



# Results of the Food Integrity Scientific Gap Analysis

Version 18-12-2014



## **Topic 1. Standardization and harmonization of untargeted food integrity methods**

Keywords: Protocol, validation of untargeted analytical methods

Challenge: The challenge identified is the development of a science-based, internationally accepted standardised procedure for the validation of untargeted analytical methods. These methods are increasingly being used as a means of identifying change from the norm and are therefore ideal methods for assessing whether the integrity of a food product has been compromised.. Definition of performance characteristics of these analytical methods, which involve chemical/physical measurements as well as statistics, is pivotal, as well as broad standardised protocols for formal and "in house" validation. Moreover, efficient and standardized ways of selecting important variable/parameter combinations, minimizing noise and thereby reducing the complexity of data obtained with fingerprinting methods are essential as is the ability to compare results between laboratories. Demonstration of the scientific value of the developed protocols will need to be addressed to allow further future acceptance by standardisation bodies.

Background: In the scientific world many analytical methods have been developed. However, few of them are implemented by commercial, regulatory and industry laboratories. For use in practice, results of methods must be beyond any reasonable doubt to be accepted in regulatory or legal cases. This requires formal validation and proven performance characteristics of the methods, to internationally agreed procedures, e.g. such as those of ISO, IDF, AOAC, etc. Relatively few new scientific methods are brought forward to these bodies. On the one hand this is probably due to the fact that academic scientists are rarely involved in this process and perhaps not even interested in these formal standardization procedures. On the other hand, the methodology approach has developed over the years. Traditional approaches aim at the analysis of a single marker, but newer methods focus on pattern recognition of a range of chemical or physical properties and involve both analytical chemistry and statistics. For these newer 'multi-component' or 'untargeted' methods there are no formally defined performance characteristics available nor procedures for standardized validation. Furthermore, for the combination of analytical chemistry and statistics there are also no formal standardized validation protocols available. These newer "fingerprinting" methods are generally used for broad anomaly screening, or for traits of products which cannot be determined with a single marker (e.g. verifying a particular branded product). There are many methods which have been developed up to the proof of concept stage in European and national research projects. Non targeted, often referred to as "fingerprinting" and "profiling" methods offer considerable advantages in terms of efficiency and cost effectiveness; formal validation of these techniques will allow further implementation of these methods in practice.



## **Topic 2. Approaches to assure the integrity of complex foods**

Keywords: Complex foods, multiple components of plant and animal origin, system approach, food fraud

Challenge: The specific gap identified are the challenges faced, by the stakeholders of the supply chain, of complex, multi-ingredient foods to ensure that there are systems in place that assure their food integrity with focus on prevention of food fraud. The challenge is to identify appropriate approaches that can be implemented in a cost effective fashion, which can assure their authenticity. The approaches may require additional validation arising from the multi-component matrix of the complex food. Suggested issues that need to be addressed include: i) Identification of ingredients in complex foods; ii) Cost effective procedures; iii) Assurance of integrity of the final product.

Background: An analysis of previous traceability and authenticity projects funded by the EU demonstrates that the majority of projects funded focussed on commodity products or 'single products' such as meat, dairy or olive oil. Only a small number of projects focussed on complex, multi-product foods such as ready-to-eat meals, pizzas, *etc.* By their nature, these complex foods consist of a large number of ingredients, each of which has its own separate supply chain. Processing introduces further difficulty including product mixing and processing which further complicates traceability and authenticity issues. In addition, certain ingredients, such as spices, flavourings and stabilisers are present in low concentrations but still require appropriate traceability and authenticity systems to be in place.



**Topic 3. Common platform and tools for sharing information across stakeholders (producers, retailers, regulators, consumers) to increase transparency along the food supply chain in order to assure the integrity of the food supply chain. Technology transfer project, focus on EU.**

Keywords: Facilitate sharing, initiatives for intelligence sharing, Information exists, but fragmented,

Challenge: Information and documentation on most food ingredients, production processes and distribution routes is available, in some form or another. The goal of the activity is to investigate and identify ways for providing an infrastructure for these currently dispersed data sets, or the essential information therein. The platform must allow access to all stakeholders in the food production value chain, and beyond, such as producers, retailers, consumers and regulatory bodies. Detailing the advantage of such a system for the food production value chain will be critical. Analysing the cost benefit of the resource input and confidentiality issues of actors in the food value chain, and optimal efficacy of the information presented will be essential for a successful solution. Involving relevant industrial players and consumer voices will be crucial to producing adequate mechanisms, tools and a platform that will have significant take-up to ensure a critical mass to engage all/most of the value chain players.

*Mechanisms, tools and a platform should be proposed that reduces (perceived) complexity and increase transparency of the supply chain, that addresses distinct information needs of the respective stakeholders (probably need to be determined first), that facilitates intelligence sharing and involves consumer needs in the process and that includes feedback mechanisms to reflect efficiency and allow improvement of the process.*

Background: Today's food supply chains are complex and of low transparency for all stakeholders (producers, retailers, regulators and consumers), who commonly indicated a need for more information on supply chain and authenticity issues. For assuring food integrity along the supply chain, this complexity needs to be addressed (in particular by business operators and regulators) to increase transparency for all stakeholders (including consumers). The current lack of information is not a matter of responsibilities and knowledge, but a matter of availability of the information among single stakeholders. Thus, the access to and sharing of information should be facilitated in an efficient and transparent way taking into account confidentiality issues where they arise. Hereby, different information needs have to be considered. Business operators and regulators require as much information as possible to minimize vulnerabilities along the supply chain, and they need tools that allow information management and sharing. Moreover, the efforts made by business operators and regulators to prevent food fraud should be communicated to the consumer to increase consumer trust, particularly in responsibilities of single supply chain actors and mechanisms for monitoring and controlling are of interest. (Product) information about authenticity and supply chain provided to the consumer should match their needs (understandable, comparable), for which adequate tools / solutions are required and consumer voices need to be involved in the process. Together, the goal of any new measures must be to prevent food fraud (which causes high economic losses for business operators each year) and to increase consumer trust by enabling them to make informed choices on authentic products.



#### **Topic 4. Rapid, cost efficient methods for fraud detection**

Keywords: Anomaly testing methods, rapid, physical/chemical/biological/sensor technology fit for purpose, cost efficient, broad application, anomaly testing

Challenge: This activity aims at the inventory and exploration of state-of-the-art technology that can authenticate food products rapidly and cost efficient from a multi-disciplinary perspective. Rapid, on-line systems as well as on-site screening procedures are required that can give users quick decisions about product integrity. Methodology involves especially emerging techniques and tools beyond those currently applied in the food sector. The diverse nature of food integrity issues requires best solutions for different commodities and product types. The cost effective solutions should target food industry stakeholders in the food production chain as well as techniques that inspection bodies can use on-site.

Background: Analysis of large sample numbers or batches bring concomitant high analysis costs that often hinder detecting food fraud. Rapid methods and cost effective methods for assuring the integrity of foods/food ingredients are required. A wider look at all the technologies available is required looking at other scientific disciplines such as the physical sciences is required to reappraise and assess the best approaches. The costs of verification procedures could be reduced by either (I) reducing the amounts of samples to be checked or (II) find cheaper and faster alternatives for verification. In order to reduce sample streams, fast on-site methods in order to discriminate between suspected and correct products or ingredients could be used. Although it is probable that there is a deflation on the costs of complex (automated analytical) methods to be expected over the coming years, the search for easier to measure (combination) of fraud markers need to be encouraged.