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INVITED REVIEW

Future topics of common interest for EU and SEA partners in food quality, safety and traceability

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Abstract

SEA-EU-NET project is based on the program Capacities under the 7th Framework Program (FP7) of the EU Commission with the strategic objective of Integrating and Strengthening the EU-ASEAN Science and Technology Dialogue through coordination and supporting activities. It is a 4 years program started in January 2008, and is currently supported by 22 institutions from Europe and South-East Asia. The objective is to increase the quality, quantity, profile and impact of bi-regional Science and Technology cooperation between the 10 ASEAN countries and the Members and Associated States of the European Union. Every Thematic Priority of FP7 has to implement dedicated international cooperation activities to achieve the program's goals and to address specific problems of 'Third Countries/Regions' (non-EU Members States or non-Associated States). This activity is performed through the organization of annual Thematic Workshops, with the objective to produce a document containing duly justified proposals for Specific International Cooperation Actions. This paper presents the results of the Thematic Workshop on 'Food Quality, Safety and Traceability'. This expert meeting was done in Thailand in February 2009. Titles for 10

possible themes were identified on the following fields: Bacteria antibioresistance, Mycotoxins, Pathogens (bacteria), Pesticides, Heavy metals, Food traceability, Food Supply Chain, Preserving nutrients, Consumers attitudes, Peri-urban markets.

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Introduction

The SEA-EU-NET project is based on the program Capacities under the 7th Framework Program (FP7) of the EU Commission with the strategic objective of 'Integrating and Strengthening the EU-ASEAN Science and Technology Dialogue through coordination and supporting activities' (http://www.sea-eu.net). Started on January 1, 2008, it is a 4-year program, and is currently supported by 25 key Science and Technology (ST) institutions (17 participants and eight additional members of the steering board) from UE and SEA.

The objective of SEA-EU-NET is to increase the quality, quantity, profile and impact of bi-regional ST cooperation between the 10 member countries of the Association of SEA Nations (ASEAN) and the Members and Associated States of the European Union (EU). In particular, a specific objective is strengthening the participation of SEA-partners in the FP7.

One key activity of SEA-EU-NET is therefore to support Specific International Cooperation Actions (SICAs) in the Thematic Priorities of the 'Cooperation' part of FP7. Indeed, every FP7's Thematic Priorities have to plan and implement dedicated international cooperation activities to better achieve the program's goals and to address specific problems of 'Third Countries/Regions' of interest to the EU as well. Consequentially there is great interest to identify topics of common interest with regards to SEA partner countries, where both EU and SEA partners will benefit from cooperation. In this context, it is important to provide validated input to the Program Directorates on the ST potentials of SEA and research topics of mutual EU–SEA interest while at the same time considering the specific needs of the partner countries.

This activity is performed through the organization of several Thematic Workshops on an annual basis, with the objective to produce a document containing duly justified proposals for SICAs. This paper gives the key topics for cooperation corresponding to FP7's Thematic Priorities. It is expected, that some of the proposed topics will be included in the revisions of the Thematic Work programs through SICA activities, dedicated to SEA.

This paper summarizes the outputs from an expert meeting organized on February 24–27, 2009 at the Asian Institute of Technology (AIT), Bangkok, Thailand to tackle the thematic issue 'Food Quality, Safety and Traceability.' Organized by CIRAD (France) and AIT (Thailand), the workshop gathered 33 invited experts from 11 countries. The specific objectives of this expert meeting were to take stock of existing and planned research projects in food safety and identify mid- to long-term research issues which could be taken-up by EU and SEA due to the international dimension of the topics.

The expertise fields were: Bacteria antibioresistance, Mycotoxins, Pathogens (bacteria), Pesticides, Heavy metals, Food traceability, Food Supply Chain, Preserving nutrients, Consumers attitudes, Socio-economics, Peri-urban markets and food supply chain.

ASEAN Food Safety Improvement Plan (AFSIP) and European research objectives

The Regional Office for SEA of the World Health Organization (WHO) formulated a 10-point strategy for enhancing food safety in the SEA Region. This strategy includes a strong component to support a coordinated, approach to food safety research (WHO, 2004). Food safety is a major concern for ASEAN in administering the food chain and has been identified as one of the priorities of the Sub-Committee on Food Science and Technology in the ASEAN Plan of Action on ST (http://www.astnet.org).

