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Proposal to develop a framework for international food safety laboratories' training and capacity building

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1. Introduction

This document aims to clarify how technical training by specialist regulatory-facing food analysis training establishments impact on the wider food safety capacity building agenda. It will provide the Global Food Safety Partnership (GFSP) with a complete food supply chain view of food testing training needs and related drivers for adoption of food safety standards. It rides with the assumption that only by having food move through regulated pathways, can food safety be assured for the public and the interest of private sector ventures be protected. This identifies with the particular challenge of food systems (national and regional) in developing countries, i.e. the transition from informal food systems to those that have to meet regulatory standards.

The report maps the various tiers of technology transfer to relevant stakeholders (trainees) in the agri-food supply chain. For example, training establishments such as the International Food Safety Training Laboratories (IFSTL) address training in food analysis for regulatory compliance to formal international quality standards, e.g. ISO 17025. As we move down the food chain from fork to farm the number of actors increases and the technology needs are for faster and cheaper screening methods, but importantly, they are influenced by the ***analytical requirements*** of those actors that are higher up in the food chain. Growers work to the specifications set by the co-operatives, who work to the requirements of the processors, who work to retail standards that are aligned to formal international standards. So whereas farmers need cheap screening diagnostics; and processors need online sensors, they all will be influenced by the legislative and quality assurance aspects of the smaller but influential target group that training establishments such as the IFSTLs address. Providing training in methodology to the high level stakeholders in this context is key, as they will, through their subsequent compliance testing, provide ***the environment and drivers*** for technology transfer to farmers and growers to thrive.

There are a number of key institutions, donors and organizations that are providing training and expertise to support technology transfer and laboratory capacity building in developing countries.

Some of these programmes are carried out in isolation and are not linked to a sustainability strategy that addresses the analytical needs of the public and private sectors, including farmers. This report aims to identify some of the key players internationally and, in cooperation, attempt to align both content and resources to ensure sufficient consistency for the GFSP to support these programmes globally. This work will also provide an approach for Governments and countries to identify

their food safety laboratory needs as part of the proposed national food safety training and capacity building needs assessments.

Ultimately, the framework will lead to the development of a comprehensive set of laboratory training resources to be supported under the GFSP and starting with a few pilot programmes to demonstrate the utility and efficiency of this approach.

Key questions to be answered?

- Global food safety laboratory capacity building needs and rationale
- The role of food analysis in supporting a food safety infrastructure
- Food analysis requirements along the food chain including detailed annexes and tables for tests and reference methodologies
- The role of regulatory compliance testing in supporting food standards and safety
- Training requirements and solutions
- The role of the private sector laboratories including case studies

Some of the above were answered through the use of a survey of food training establishments and subsequent feedback on their training programmes and methodologies (See Annex B).

2. Global food safety laboratory capacity building needs and rationale

It is clear there is a strong relationship between food safety within a particular country and the robustness and functioning of its internal food safety infrastructure. However considerable resources are required to maintain such an infrastructure so there needs to be strong political and economic drivers in place to ensure such a system is a priority for the residing Government. Often the internal agri-food market, or consumer pressure, is insufficient to maintain such a system with the result that in developing countries it is often the external market (exports) that is the driver for the development of food standards and safety systems. This results in a two tier system with marked differences between the safety and quality standards of food intended for export and that intended for internal consumption. A key question that needs to be addressed in such a two tier system is the time lag between the development of the food safety system to support external trade and the development of a functioning system for domestic public health.

2.1 The role of food analysis in supporting a food safety infrastructure

Figure 1 describes a generic food safety infrastructure that is required to monitor and enforce food safety. The requirements are, for many developing countries, complex, resource intensive and economically prohibitive. The tools that are presently available to control food safety across the food supply chain can be summarised as follows:

- Preventative control plans
- Mandatory product safety standards
- Risk base inspections
- Product tracing
- Inspections through third party certification
- Product certification for high risk foods

In terms of the key challenges that relate to application of these control measures, the following issues have been identified as key to ensuring their effectiveness:

- Ensuring close interaction with all elements of the supply chain – ingredient vendors, packaging providers, distributers and retailers
- Understanding all possible hazards across the food chain
- Implementing mitigation strategies against the risks
- Ensuring monitoring and verification across the supply chain

Drivers from the regulation bodies

- Prior notification of all import shipments
- Physical inspection of imports
- The global move to register food production facilities and inspection, e.g. by the FDA and EU (FVO)
- Global coalition of regulators
- Global data information systems
- Expanded capacity for intelligence gathering

2.2 The role of regulatory compliance testing in supporting food standards and safety

Food analysis is a key component of assurance and compliance of all of the above and can be initiated through the internal drivers of the national infrastructure or as is commonly the case in developing countries, through external drivers resulting from external trade. In order to enter external markets, food standards need to be visible and validated. The standards, whether national, commercial or global need to be verifiable to assure compliance. Figure 2 describes how food standards need to be

assured by testing of the components in the food chain wherever they apply. For example Maximum Residue Limits (MRLs) for pesticides apply to crops whereas many other standards/Regulations apply to the finished product as purchased at retail. The non-compliance with a standard/Regulatory limit has implications both upstream and downstream. Non-compliance should prevent further progression of the product upstream and recall/rejection of products downstream. The many different standards that may be applicable for export (e.g. Codex, EU, FDA, industry) result in a strong driver and need for laboratory testing services to verify compliance, hence export is probably the most important driver in developing food safety testing and capacity building.

Key drivers for the producers / importers

- Risk based foreign supplier verification
- Clear product specifications
- Purchase agreements
- Accredited 3rd party audits
- Preventative controls and testing programme
- Traceability measures.

The need to assure actors in the supply chain that the food complies with the required standards whether global, governmental or commercial is the major driver for developing food safety initiatives in the majority of developing countries that have a significant export market.

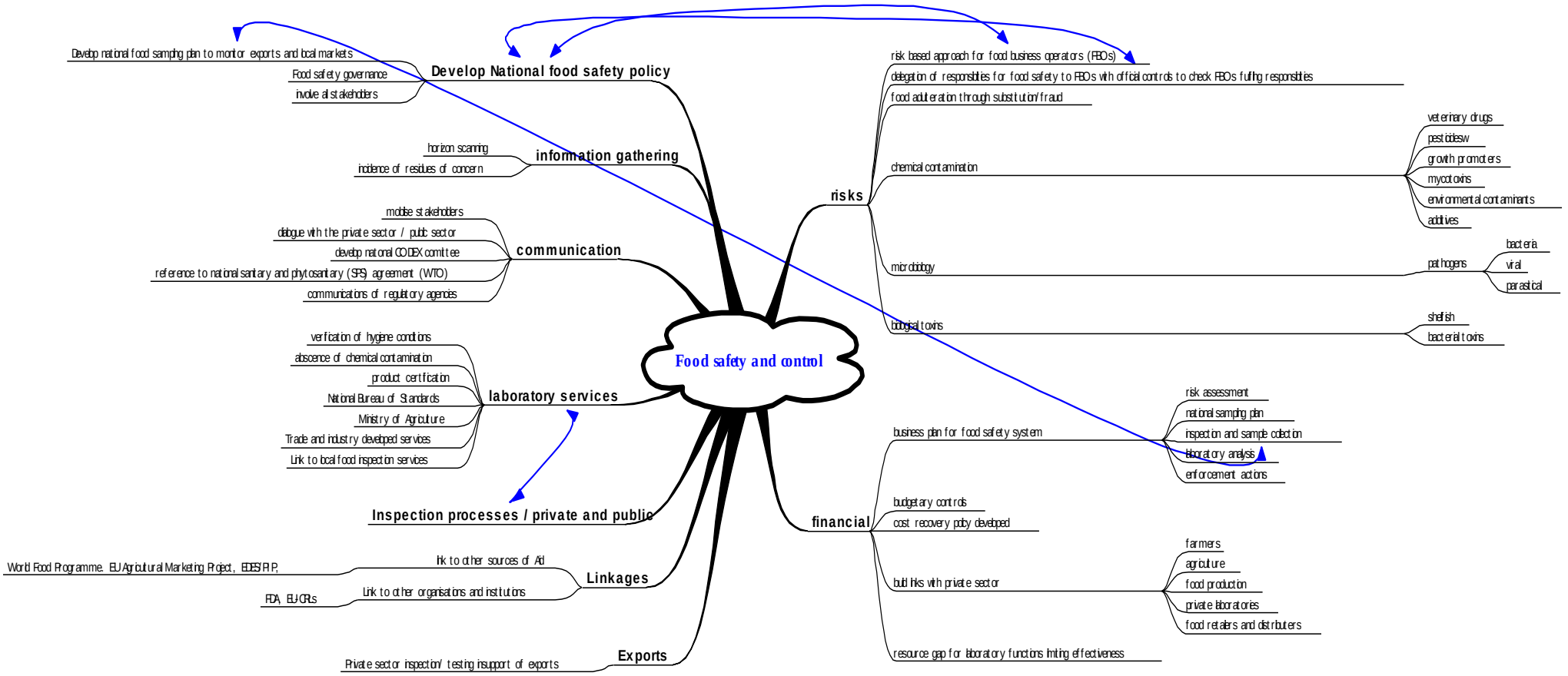


Fig 1 A generic food safety infrastructure that is required to monitor and enforce food safety

