



Standardisation of Non-Target Methods for Food Authentication  
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Berlin



# The Importance of Standardised Non-Targeted Methods in Food Authentication

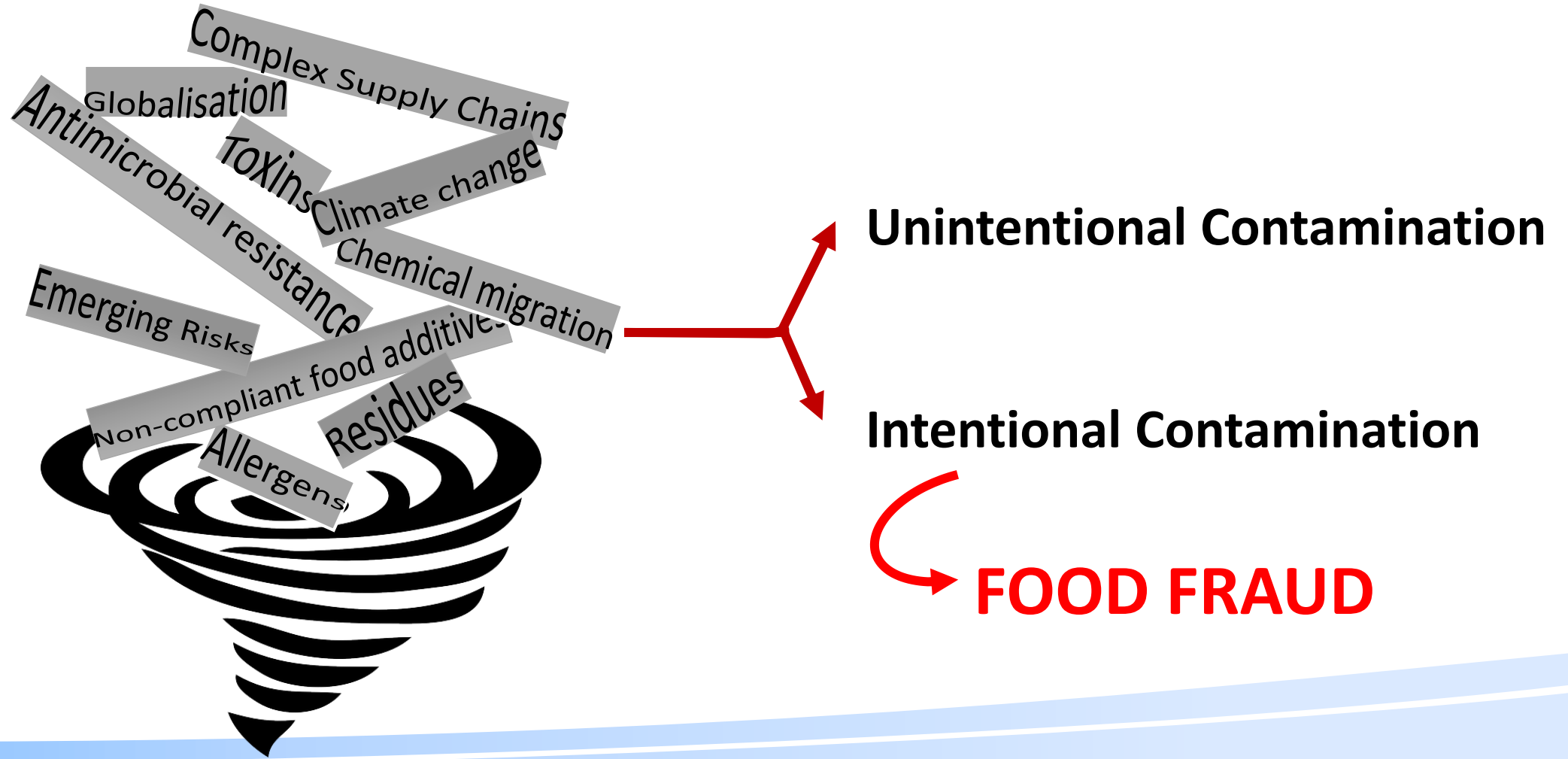
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## Some key questions

- Why are non-targeted methods important?
- And if they are so important, why haven't these methods been more widely deployed?
- Is lack of standardisation the stumbling block? Is so what are the needs and requirements to take this forward?