The ASEAN Vision 2020 envisaged 'a stable, prosperous and highly competitive ASEAN Economic Region in which there is a free flow of goods, services and investments, a free flow of capital, equitable economic development and reduced poverty and socio-economic disparities.' This led to the establishment of ASEAN Food Safety Policy and an ASEAN Framework on Food Policy as part of a comprehensive program of action to

address the impact of globalization and trade liberalization. In parallel, the AFSIP was developed to take into account scientific and risk-based approach of both programs. Food Safety encompasses from 'Farm to Table (fork)' whose responsibilities are shared by industry, consumer and government. The responsibility of the industry is to produce safe food. On the other hands, the government has to provide:

(i) good environment for production of safe food and to ensure that food safety requirements are enforced by monitoring, surveillance and expertise; (ii) source of reliable and correct information.

- Information to consumers to help them to make the best food choice and to prepare their food correctly.

The objectives of the AFSIP are:

- To strengthen the food control system from Farm to Table with the involvement of stakeholders.
- To increase the level of credibility and competency of regulatory authorities.
- To enhance the industry and consumer awareness, and participation in food safety.
- To coordinate ASEAN common positions in international fora, as and when appropriate.
- To facilitate the alignment of member countries' food safety policies with obligations under the WTO Sanitary and Phytosanitary Agreement and Technical Barrier to Trade Agreements.
- To facilitate the harmonization of national regulatory standards with Codex standards.

Strategies of AFSIP are defined in four components: (i) to coordinate and integrate food safety activities of ASEAN; (ii) to engage international organizations or donor countries to mobilize resources for the implementation of the Plan; (iii) to promote the sharing of resources including technical expertise among ASEAN Members countries; and (iv) to use the mechanism of cost sharing as a modality for implementing priority projects. The program of the AFSIP contains 10 components with existing and proposed activities. These 10 components are the baseline to identify mid- to long-term research issues that could be undertaken eventually by ASEAN.

In Europe, the European Community addresses the Knowledge-Based Bio-Economy (KBBE). The KBBE will play an important role in a global economy, where knowledge is the best way to increase productivity and competitiveness and improve the quality of life, while protecting the environment and social model. The KBBE addresses the following needs:

- growing demand for safer, healthier, higher quality food;
- sustainable use and production of renewable bio-resources;
- increasing risk of epizootic and zoonotic diseases and food related disorders;
- sustainability and security of agricultural, aquaculture and fisheries production;
- increasing demand for high quality food, taking into account animal welfare, rural and coastal contexts, and response to specific dietary needs of consumers.

The KBBE aims at supporting various EU policies and strategies such as the Renewed Sustainable Development Strategy, the Green paper on adaptation to climate change, the Strategic Energy Technology Plan, the Integrated Maritime policy, the Revision of EU strategy for sustainable aquaculture, the Animal Health Strategy, the Strategy on nutrition, overweight and obesity-related health issues, the Organic Farming Action Plan, the Forestry Action Plan and the Common Agricultural Policy Health Check. The KBBE is one of the 10 Thematic Priorities of the 'Cooperation' part of the FP7 of the European Commission. It is organized in the following 3 activities:

Activity 2.1 – Sustainable production and management of biological resources from land, forest and aquatic environments (for micro-organism, plants and animals, sustainable and multifunctional agriculture, forestry, fishery and aquaculture, animal health production and welfare, animal diseases, marine resources, development of policy strategies, etc.).

Activity 2.2 – 'Fork to farm': Food (including sea-food), health and well-being (consumer, societal, industrial and health aspects of food and feed, nutrition, diet related diseases and disorders, innovative food and feed processing, improvement of food quality and safety, etc.).

Activity 2.3 – Life sciences, biotechnology and biochemistry for sustainable non-food products and processes (novel sources of biomass and bioproducts, industrial biotechnology, biorefinery, environmental biotechnology., etc.).

All these activities are open to international cooperation towards reaping the full benefits of internationalization of R&D, contributing to the production of global public goods and further integrating the EU into the world-wide research community. Where possible, the KBBE will contribute to meeting the Millennium Development Goals by 2010 (http://www.undp.org/mdg/).

Participation of SEA countries to the KBBE can be done in several modalities: (i) general opening as all activities/topics of the KBBE (and more generally, of the FP) are open to participation by Third Countries; (ii) targeted opening as some topics encourage international cooperation: the participation of specific Third Countries is particularly welcome and clearly stated in the topic description for consideration by the

evaluators; (iii) SICAs as topics are clearly of mutual benefit (global challenges, problems of shared interest, focus on Millennium Development Goals, etc.) with mandatory participation of some TC-ICPC; (iv) twinning with programs in Third Countries (no twinning program with SEA is known in KBBE).