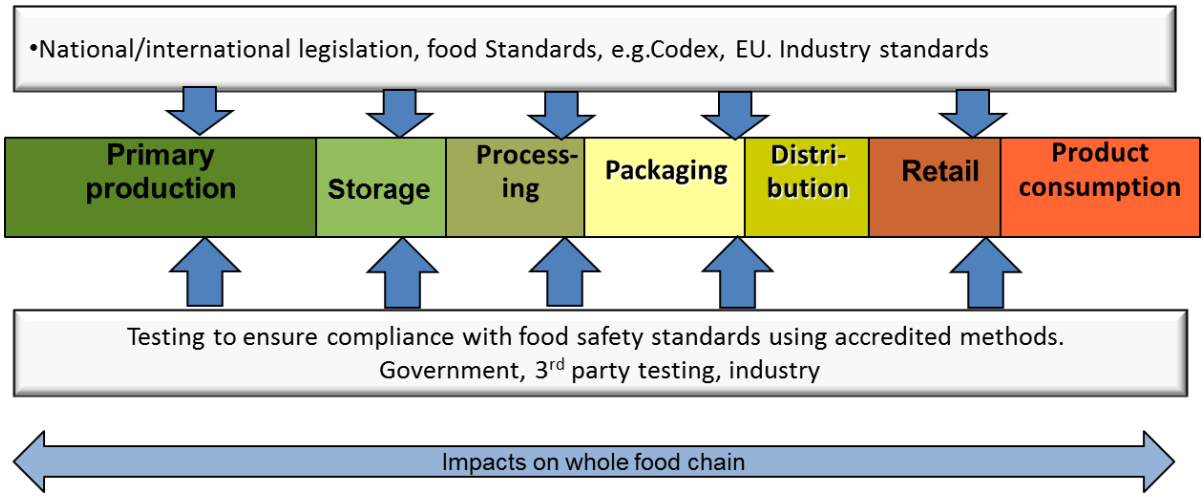


Fig 2 Relationship between food standards and testing. Food standards can apply at various stages of the food chain and impact both upstream (barrier to further progress along the food chain) and downstream (product recall). Standards and commercial standards in particular are directly dependent on immediate upstream requirements and indirectly on retail requirements.

2.3 Food analysis requirements along the food chain

Laboratory analysis features heavily in the establishment of food control systems by contributing to the assessment of the level of exposure potential risks in the food chain and through compliance assessment. Laboratory services can be provided from both within the government and the private sector and there are good working examples of both types of operation in many parts of the world. Figure 3 describes the key elements to the provision of successful laboratory service that is able to support food safety within a country.

Having effective capacity in these laboratories is critical to the success of the food control systems. It is now the norm that food control laboratories will achieve third party verification of their competence through accreditation to international quality standards e.g. the ISO 17025 laboratory competence quality standard. This necessitates the implementation of an effective quality system that includes both internal and external quality control measures for their operations. Staff training in the effective application of the laboratory methods is also critical to this. Figure 4 describes the potential areas for capacity building in laboratories carrying out food safety analysis to help ensure the laboratory meets both the expectations now in place for quality as well as the needs of the stakeholders and users of their services.

It is clear that in order to perform trace analyses to internationally recognised standards, considerable investment in staff training and infrastructure is required. ***Demonstration*** of competence in sampling and analysis through the audit of procedures and accreditation is essential and must be included in any capacity building requirements if the resulting analyses are to be accepted at export. Training in methodology and techniques for analysing food are only part of the training requirements needed for food analysts to be able to verify compliance with food standards. Other important components include:

- Method validation
- Relevant legislation
- Official sampling procedures
- Quality system (ISO17025)
- Equipment installation and maintenance

Any capacity building programme in the area of food analysis needs to include these wider elements in order to deliver sustainable fit for purpose training outcomes.

Scope of methods of analyses

As previously discussed the method requirements for testing will be dictated by the standards/legislation relevant to the intended market. Whereas the specific reference method may change, there is general commonality on the types of analytes that are required to be tested. These will generally fall in one of the following headings:

- Food composition
- Food labelling
- Food pathogens
- Trace elements/heavy metals
- Natural toxicants e.g. mycotoxins
- Food contact materials
- Pesticides
- Veterinary residues
- GM food and feeds (EU focus)

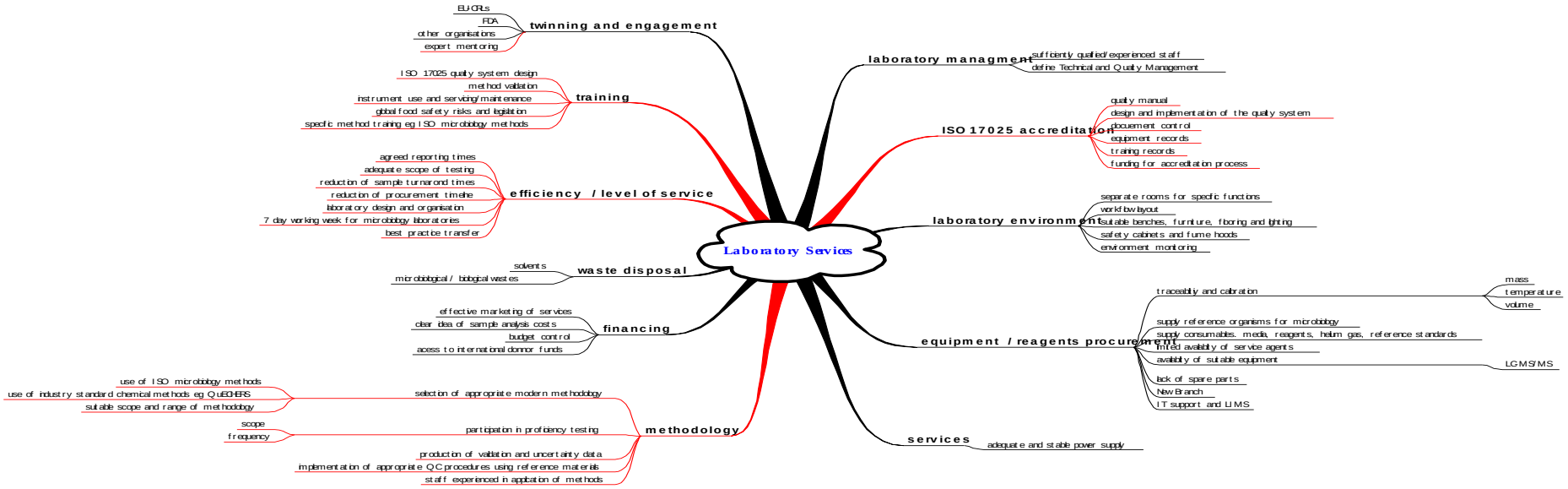


Fig 3 Key components of a food testing laboratory- items highlighted in red are those addressed by IFSTL type training establishments

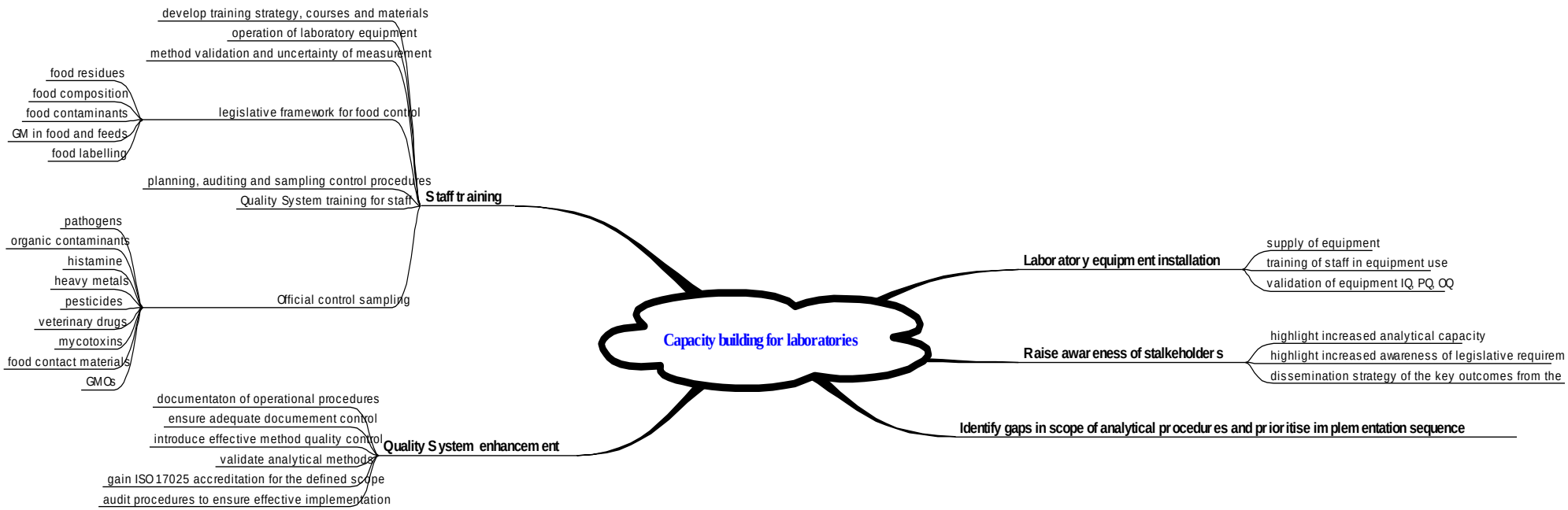


Figure 4 Key capacity building requirements in developing a fit for purpose food testing laboratory