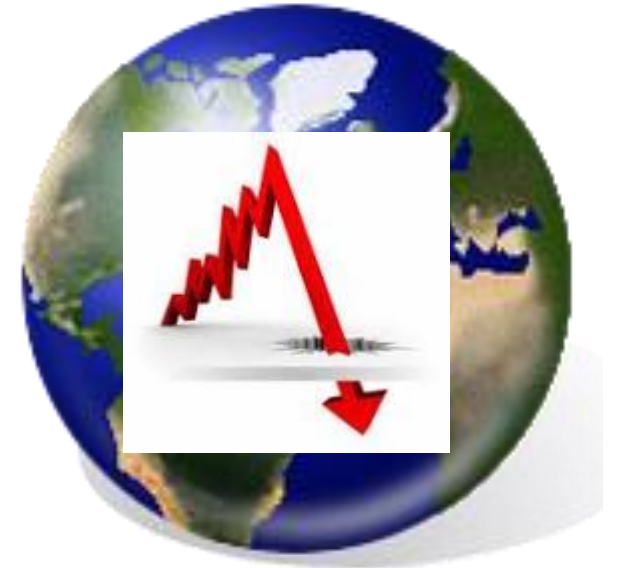


# Current challenges facing the food and beverage sector



# Major drivers of Food Fraud today

- Globalisation in general and the global supply chain in particular
- An increase in number of steps between producer and consumer
  - ⇒ food supply chains are now complex networks
- Differences in regulatory control in exporting/importing countries
- Difficult economic context
  - ⇒ rising global food prices
  - ⇒ move towards cheaper processed food and ready meals



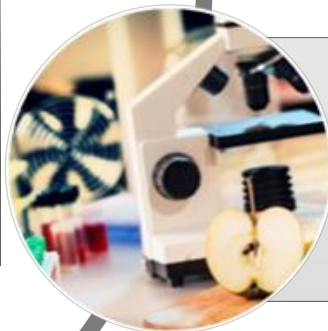
# Industry requirements for food fraud mitigation

GFSI\* has identified 2 key elements to be included in a company's Food Safety Management Scheme:

*\*Global Food Safety Initiative*



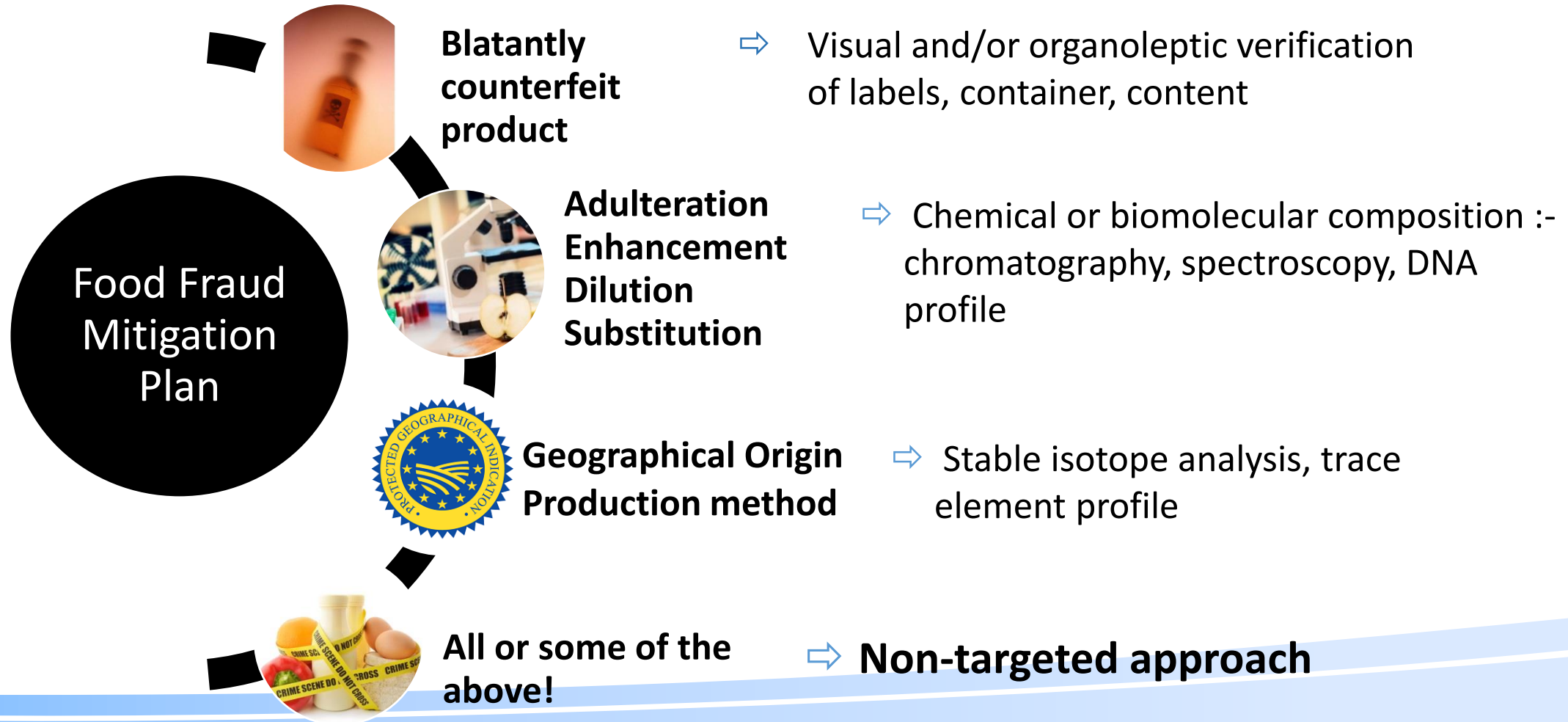
Vulnerability Assessment



Vulnerability Mitigation Plan

- Managing specifications
- Supplier audits
- Anti-counterfeit technologies
- Analytical testing strategy**

# How to choose the right analytical strategy to reduce the food fraud risk



# Non-targeted methods treat food products as “fingerprints”

## A number of advantages:

- Offer a global approach to the food sample being tested
- Deal with the diversity and unpredictability of food fraud issues
- Provide an “early warning system” that something is not right

## Different analytical techniques involved:

LC, GC, LC-HR-MS, FT-IR, NMR...



# Fingerprinting methods also get encouragement from Europe



European Parliament resolution of 14 January 2014  
on the food crisis, fraud in the food chain and the  
control thereof 3/2091(INI)

...calls on the Commission and Member States to further stimulate European and national research and development programmes, to develop and implement technologies and methods used to detect food fraud, such as sensor technology, data analysis and the fingerprinting of products, and to facilitate the commercial availability of tests in the short term;



# So why aren't NON-TARGETED FINGERPRINTING methods more widely used?

## The “black box” syndrome

- Non-targeted methods produce multi-variate data sets that require processing and analysis
- Statistical techniques used are complex and difficult to understand by the non-specialist
- The legal profession are not always willing to accept evidence based on statistics
- Interpretation is often based on a proprietary database and the method only available in one laboratory