Methods

For the selection of research topics where both EU and SEA partners will benefit from ST cooperation, the following methodology was used within the workshop:

Ten keynote speakers from EU (five experts) and SEA (five experts) addressed presentations on a wide range of ST issues related to food quality, safety and traceability in UE and SEA, including outcomes from on-going FP7 project and past FP6 projects. Each expert concluded the keynote address with recommendations on the knowledge gaps and research needs identified through their experience and expertise. They also proposed a first list of topics that seemed particularly relevant to EU-SEA cooperation, including some elements of justification. Each proposed topics were then summarized and discussed in plenary session. A selection of 10 most relevant topics has been made following five criteria: (i) relevance of the topic for SEA and added value for EU by targeting to SEA compared with another tropical or sub-tropical region in Africa or Latin America; (ii) pertinence of the topic regarding EU and/or ASEAN policy guidelines and drivers; (iii) recommendations issued from previous EU projects (FP6, on-going FP7 projects or other European projects); (iv) importance of the knowledge gaps and need for research in reference to recent international scientific publications. Finally, the selected topics were further detailed and discussed in parallel groups. The groups drafted as deliverables the Terms of Reference of the topics following the standards of the Work Program of the KBBE of the FP7.

Results

Possible links between ASEAN research needs and KBBE in food quality and safety

Discussion between experts showed that there are a lot of converging topics between the needs of the two continents and the consumers' health. They focussed on the problems encountered during import-export and tried to find common topics of interest in the following three activities of the KBBE.

Activity 2.1 – Sustainable production and management of biological resources from land, forest and aquatic environments

In this activity, the experts found that aquaculture is the most problematic field focussing on the extensive use of antibiotics and their impact on the bacterial antibiotic resistance. Proposed projects will focus on practical handling to reduce the use of antibiotics in aquaculture and to identify alternatives to the prophylactic use of veterinary drugs and other materials used to increase yield and prevent disease in livestock production and aquaculture.

Another interesting aspect that could be treated by new project could be the reduction of excessive heavy metal (in particular cadmium and mercury) contamination in seafood (e.g. fish molluscs and crustacea) and to model the effects of factors such as heavy metal source and climate change on the prevalence of such contamination both now and in the future.

Activity 2.2 – 'fork to farm': food (including seafood), health and well-being

In this activity, the experts found that reviewing of current rapid and reliable methods could be investigated in the market to study the contribution of mycotoxin contamination of crops (e.g. cereals, vegetables and fruit) in the food chain. It will be necessary to verify their applicability, quantification, sensitivity, in susceptible selected products of relevance of health and trade.

Another field on investigation could be the identification and application of pre- and pro-biotics that could be active on pathogens and/or increase the nutrient absorption. A special focus could be done on pre- or pro-biotics stabilization in the digestive tracts and during storage and transportation.

The development of innovative methods to analyze undesirable or emerging microorganisms by a global and precise system will be interesting for all food chains.

A new field of research could be the quantification of the effect of climate change on food safety. What is the real food safety change and what will be the measures adopted by Human?

Experts proposed also to study the determination of the economic viability of food safety in seafood industry in SEA in order to improve the market access to the EU markets.

Certain risks are greater among the poor people, as inadequate access to potable water and lack of appropriate information on food safety risks. A research could be conducted to generate knowledge to increase the accessibility of safe food by insecure poor people.

Recommendations for highly relevant topics for the Europe and SEA cooperation

This chapter details the outcomes from the different groups of work that wrap up recommendations for topics relevant for international cooperation between Europe and SEA (Table 1).