2.4 Training requirements and solutions

The general scope of training requirements was identified in Section 2.3. Further evidence was obtained through the results of a detailed questionnaire that was sent to candidate organisations thought to undertake capacity building in the food analysis area. The results of the study are given in Annex B but the key findings obtained from the 25 respondents are summarised here:

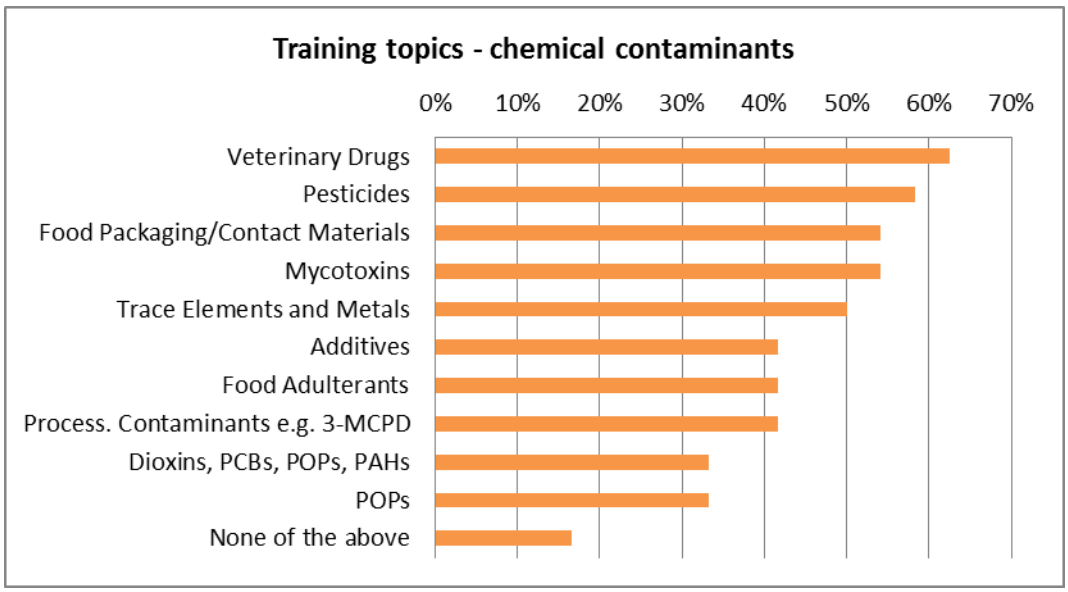


Fig 5 training programmes for those training providers that carry out food testing (chemical contaminants) training in developing countries.

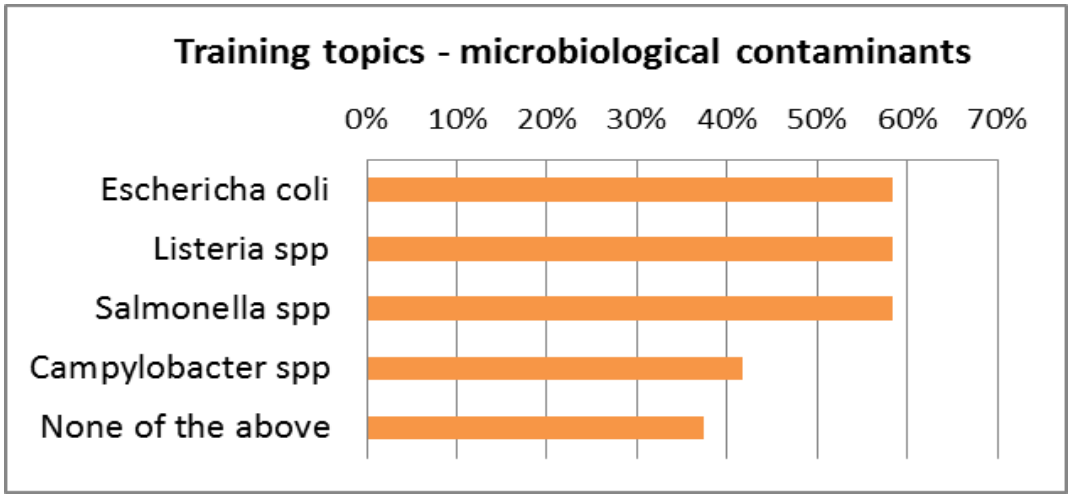


Fig 6 Training programmes for those training providers that carry out food testing (food pathogens) training in developing countries. Other consisted of staphylococcus aureus, vibrio, bacillus sp. Clostridium, toxigenic fungi,

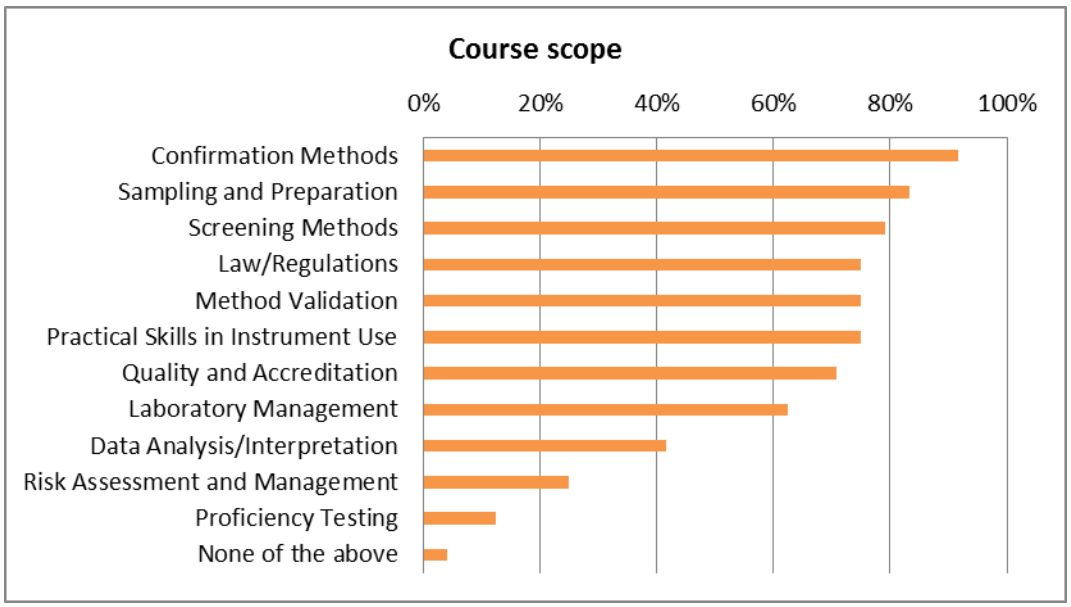


Figure 7 Scope of respondents training programmes

As expected the results demonstrate the main requirement is for training in methods of analyses and associated screening procedures that can be used for official control/verification of formal standards/regulatory limits. In addition there is a demand for knowledge of the quality assurance and audit processes necessary to be able to demonstrate competence. It is interesting to note that less than 50% of all the providers in the study provided training on data analysis and interpretation, two essential components of food analysis but ones which are resource intensive in terms of training provision. This raises a key aspect of capacity building, that is how to best deliver sustainable technology transfer ***outcomes*** rather than just deliver training programmes; the former is a continuum, the latter finite.

2.5 A Framework for capacity building in food analysis

Advanced analytical procedures demand continual updating with the state of the art to ensure efficiency gains can be realised. It is clear therefore that it is essential to offer post training aftercare as a means of ensuring continual professional development. E-learning and communication tools have a role to play in forging and servicing a user community of food analysts. Webinars will always struggle to replace hands on training but have a role in *pre* and *post* training evaluation and

proficiency; communication tools such as Facebook and LinkedIn are well suited to developing an interactive user community; whereas tools such as Twitter could be used in 1:1 aftercare for trouble shooting. Assuming the desired outcome is to provide recognised competence in food testing, for this to be achieved it needs to be sustainable both economically and scientifically. The latter can be achieved using a "twinning model" rather than traditional training programmes. The aim of twinning is develop competence and bring the trainee into a larger group of competence where the experiences, mentoring, coaching and links provide a more sustaining environment (see Fig 8).