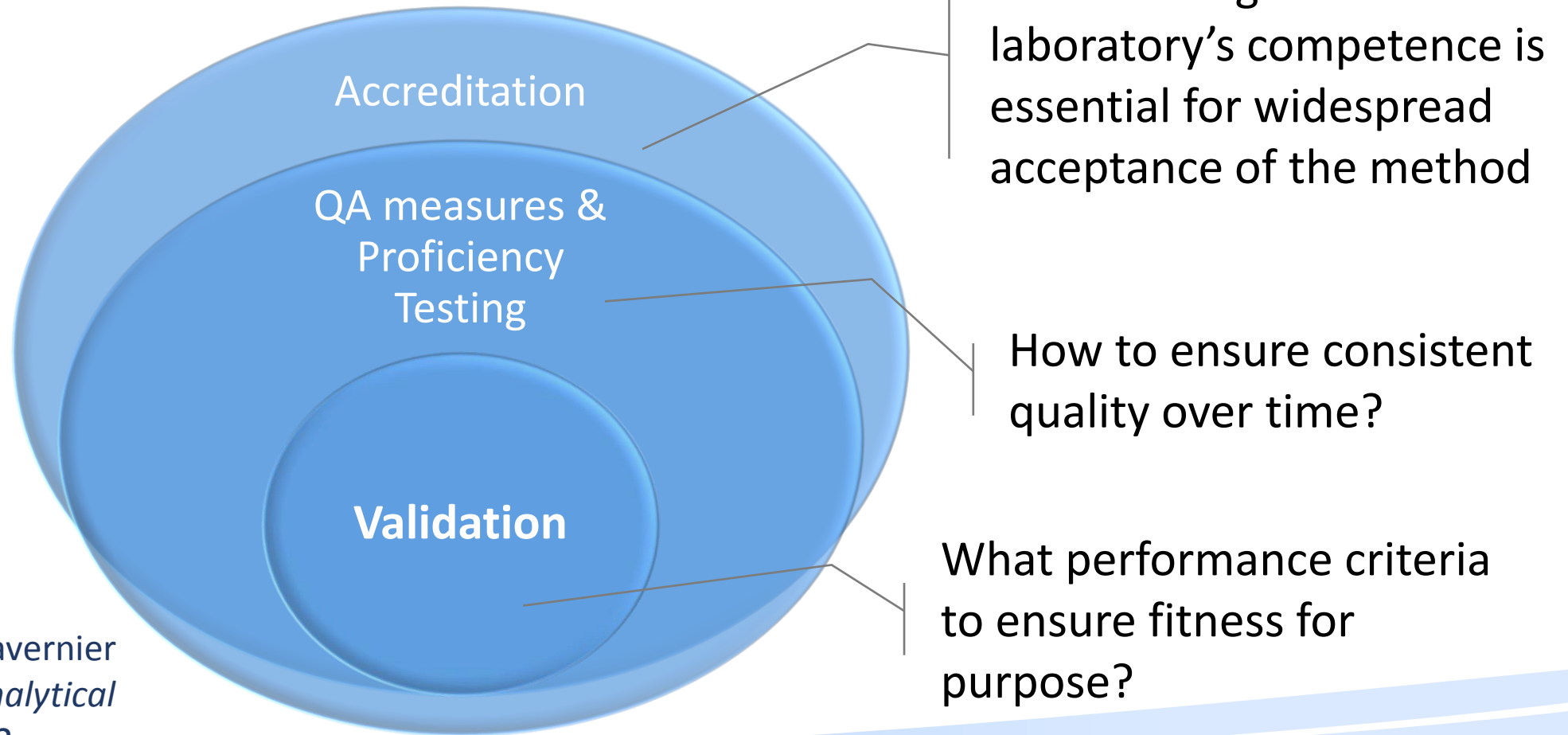
# So why aren't **NON-TARGETED FINGERPRINTING** methods more widely used?

## Perceived unreliability of Non-Targeted methods



- Interpretation relies on a reference database:
  - the database used may not be a large and/or as comprehensive as it should be to cover all possible variations of a food product
  - different databases can lead to different conclusions on a given sample
- Such discrepancies in judgement discredit the methods used

