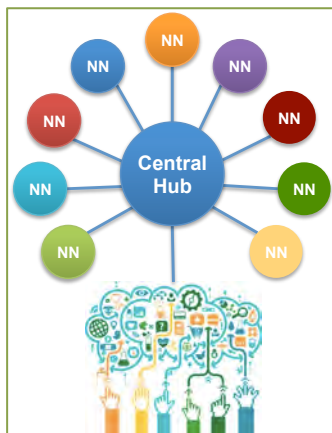
(e.g. mycotoxin analysis, isotope analysis, NP characterisation, SCC)



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

Physical



Remote



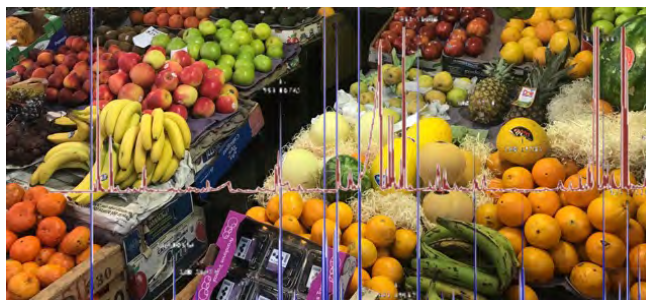
Virtual



Excellence-driven access

Market-driven access

Wide access



Stakeholder Forum

Organisations at EU Level
Eurachem
EMPHASIS
EuroFIR
MoniQA
OLEUM
SAFE Consortium
NMKL - NordVal Int.
ICAR
SPES GEIE
FNH-RI
SEEN-FSQC
Organisations / Institutes at National Level
Accredia (IT)
CRUI (IT)
SISSG (IT)
CL.A.N. - Cluster Agrifood (IT)
ASSITOL (IT)
Federbio (IT)
Federconsumatori (IT)
TPF4L-SP/FIAB (ES)
ELIKA (ES)
ACTIA (FR)
BFR (DE)
MRI (DE)
Milchprüfing Bayer (DE)
EFO SZ (HU)
OPM (MK)
FVA (MK)
MAP (MK)
NVWA (NL)
Qlip (NL)
OdN (PT)
OIKOS (PT)
USAMV-FB (RO)
TPF4L-RO (RO)
INFOCONS (RO)
SKM (SI)
HMD (HR)
LGC (UK)

Outputs & Impacts

Promotion of excellence & interoperability

Enabling the agrifood sector to digitalisation and internationalisation

- **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...



Alignment of research & innovation with the values, needs and expectations of the whole Society

Grazie per l'attenzione!

Contatti



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