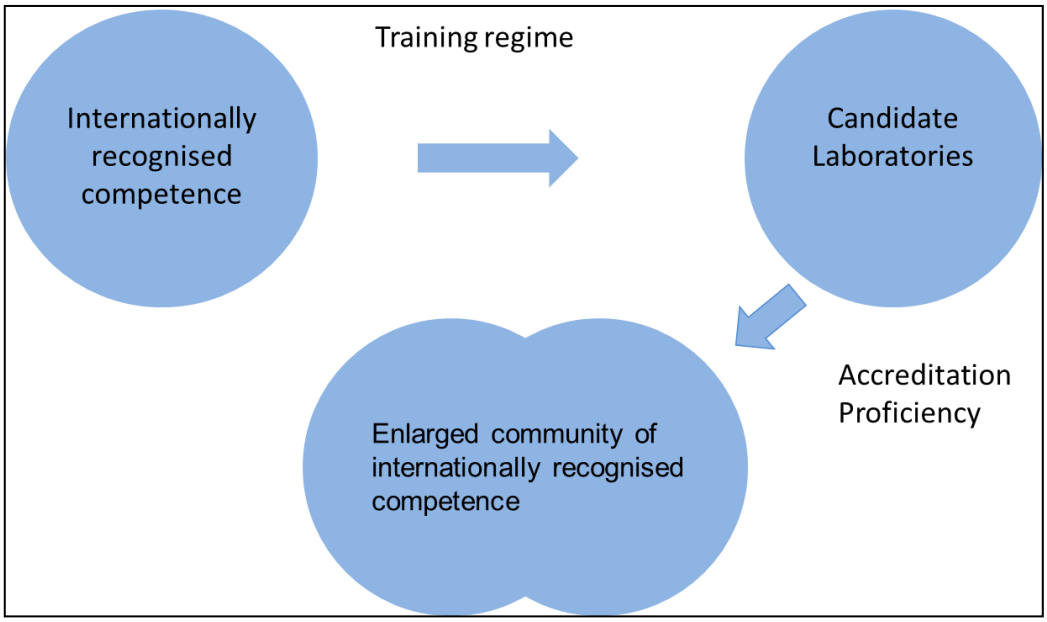


Fig 8 Twinning approach to technology transfer: the twinning approach although initially resource intensive has the potential for the trainee institutes to eventually be the twinning mentors of the future with concomitant economic savings.

The twinning approach is similar to that advocated in APEC's FSCF PTIN Laboratory Competency Strengthening Initiative where relationship building is a key part of sustainable technology transfer. Figure 9 shows a suggested framework for sustainable technology transfer based on the twinning approach. A key aspect is evaluating whether the candidate country/laboratory is suitable for receiving the training i.e. are the correct conditions in place to facilitate the desired training outcome? A combination of remote and in situ training (of the trainers) transfers the vision of a competent laboratory to the trainee, and establishes the links that will be needed to sustain personal scientific development in food analysis. Training outcomes are validated through external proficiency and through a final evaluation of the training process.

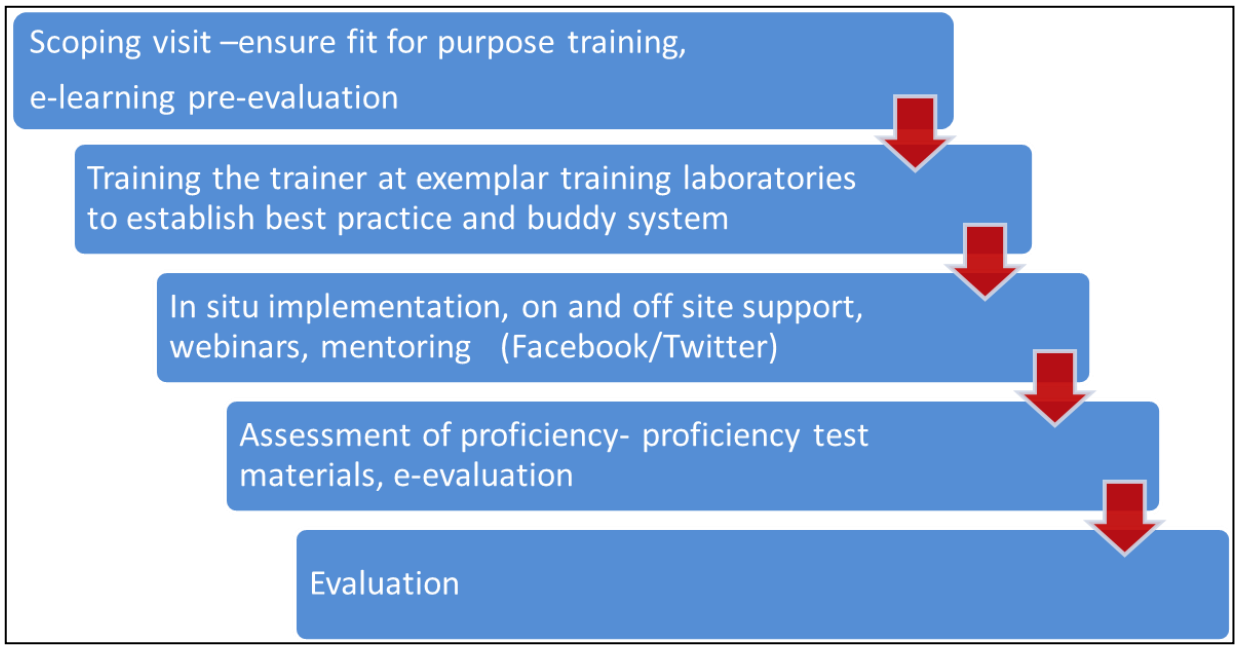


Fig 9 An effective sustainable technology transfer framework for training in food analysis for food safety using a combination of e-tools, remote and in situ training and mentoring.

2.6 The role of the public and private sector laboratories delivering services in support of National food safety standards: case studies

Some of the present capacity building initiatives and strategies for Laboratories are given below:

- APEC FSCF PTIN Laboratory Competency Strengthening Initiative (2013)
- FDA's International food safety capacity building plan (2013) and ongoing assessments through the USDA/FAS programming and their STAG laboratory group.
- Embedding crop pest risk management and surveillance into commercial and community practices for a more secure farming and food future: a case study for east Africa. https://www.agriskmanagementforum.org/ (2013)
- SPS compliance; a requisite for agro-industrial exports from developing countries. UNIDO'S Trade Capacity building programme, V.07 87831, Nov (2007)
- EU training programmes including collab4safety, EDES http://edes.coleacp.org/en/edes/page/20330-introduction and Better Training Safer Food http://ec.europa.eu/eahc/food/about.html
- Private sector participation including consultations through the IFSTL, Waters Corp., Abbott, EcoLab and others and including assessment of their in-house training resources and availability

Most of these initiatives are publically funded either nationally, internationally, or through Non-Government Organisations such as the EU, UN, and charities. Private sector funding for capacity building is relatively small and limited to large multinational food companies and instrument providers e.g. Mars, Waters Corp.
In contrast there is considerable private sector funding of private sector laboratories in order to facilitate trade. Private laboratories in developing countries are often the "first adopters" as they have clear financial objectives and purpose.

2.7 Case Studies

The following case studies from Africa are given to some indication of the issues associated with the establishment of effective food safety monitoring laboratories in countries where there are significant resource gaps. The role of the private sector laboratories in these case studies illustrates the growing interface between public and private labs delivering services in support of national and international food safety standards

Case study 1

A Government Fisheries Laboratory

- Lack of laboratory management with sufficient technical expertise and leadership
- Not accredited to ISO 17025
- No embedded quality system
- Poor electrical power supply
- No quality control checks on results
- No participation in proficiency test schemes
- No financial control with no separate budget and accounts
- No clear purpose for the laboratory with no link to the food inspection and sampling process resulting in very small sample numbers
- Lack of spares and maintenance for key equipment
- Critical reagents such as media not available
- No microbiology reference organisms
- IT problems with corruption of data and files
- No effective validation of methodology
- No access to international methods
- Extremely convoluted and lengthy procurement process (reagents are out of date by the time they are delivered)
- The laboratory is not financially sustainable and not fit for purpose

This case study emphasises the need for the correct economic and political drivers to be in place as well as basic infrastructure before technology transfer can take place that will deliver the required sustainable training outcomes.