# Will standardisation / harmonisation offer a way forward for **NON-TARGETED** methods



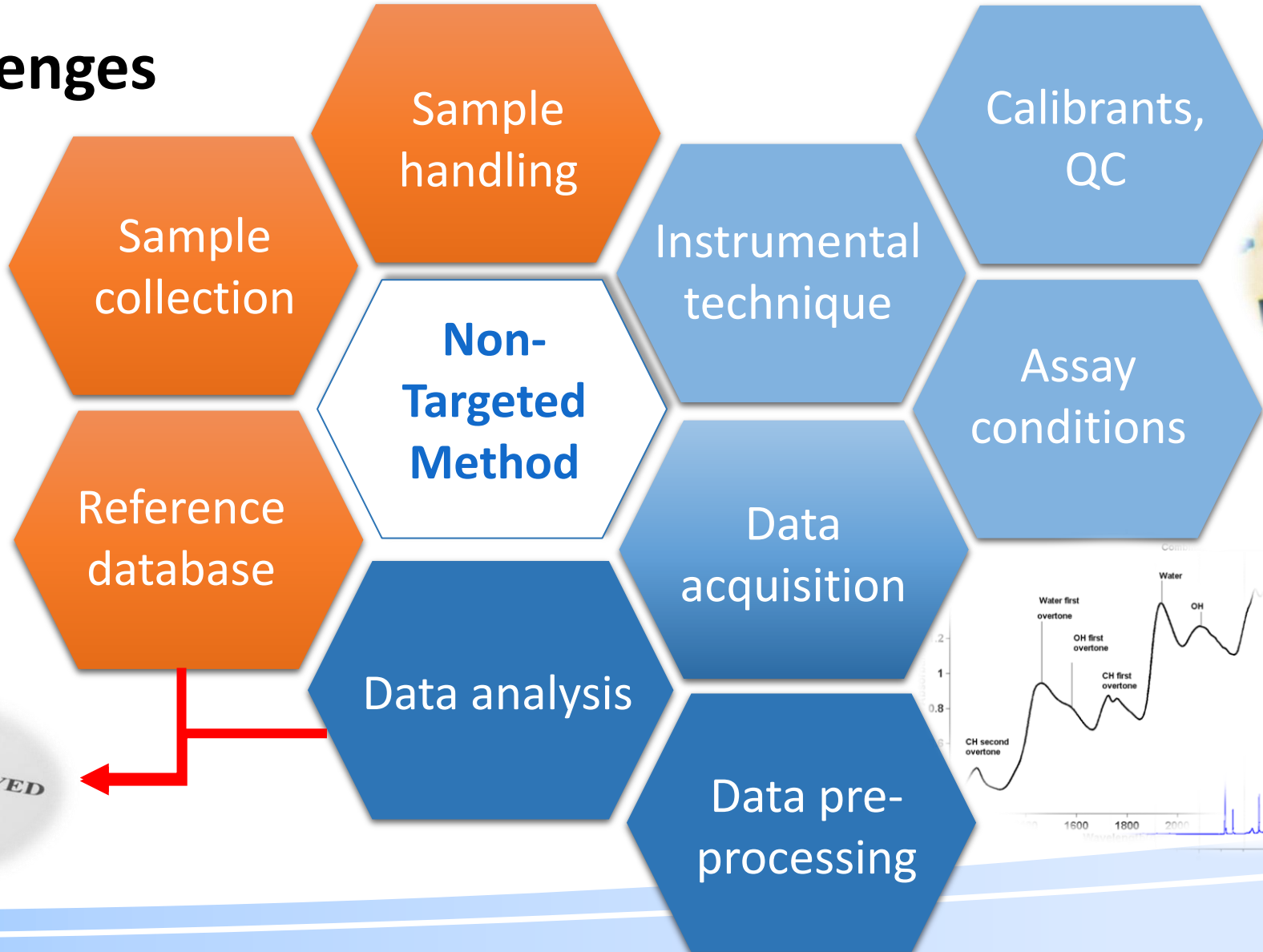
Source: Modified from Tavernier *et al.*, 2004, *Trends in Analytical Chemistry*, 23(8), 535-552

# The challenges

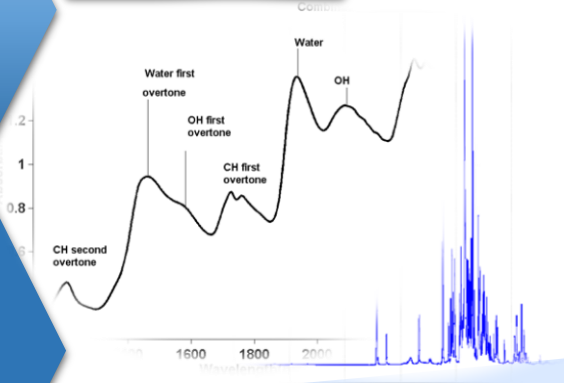
Food product



Analytical technique



Interpretation



# Early attempts at standardisation



## Report Summary

Project ID: AIR21111  
Funded under: FP3-AIR  
Country: France

### Common methodology

...developing a common methodology for food product authentication based on metabolic model identification, leading to proposals for European standardization...

...agreed analytical parameters such as glucose, multivariate parameters such as (e.g. peaks typical of a juice), and qualitative parameters such as sensory analysis. Tight control of the project is database management. The first element of the project is database management. The second element relates to fingerprinting which is a characteristic signal obtained from high pressure liquid chromatography. The fingerprints are being modelled (ie the signal is represented by one convenient function); their reproducibility and repeatability are being tested, and their use in quality standards is being evaluated. The third element is quality assessment which is aimed at determining the minimum quantity of each individual component added illegally to a fruit juice which can be detected. Current project activities include application of the procedures developed, extension to olive oils and wines, and ring tests on seven fingerprinting methods. A key additional aim of the project is to eliminate 'wrong condemnations'.

# Early attempts at standardisation

The work carried out was applied to HPLC analysis of fruit juices. Involved 3 key elements:

- **Database management**
  - using a model based on the relationships between parameters that can be explained through knowledge of the product's metabolism
  - to help accept or reject addition of a new sample to the database
- **Fingerprint modelling**
  - the HPLC chromatogram is reduced to a single convenient function
  - repeatability (reproducibility) standard deviations replaced by covariance matrices of repeatability (reproducibility)
  - inter- and intra- laboratory measurement dispersions replaced by confidence ellipsoids
- **Quality assessment**
  - determine the minimum quantity of an illegal component which can be detected

# Requirements for the standardisation of NON-TARGETED methods

## ■ Food Product

- Sampling guidelines
- Minimum requirements for sample description:
  - Number of samples in each category
  - Raw material / processed (type of processing)
  - Sampling location
  - Sampling period (year, harvest, season, etc.)
  - Agricultural practices (feeding regime, fertilizers, ...)
  - etc...