Table 1 Highly relevant topics for the cooperation between EU and SEA

Title 1	Towards safer and more sustainable use of plant protection agents in SEA countries to meet EU and SEA market needs
Description	The project will evaluate current practices concerning the use of plant protection agents used in the production of crops (e.g. cereals, vegetables and fruit) in SEA. It will identify appropriate best practices for the choice, handling and application of currently available plant protection agents by SEA growers as well as new innovative approaches to the question of reducing pest and disease damage to crops. Data arising from the project should not only be compatible with the needs of both consumers and growers but also assist in informing the setting of maximum residue limits for imported indigenous fruits and vegetables from the region into the EU.
Impact	The European and international added benefit lies in the ultimate adoption of more sustainable agronomic practices by farmers. This will not only reduce any adverse environmental impact and assist in maintaining biodiversity; but also promote the availability of safer food (in terms of reduced residue levels) to both European and SEA consumers. Additionally this will also contribute to improved worker safety by reducing exposure to toxic chemicals. Overall successful completion of the project will help to sustain and promote consumer confidence both locally and in the EU.
Title 2	Improved use of chemical prophylaxis and medication in aquaculture and meat production within SEA countries to meet EU and SEA market needs
Description	The goal of this project is to identify alternatives to the prophylactic use of veterinary drugs and other materials used to increase yield and prevent disease in livestock production and aquaculture. A risk-based approach will be used to evaluate current practices and suggest alternatives which contribute to improved sustainability and animal welfare. This will inevitably involve the development of both alternative animal management strategies and also innovative materials such as pre- and pro- biotics.
Impact	The European and international added benefit lies in the development in new and sustainable strategies for aquaculture and livestock rearing. Inappropriate use of drugs and other chemicals leads to levels of veterinary residues which are unacceptable to the consumer and prohibited by EU law. Development and adoption of practices which are sustainable within the SEA context will contribute to increased consumer (EU and SEA) confidence and safety and reduce barriers to trade. Additional benefits will include a reduced impact on the environment and general food chain through secondary contamination via animal waste, as well as improved animal welfare.
Title 3	Reducing the risk of heavy metal contaminated seafood caught in SEA waters entering the EU and SEA food supply
Description	The project will seek to identify those locations most at risk of yielding seafood (e.g. fish molluscs and crustacea) with excessive heavy metal (in particular cadmium and mercury) contamination and to model the effects of factors such as heavy metal source and climate change on the prevalence of such contamination both now and in the future. In order to be applicable in the market, additional approaches will be required. These will include the development of improved methods of detection and analysis of heavy metal speciation relevant to their toxic effects but also appropriate traceability systems to assure confidence in the supply chain
Impact	The European and international added benefit lies in the identification of those locations at greatest risk of being source of contaminated seafood. An additional benefit will be the development of improved methods of heavy metal analysis which will facilitate improved control and intervention with regard to heavy metal contamination. These developments coupled with an appropriate traceability system will facilitate the more focussed application of limited resources and thus reduced control and intervention costs.
Title 4	Development of sustainable agricultural methods in SEA to reduce heavy metal contamination to meet both EU and SEA consumer needs
Description	The project will review current agricultural practices within the context of their contribution to heavy-metal (arsenic, lead and cadmium) contamination of crops (e.g. cereals, vegetables and fruit). This information will be applied to the development of sustainable strategies appropriate for SEA farmers to reduce the levels of heavy metal contaminants in their crops. It will also be necessary to develop improved methods of laboratory detection and analysis in order to differentiate between those species of heavy metals which are or are not 'bioavailable' and consequently their potential of contributing to a toxic hazard.
Impact	The European and international added benefit lies in the in the development of sustainable agricultural practices capable of being implemented by SEA farmers at all levels of economic development. This will lead to a reduction in heavy metal contamination of crops. Development and adoption of these practices will contribute to increased consumer (EU and SEA) confidence and safety. Additional benefits will include a reduced impact on the environment and general food chain through secondary contamination via manure etc. The development of improved methods of heavy metal analysis will facilitate improved control and intervention practices with regard to heavy metal contamination.
Title 5	Substantiation of rapid methods for the screening of mycotoxins of relevance in the whole supply chain
Description	The project will review current rapid and available methods, being in the market and will appreciate their contribution to the evaluation of mycotoxin contamination of crops (e.g. cereals, vegetables and fruit). It will be necessary to check their applicability, quantification, quantification limits and working range, in susceptible selected products of relevance of health and trade. The project will propose to find tools for monitoring the effectiveness of mycotoxin reducing strategies and procedures and evaluate and validate the effects of handling procedures. Use of GIS methods for predicting the mycotoxins spread could be proposed.
Impact	The increase of confidence in rapid analytical methods for mycotoxin analysis. The European and international added benefit lies in the knowledge in sustainable agricultural practices that conduct to low contamination by fungi.