Case study 2

Public laboratory moving into public/private partnership

- Offers food inspection services to ISO 22000
- Partnership with SGS a global Certification and Testing Body
- Wide range of both private and government customers
- Laboratory accredited to ISO 17025
- Well run embedded Quality System in place
- Good laboratory environment
- Well maintained general equipment but clear knowledge gap in use and maintenance of instrumental equipment
- Adequate supply of reagents and reference materials including microbiological reference organisms
- Some equipment failures due to lack of spares and service agent interventions
- Very good quality food microbiology testing but very limited trace level analysis expertise covering pesticides, mycotoxins and veterinary drugs
- In the process of procuring key new equipment including LC-MS/MS instrumentation but no knowledge base for the operation of such equipment
- Food safety training carried out in India and South Africa
- ISO Standard methods used for microbiology
- No waste management policy and procedures
- No LIMS implementation
- Move away from Government to private sector funded organisation
- Good level of control of budget and effective management of resources
- Simple procurement pipeline with good delivery times for consumables
- 7 day a week working pattern for efficient service delivery

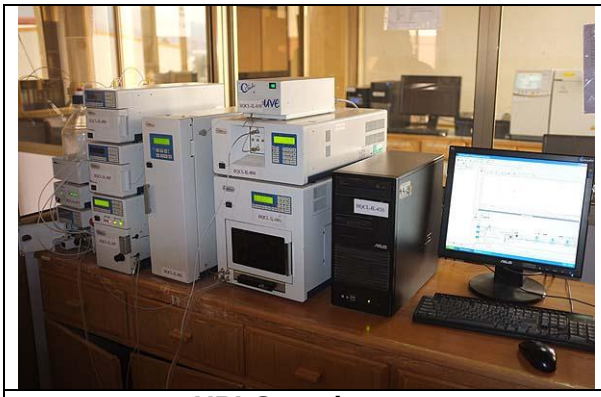
The laboratory is a federally owned public enterprise governed by the Ministry of Science and Technology. It services both public and private sectors. There is a very clear role for the laboratory in supporting both the food industry and food enforcement. The staff are very proactive and are looking to improve their methodology and are procuring LC-MS. They are a good candidate for twinning and for eventual internal technology transfer within the country and region (“train the trainers”).

New automatic Kjeldhal system	New HPLC system for aflatoxin analysis

Case study 3 Private laboratory

- The Laboratory facilities at a food supplement production plant are comprised of chemistry and microbiology laboratories. There has been a long established management structure in the laboratory with clearly defined Technical Management and Quality Manager roles. The laboratory is also a member of the country's Laboratory Association. A 5 story private laboratory, training and conference centre is being developed and will offer a wide scope of food testing services.

- Established food chemistry and microbiology laboratory in support of enriched and infant food production plant
- Laboratory accredited to ISO 17025
- Good laboratory environment
- Good supply of regents and reference organisms
- Good macro analysis expertise but very limited trace analysis knowledge
- Waste disposal policy and procedures not developed
- New instrumentation being purchased but this did not include LC-MS/MS at the time of the visit



HPLC equipment

Chemistry area

The planned new laboratory

Potentially a very effective laboratory service with what appeared to be very good links with food producers and distributors. The new establishment could also act a regional training centre.

These case studies indicate that public and private laboratories can both be the targets for technology transfer, as it is having the correct drivers for sustainable change that is of prime importance rather than whether the laboratory is public or private.

2.8 Key food legislation and the related analytical methodology

As described in sections 2.3 & 2.4, the scope of the training requirements for food testing is quite clear and similar for most testing laboratories around the world involved in compliance testing. The exact description of the methods differs widely however, particularly with the advent of methods criteria that are now being used within international standards e.g. EU, Codex. Method criteria-based legislation/standards permit the use of any method that fulfils the method performance criteria. It is unrealistic therefore to try to document all of the variants of potential methodologies. Some official method descriptions do still exist in vertical legislation describing commodity standards within EU and Codex, but these are only used for reference purposes with "equivalent" screening methods being employed on a routine basis. Annex A describes some of the relevant EU legislation and associated reference methodology. In many cases (especially more recent legislation) use is made of method criteria rather than prescriptive method descriptions.

Some of the sources of official methods are:

- National legislation within each country – the US being the most significant in terms of trade
- NGO's e.g. European Union, Codex Alimentarius, ISO, CEN, OIV
- Industry standards – a large number of methodologies are identified through the various industry standards for commodities as well as proprietary standards and methods within the private sector.

An example of some of the major sources of methods and related standards is provided in Annex A, the list is not exhaustive. A more detailed examination of the composition of some EU standards is provided to demonstrate the sheer complexity of the international standard/method matrix.

3 Conclusions

- Laboratory testing of the compliance of food safety components of the food chain with national and international standards is an essential component of a food safety system.
- In developing countries drivers for developing a food safety system are usually derived from the external market primarily to facilitate international trade.
- In the absence of suitable economic and political drivers, capacity building in such countries is very difficult; case studies have been provided from 3 laboratories in Africa that illustrate this point.
- Laboratory capacity building in developing countries is primarily facilitated through public/NGO/charity training programmes with a limited number of suppliers.
- Data is available from 25 training organisations on their programmes in training in food analysis.
- Most of the training programmes consolidate around two major types of food analysis: chemical contaminants and food pathogens
- References to those organisations that have compendiums of methods of analyses are provided: the number of individual methods is too large to be practical to index on an individual basis
- Capacity building should focus on training outcomes rather than outputs: a framework is proposed in order to provide sustainable competence in food analysis and exploit the e-tools that are now available

4. Acknowledgements

The authors would particularly like to thank the following for their help in the compiling and data gathering of the information in this report:

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Julian Smith (Fera)

Annex A Examples of international standards and sources of methods of analyses

European food safety legislation

General food safety framework		
Region	Legislation	Scope
EU	Regulation (EC) 178/2002	General principles and requirements of food law
EU	Regulation (EC) 882/2004	Official controls performed to ensure the verification of compliance with food and feed law, animal health and animal welfare rules
EU	Regulation (EC) 854/2004	Specific rules for organisation of official controls on products of animal origin intended for human consumption
EU	Regulation (EC) 315/93	Prohibits the marketing of foodstuffs containing an unacceptable amount of residual substances

Analyte	Matrix	Legislation	Scope	Key analytical methodology
Microbiological pathogen contamination	Foodstuffs	Commission Regulation (EC) No 2073/2005	microbiological criteria for foodstuffs lays down food safety criteria for certain important food borne bacteria, their toxins and metabolites, such as Salmonella, Listeria monocytogenes, Enterobacter sakazakii, staphylococcal enterotoxins and histamine in specific foodstuffs	ISO food microbiological methodology
Pesticides	Food and	Regulation (EC)	Maximum residues in or on food and	EU CEN 15662 QuEChERS Method

	feeds	396/2005	feed of plant and animal origin establishing maximum residue levels (MRLs)	using dispersive sample preparation and Gas Chromatography(GC)-Mass Spectrometry(MS) and Liquid Chromatography(LC)-MS/MS covering 300 or more active ingredients
Veterinary drugs and growth promoters	Foodstuffs of animal origin	REGULATION (EC) No 470/2009 with laboratory performance criteria for validation of methods in Commission Decision 2002/657/EC and amendments Commission Decision 2003/181/EC and Commission Decision 2004/25/EC	Lays down Community procedures for the establishment of residue limits of pharmacologically active substances in foodstuffs of animal origin	Broad-spectrum bioassays used routinely screen urine, milk and kidney for the presence of antimicrobial agents with specific bioassays used for quantifying residues of antibiotics Instrumental methods utilising LC-MS/MS used to confirm and quantify residues.
Mycotoxins (aflatoxins, ochratoxin A, patulin and fusarium)	Groundnuts, nuts, spices, processed cereal based foods and baby foods for infants and small children, cereals, dried vine fruit, coffee, wine, apple juice, cereals and cereal products	Regulation (EC) 1881/2006	setting maximum levels for certain contaminants in foodstuffs	Solvent extraction and clean-up with thin layer chromatography (TLC) and LC
Heavy metals	Milk, infant	Regulation (EC)	setting maximum	flame atomic absorption spectrometry (FAAS),

(lead, cadmium, mercury)	formulas, meats, vegetables, fruits, fats, oils, wine, fish, cereals, canned baby food and infant formula	1881/2006	levels for certain contaminants in foodstuffs	graphite furnace atomic absorption spectrometry (GFAAS), cold vapor atomic absorption spectrometry (CVAAS), inductively coupled plasma atomic emission spectrometry (ICP-AES), and inductively coupled plasma mass spectrometry (ICP-MS)
Nitrates	Spinach, lettuce, processed cereal based foods and baby foods for infants and small children	Regulation (EC) 1881/2006	setting maximum levels for certain contaminants in foodstuffs	high performance liquid chromatography (HPLC)
Monochloro-propane-1,2-diol (3-MCPD)	Hydrolysed vegetable protein, soy sauce	Regulation (EC) 1881/2006	setting maximum levels for certain contaminants in foodstuffs	Gas chromatography mass spectrometry
Dioxins and dioxin-type PCBs	Meat and meat products, eggs, fats and oils	Regulation (EC) 1881/2006	setting maximum levels for certain contaminants in foodstuffs	Isotope dilution gas chromatography high resolution mass spectrometry
Polycyclic aromatic hydrocarbons (PAH)	Oils and fats, smoked meats and smoked meat products, smoked fish	Regulation (EC) 1881/2006	setting maximum levels for certain contaminants in foodstuffs	Gas chromatography mass spectrometry
Inorganic tin		Regulation (EC) 1881/2006	setting maximum levels for certain contaminants in foodstuffs	inductively coupled plasma mass spectrometry (ICP-MS)
Packaging		EU Framework Regulation EC 1935/2004	general requirements for all food contact materials	
Biological toxins	Seafood	Commission Decision	laying down detailed as regards the maximum levels and	methodologies based on biological assays (citotoxicity, etc.) and