Guidelines are being drawn up as part of the Food Integrity Project (Deliverable D2.3)

# Requirements for the standardisation of NON-TARGETED methods

## ▪ Analytical Technique

- Clearly defined Standard Operating Procedure
- Minimum requirements for information to be provided on the technique used:
  - Instrument
  - Use of calibrants, standards, etc...
- Expression of results
- QC measures implemented



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# Requirements for the standardisation of NON-TARGETED methods

## ■ Data production, preparation and evaluation

- Appropriate validation of statistical model
- Standardized data format to enable:
  - Exchange/transfer of data
  - Data reuse, etc...
- QC measures implemented to ensure consistent data quality
- Database management / assessment – ensuring a “clean” database

# Requirements for the standardisation of NON-TARGETED methods

## ■ Interpretation of authenticity data

- Carried out by an authenticity expert
- Assessment of food sample based on knowledge of the food in question (production, processing technique, etc.)
- Rules / guidelines for the interpretation
- Periodic reviews – in function of database updates
- Interlaboratory comparisons



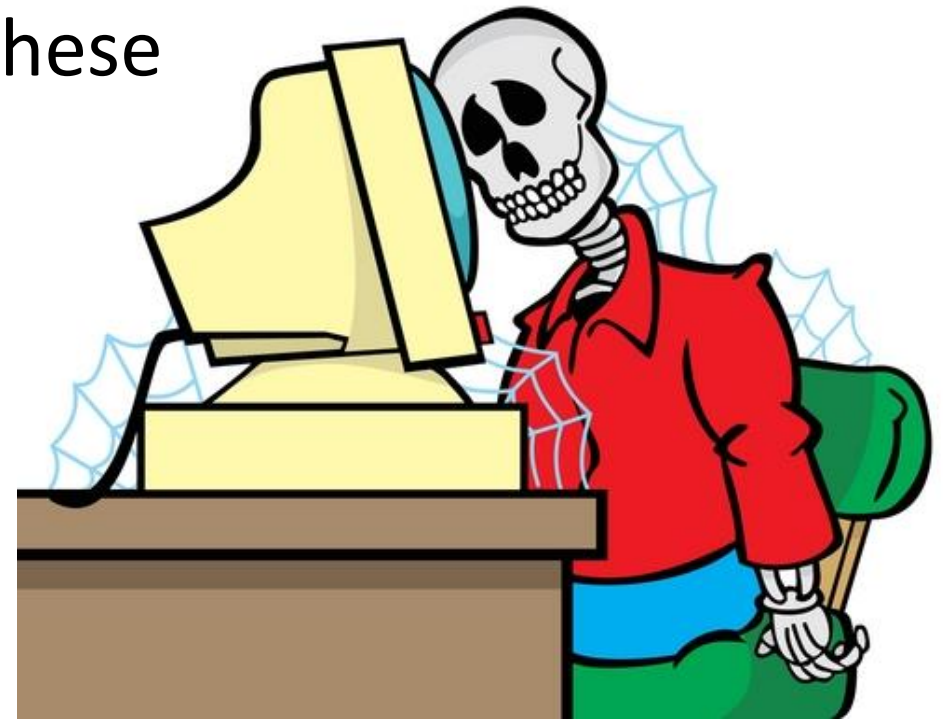
# Requirements for the standardisation of NON-TARGETED methods

- 2012 Report of the BuTraFoS (Building Trust through Authentic Food & Safety ) Workshop
- Organised by the State General Laboratory of Cyprus and the EC Joint Research Centre
  - Supported by the Customs 2013 Programme

Non-targeted or fingerprinting analyses will be part of the tools of the future .... A number of robust analytical tools are available but a better strategy is required for their implementation.  
...the terminology – “untargeted”, “non-targeted”, “fingerprinting”, “profiling” - should to be standardized. Guidelines must be devised for the validation of these techniques for which the performance criteria of traditional targeted methods are no longer applicable

## Key message to take forward

Let's not wait too long before finding a means of standardising / harmonising these hugely potential methods .....





Let's not wait any longer .....