		2002/225/EC	the methods of analysis of certain marine biotoxins in bivalve molluscs, echinoderms, tunicates and marine gastropods.	LC-mass spectrometry (LC-MS/MS)

International standards for foods and food analyses

Codex Alimentarius lists over 300 Standards. These and the associated methods can be found at http://www.codexalimentarius.org/standards/list-of-standards/

FDA standard methods can be found at http://www.fda.gov/Food/FoodScienceResearch/LaboratoryMethods/default.htm

CEN standards and methods can be found at https://www.cen.eu/Pages/default.aspx

ISO methods can be found at http://www.iso.org/iso/home.htm

AOAC International http://www.aoac.org/imis15_prod/AOAC/Publications/Official_Methods_of_Analysis/About/AOAC_Member/Pubs/OMA/AOAC_Official_Methods_of_Analysis.aspx?hkey=ccc1fa5c-3e0f-4f76-87ab-1604b266f9df

AOCS http://www.aocs.org/Methods/index.cfm

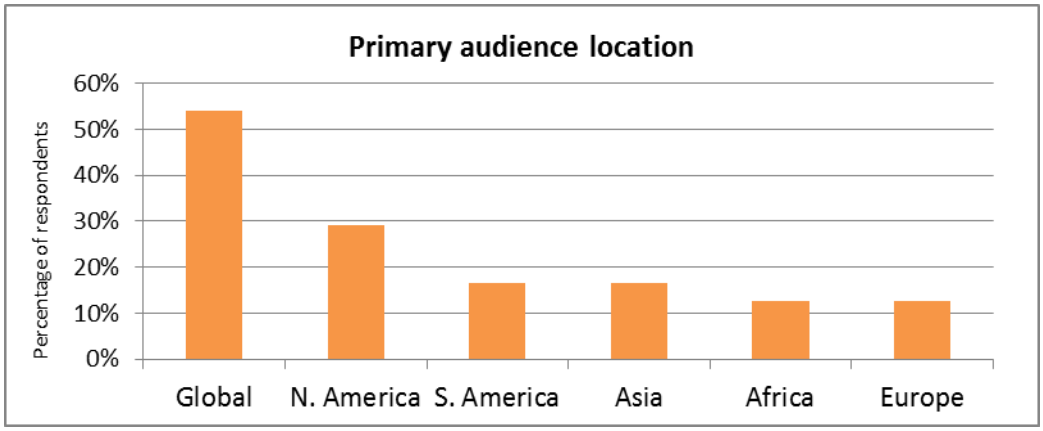
OIV http://www.oiv.int/oiv/info/enmethodesanalyses

IOC http://www.internationaloliveoil.org/estaticos/view/224-testing-methods

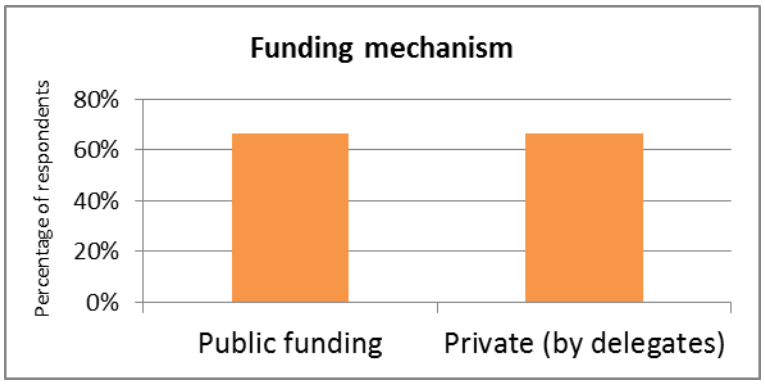
ANNEX B Global Food Safety Partnership: Mapping Exercise of Analytical Training Provision – Results Summary

Number of respondents - 25

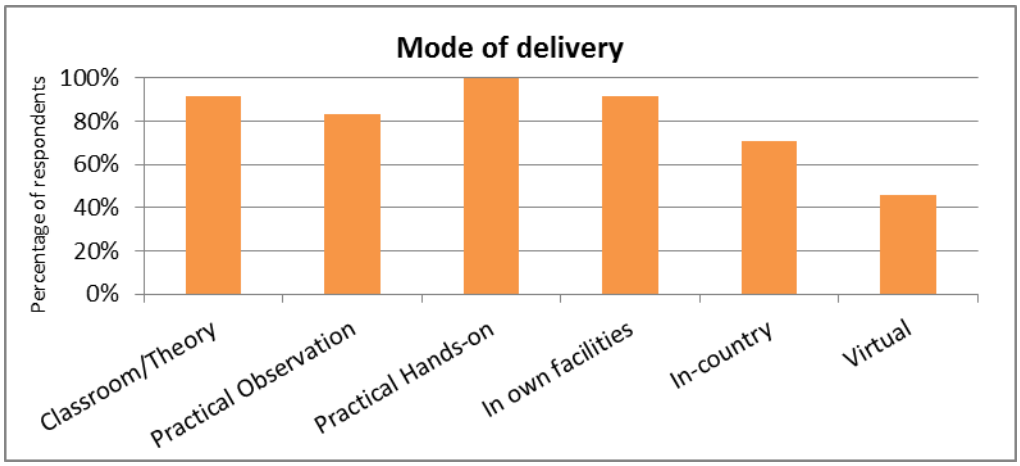
1 Primary audience location



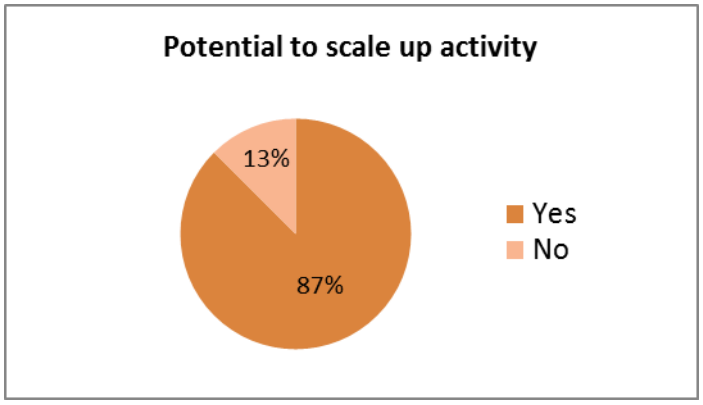
2 Funding mechanism



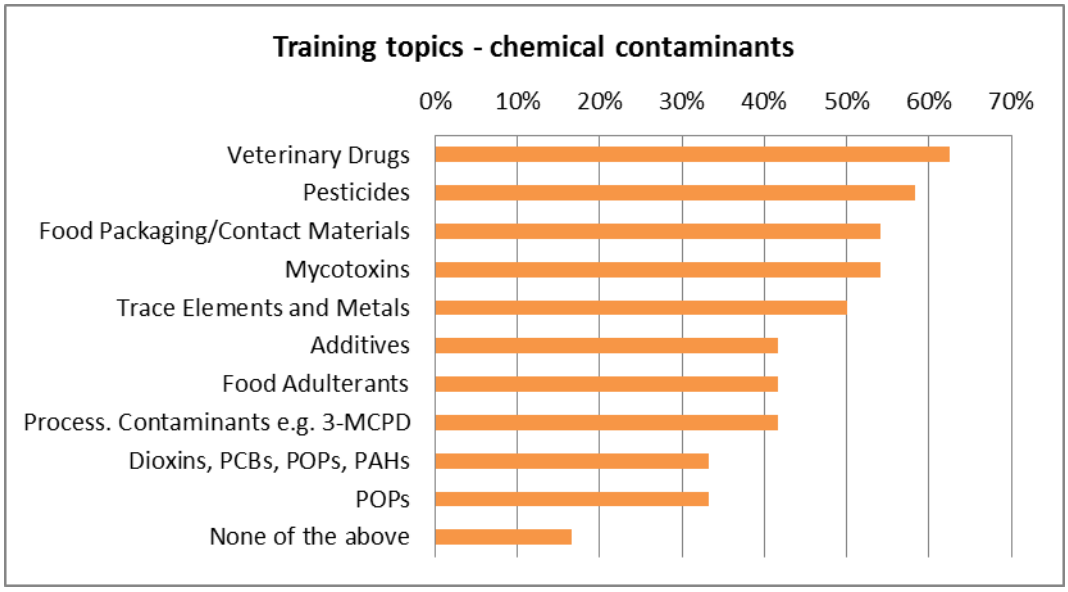
3.Mode of delivery



4. Do you offer potential to scale up activity?



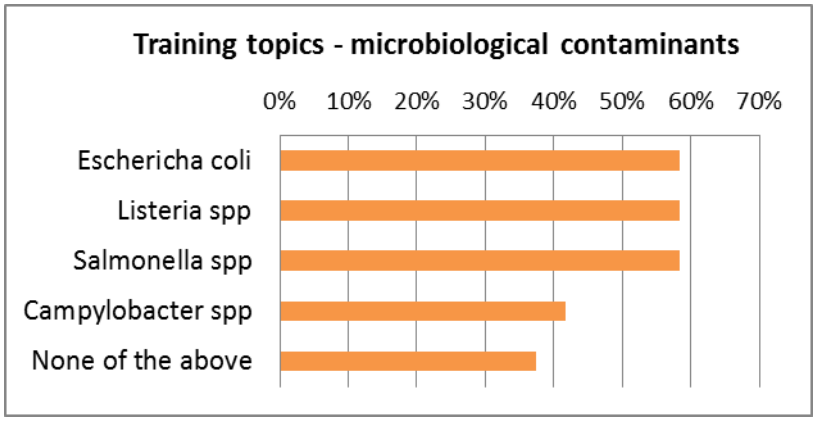
5. Training topics – chemical contaminants



Other:

- Biotoxins, Aflatoxins, Benzypren
- Full water analysis (WHO/EPA), Gas contaminants (CO2/N2,Air), Nutritional Panel
- Hormones and growth promoters in general, endocrine disrupting compounds

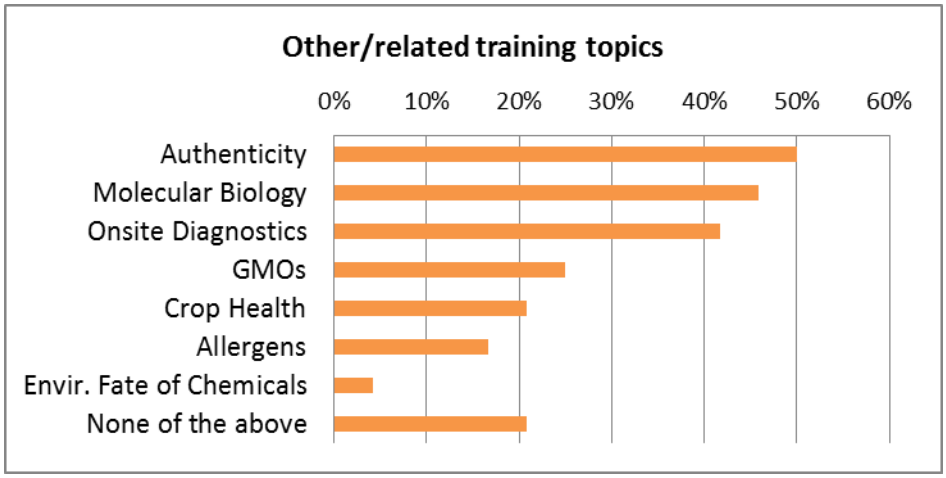
6. Training in microbiological contaminants



Other:

- Staph aureus, vibrio, bacillus spp., clostridium, etc.
- Toxinogenic fungi
- TVCs
- VTEC, MRSA
- Vibrio

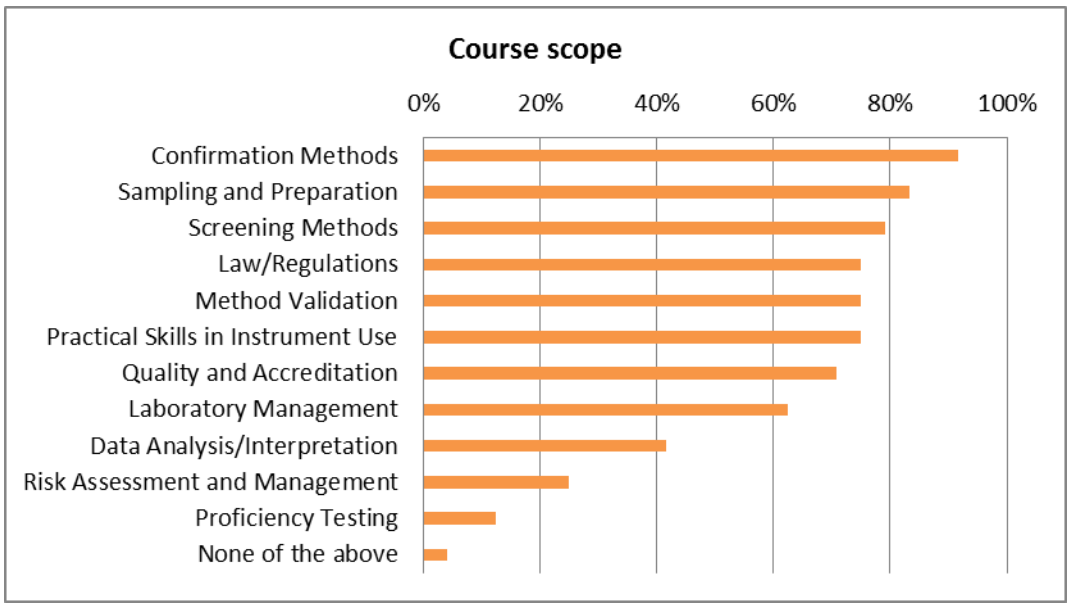
7. Other/related training topics



Other:

- SPS procedures; ISO-17025 implementation; laboratory set and operation; biosafety and biosecurity
- Bioinformatics
- Botanicals
- estimation of uncertainty; reference materials
- Food fraud, microscopy
- HACCP, quality
- Human nutrition
  Toxicology
  Zoonoses
  Microbiological criteria
  Outbreak investigation
  Sensory science
  International standards
- Metabolomics
- Microscopy; Nanoparticles; Marine biotoxines; chain management; growth promoters; laboratory safety
- Feed Industry Definitions and Virtual Feed Mill; Sanitation (levels 1 and 2); Food Safety in Retail Establishments; Virtual Tour of a Food Manufacturing Facility; Layer Management Systems (about the different management systems in the poultry industry); Specialty Eggs; Certified Aquaculture Professionals courses.

8. Course scope



Other:

- PT Schemes Advice
- Sensory evaluation, monitoring exposure

Summary of Individual responses

Name of organisation	Examples of potential to scale up activity	Particular challenges/barriers to training provision faced	Additional comments
Análisis Técnicos, SA de CV (AGROLAB MEXICO)	Increase in training capacity with new rooms and space.	Some updates in instruments and training in the latest technologies for some of the trainers are needed.	'We are already receiving people from Costa Rica for LC/MSMS QQQ training and from Panama this September for ICP and ICP/MS'
Auburn University Food Systems Institute (AUFSI)/Virtual Food Systems Training Institute (VFSTC)	Working with FDA, we are in the process of creating numerous online training courses at various levels that will make it easier for inspectors to receive critical training at a lower cost for state and local governments. This project is ongoing, and there will be more training created over time. The training will be available to inspectors of FDA-regulated foods at no cost; in the future, we intend to make this training available to industry and other interested parties for reasonable fee. Because the FDA regulates so much of the food that is imported into the U.S., we expect to eventually have an international audience for our online training, consisting of exporters of produce and seafood whose product is coming to the U.S.	N/A	'Because we bring together faculty ("subject matter experts") from various disciplines, we are able to design customized training.'
Cirad	Creation of food safety agencies in developing countries.	Little awareness of governments of health safety. No national regulations. National legislation poorly enforced.	N/A

		Internal Trade undemanding food safety.	
Crawford Scientific	'We regularly use consultants to handle with increased workload. Crawford Scientific currently have 5 people capable of delivering training (1 full time trainer).'	On some period of high training demand, our calendar can be filled very quickly and our lead time can be 2 to 3 months in some occasion. This would also apply if you require customised courses - this would require a minimum of 2 month for the production of customised material.	N/A
Dept. IFA-Tulln, University of Natural Resources and Life Sciences, Vienna - Mycotoxin Summer Academy	Capacity is limited to 15 persons as 3 mass spectrometers are used for training. Max 5 persons are suitable at one time in front of the instrument. The most feasible scale up is to provide more than 1 course per year.	As the course is announced as a non-degree studies of its own, bureaucratic challenges for the participants arise. E.g. study certificates have to be translated to English or German to be accepted by the university.	N/A
Dianova and National Food Institute, DTU	We are engaged in several EU funded food safety capacity building projects in ACP countries. We plan to extend our involvement in capacity building further establishing cooperation with other relevant international organizations.	Significant interests from candidates in Asia, South America and Africa, but such are reliant on funding to support participation in training.	N/A
EAS Consulting Group	EAS would develop a curriculum to meet the needs of the target laboratories. We would pilot test the training and then scale up to present whatever number of sites needed. At the present time we anticipate being able to conduct 12, 2-day seminars per year with current staffing. Additional seminars could be considered with the addition of new consultants.	The extent of travel and possible language barriers if many foreign laboratories are involved.	N/A
Fera IFSTL	Working in partnership with JIFSAN IFSTL – plans to extend IFSTL network further establishing strategically located training labs internationally. Capability and interest to explore additional modes of delivery and post-course support through virtual and physical networks.	Significant interest from African-based candidates but such are reliant on securing grants/funding to support participation in training.	N/A
Ghent University - Laboratory of Food Analysis	Currently up to ± 10 scholarships per year are granted (= financed by the government) while capacity is between 20– 30. • The facility for theoretical lessons is OK, but practical session limits number of	Funding mechanism limits the number of scholarships • Selection of the appropriate (10 -15) candidates is a	The need for this kind of training is

	participant	difficult and time consuming as more than 500 applications are received yearly.	enormous which can be seen from the number of applications received yearly.
Health Canada and Canadian Food Inspection Agency (CFIA)	No scaling up.	Health Canada and the Canadian Food Inspection Agency only provide training on an ad hoc or as needed basis primarily to food industry, provincial or foreign governments for specific government initiatives or as requested by other governments through official channels.	Expenses are normally not responsibility of the Gov. of Canada and are normally the responsibility of the attendees.
IAEA (Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture)	Inter-regional 'train-the-trainers' workshops and for individual fellowship training could be up-scaled given sufficient funding, through additional training workshops, group training focusing on common themes, increased duration of courses etc. In conjunction with a formal food safety/quality laboratory network initiated by IAEA in Latin America/Caribbean, the RALACA, the potential exists to greatly enhance the training in analytical techniques for food safety through national and regional training courses and exchange of scientists between countries/institutes.	The main barrier to provision of training is budgetary. The Joint Division focuses its training on developing country institutes and depends largely on a very limited regular budget, and extra-budgetary funding for complete or partial sponsorship of most trainees.	N/A
ICT Prague (Institute of Chemical Technology)	Any of topics included in the training course on ´Strategy Of Natural Products And Food Analysis: Quality, Safety And Authenticity´ can be outlined in more details and trained separately, depending on the trainees´ requirements.	N/A	N/A
Iowa State University	more delegates per course; more days	N/A	N/A
Jane Weitzel	1) Use existing information: A large amount of information is already available on the net from respected and legitimate organizations, such as the United States Pharmacopeia. This can be easily	The challenge faced the most is being able to meet all the training requests. The ability to work with an organization to	'In addition I provide individual

	organized as the base for on-line training. With a little additional work, the training could be made interactive and self-directed. 2) Use existing training technology and the understanding of how adults learn to make the courses interactive. 3) Use both verbal and written training delivery. Using these two techniques reaches both those people who learn by hearing and those who learn by reading or for whom English is a second language.	expand the training, especially through internet based training, would greatly help meet the training needs of today.	training for labs, especially those working towards accreditation to ISO 17025.'
Key Laboratory of Control Technology and Standards for Agro-product Safety and Quality, Institute of Food Safety, Jiangsu Academy of Agricultural Sciences	No scaling up.	N/A	N/A
Laboratory Capacity Development, Inc.	N/A	N/A	N/A
LGC	Our courses and training events could be scaled up considerably if required and also delivered via webinar	N/A	N/A
Oniris (Laberca)	- Pursue the organisation of SARAF/LABERCA organised training courses. - Apply to potential future calls for tenders. - Overseas training classes (5-10 experts sent) - On-the-spot missions (2 expert teams sent)	Lack of funding means for participants mainly from third countries origins and even more from developing countries	N/A
Pennsylvania State University	Need more faculty/instructors to teach; outgrowing existing space - need more lab space to teach.	Lack of faculty and/or instructors to teach; lack of space for growing student population	N/A
Ranck & Associates	Classroom training could be expanded to offer more seats per session to a maximum of 25 persons. Hands-on and other practical offerings could be expanded by offering more sessions	N/A	N/A
RIKILT Wageningen UR	Within RIKILT we have several training teams with specific and different expertise, which means that at all times teams are	We receive many requests for training courses from different organisation in the	N/A

	available for requested training courses in house and on location. We have contacts with other laboratories that can be requested to carry out a training course.	world, therefore we offer through the year 3 or 4 periods for several training courses. If possible (depending on the demand and skills of the trainees) we combine the different training requests into one training course	
The Coca-Cola Company	Facilities have been designed with both testing capacity growth and capability in mind. Each location has training facilities on site for the primary purpose of holding both theory and practical sessions with our bottling partners. Ability to scale up is possible with appropriate funding for resources. Virtual content critical to sharing broader analytical messages. Currently we have basic microbiology and sensory testing modules in place and available through a global training portal. Under development are courses in Lab safety and good laboratory practices for day zero associates (induction before entering lab). Should be complete by year's end. All virtual courses are available in 6 languages (English, Chinese, Portuguese, Spanish, Japanese, French). Practical courses are being delivered in Chinese, Japanese, English, and Spanish.	Our internal challenges at TCCC are size and scale to reach all worldwide associates (15,000 people performing tests each day from basic wet chem/physical testing /micro, to advanced testing. Given global presence, not every person can come to one of our centers for more advanced training (costs are inhibitive). We have travelled to remote locations (e.g. Africa, Middle east) for microbiological and sensory training and things are difficult there. We are reviewing potential for more webex seminars, IPAD training etc. for connectivity as virtual only works well if you have a good internet connection.	N/A
University of Georgia	1. Using teaching labs at UGA Food Science Department to train more delegates. 2. Dr. Alali has experience in conducting microbial food safety training in-house (UGA) and out-house (internationally at laboratories of government and academic institutions such as China, Vietnam, Colombia, and Guatemala)	1. Time set for training in house has to be arranged in a way that does not interfere with current research projects at the Center for Food Safety-UGA. 2. Translators are needed for delegates who do not speak English very well. 3. Cost of the training should be provided.	N/A
USDA – ARS	No scaling up.	Research as a primary mission, training is an extracurricular activity.	N/A

Annex C Global Food Safety Partnership: Questionnaire template

(adapted into word for this report)

1. About You/Your Project

Your name
Organisation and/or
Project
Country
Contact email

2. Territory

Please identify where your primary audience is based. Please select all that apply.
Africa
Asia
Australasia
Europe
North America
South America
All – Global

3. Who is your primary audience?

Please specify all that apply e.g. Industry, Government, Academia

4. Current Funding Mechanism for Training Delivery

Please select one/both as applicable
Public Funding
Private (by delegate/s)
If public, please specify provider*

* *Answering this is optional.*

5. Mode of Delivery

Please select all that apply
Classroom/Theory
Practical: Observation
Practical: Hands-on
In own training facilities
In-country
Virtual

6. Current capacity

Please specify total/average training days p/a (max. no. delegates x no. courses)
Do you offer the potential to scale up activity? Yes
No
If yes, please offer examples e.g. more delegates per course, increase no. of days, introduce new modes of delivery?*
* *Answering this is optional.*

7. Training Topics

Please select all contaminants y.ou are able to offer training in
Chemical Contaminants Additives
Food Adulterants e.g. Illegal Dyes, Melamine
Food Packaging/Contact Materials
Dioxins, PCBs, POPs, PAHs
Mycotoxins
Pesticides
Processing Contaminants e.g. 3-MCPD, Acrylamide,

Furan, HMF
POPs

Trace Elements and Metals e.g. Arsenic, Iodine,
Cadmium
Veterinary Drugs
None of the above
Other (please specify)
and/or specific
analyte/matrix*
* *Answering this is optional.*

Microbiological contaminants Eschericha coli
Campylobacter spp
Listeria spp
Salmonella spp
None of the above
Other (please specify)
and/or specific
analyte/matrix*
* *Answering this is optional.*

Other/related Allergens
Authenticity
Crop Health
Environmental Fate of Chemicals
GMOs
Molecular Biology
Onsite Diagnostics
None of the above
Other (please specify)
and/or specific
analyte/matrix*
* *Answering this is optional.*

8. Course Scope

What areas are you able to offer training in? Please select all that apply.

Sampling and Preparation
Screening Methods
Confirmation Methods
Data Analysis/Interpretation
Laboratory Management
Law/Regulations
Method Validation
Practical Skills in Instrument Use
Proficiency Testing
Quality and Accreditation
Risk Assessment and Management

None of the above
Other (please specify)*
* *Answering this is optional.*

Please specify any post-training support you offer*
* *Answering this is optional.*

9. Particular challenges/barriers to training provision you may currently face

Please outline *
* *Answering this is optional.*

10. Any other comments you may wish to make

Please outline

*

* *Answering this is optional.*