Table 1 Continued

	To promote small machines to measure mycotoxin rapidly in the field.
	To improve prevention and control strategies and dissemination of rapid techniques.
	Building capacity and knowledge to avoid contamination.
	To improve processing by early detection of the contaminants – fungi or toxin.
Title 6	Promoting and field evaluation (effectiveness) of pre- and pro-biotics for animal production (chicken or aquaculture) avoiding antibiotics uses
Description	The research will focus on identification and application of pre- or pro- biotics that could be active on pathogens and/or increase the nutrient absorption. It will focus on pre- or pro- biotic stabilization in the digestive tracks and during storage and transportation. Propositions have to focus on shelf life of the pre- or pro- biotics and on the healthy action and consumer acceptance (sensory properties, texture and other quality properties . . .). The effect of these new preparations on natural intestine flora will be studied. Synergy between different strains could be studied. New methods for investigation of pro- biotic actions will be proposed. Acceptance by farmer is a compulsory issue. Adaptability of probiotics to animals.
Impact	Improve competitiveness of aquaculture industry while high reduction of chemical antibiotics.
	Reducing antibioresistance due to treatment of natural bacteria from the environment
	Production of large scale stable commercial pre- or pro- biotics.
	Evaluation of knowledge on pre- and pro- biotic effects on animals.
	Stabilization of probiotics strains.
	New methodology for analyzing pre- or pro- probiotic action.
	Knowledge of dissemination of pre- and pro- biotics in the environment.
	Development and adoption of these practices will contribute to increased consumer (EU and SEA) safety. Additional benefits will include a reduced impact on the environment and general food chain through contamination via chemical antibiotics etc.
Title 7	Sensitive global analysis for undesirable microorganisms in the food and feed chain
Description	The research will focus on development of innovative methods to analyze undesirable or emerging microorganisms by a global and reliable system. All kind of multi analysis system will be acceptable. It will also be necessary to develop improved global methods of laboratory detection and analysis in order to differentiate between those species of microorganisms which contribute to toxic hazard.
Impact	Improve the risk assessment along the food and feed chain.
	Impact on public health by improving the conformity to norms of food and feed.
	Increase consumer confidence.
	Improve traceability of microorganisms and their genetic identification.
	Improve the time of analysis for short sell life food.
	Improve analysis in area without lab facilities.
	Reduce the cost of detection.
	Providing system of analysis in poor area.
Title 8	Development of methods and tools to evaluate the impact of climate change on food safety
Description	The project will develop methods and tools to quantify the effect of climate change on food safety. What are the real food safety changes?
	It will permit determining what will be the responses adopted by Humans?
	It will be necessary to develop improved or new methods of laboratory detection and analysis in order to determine emerging contaminants that have not been monitored yet sufficiently and that are affected by climatic changes: Toxics, toxins (algae, fungi), pathogens ecology, new pathogens, genetic adaptations, insects, pesticides etc.
Impact	The European and international added benefit lies in the development of knowledge on emerging pathogens and diseases and a better risk assessment. The development of improved methods to simulate risks including new models.
Title 9	Economic Viability of Food Safety Standards Compliance by the Food Industry
Description	SEA countries presently export various food products to the EU, including seafood, fruits and vegetables. Concern about the food safety in the export markets requires the compliance of certain food safety standards by the food industry in the SEA countries. The compliance of the standards, however, depends on the behavior of the seafood industry and the additional benefits and additional costs of the adoption. Thus this project aims at determining the economic viability of food safety compliance by seafood industry in SEA in order to improve the market access to the EU markets.
Impact	The compliance of the food safety standards will ensure sustainable production practices and promote consumer confidence both locally and in the EU. This will, consequently, improve the market access in the EU markets and improvement in income and employment in the food industry of SEA. This project will also generate strategies and programs for the proper adoption of the food safety standards by the food industry.
Title 10	Accessibility of Safe Food by Food Insecure Households
Description	Food safety is of particular concern among the food insecure households, both in SEA and the EU, due to the permanent risk of increase in prevalence of food-borne illness and other hazards associated with food. Certain risks are greater among the poor people

Table 1 Continued

	due to bad sanitation, inadequate access to potable water and lack of appropriate information on food safety risks. This project therefore aims at increasing the accessibility of safe food by the food insecure households by improving the awareness of these households and local social leaders towards food safety.
Impact	In order to improve the accessibility of safe food among the poor people, understanding of their awareness, perception and attitudes and the constraints that they are facing is crucial. With that understanding, this project will generate effective communication programs for the local social leaders and the food insecure households which ultimately will decrease the food safety risks and health care costs.

Conclusions

These topics have been submitted to the European Commission-DG RTD, Unit E3: Food-Health-Well-being and Directorate International Cooperation At the same time, these proposed SICAs will be submitted with the National Contact Points in the respective countries of the European expert that participated to the workshop. It is expected, that some of the proposed topics will be included in the revisions of the thematic Work programs through (SICA), dedicated to SEA. All in all, the workshop was also a kind of informal get-together of international recognized scientific experts from both EU and SEA, which is a good pre-requisite for future collaboration and partnerships in view of next FP7 calls.

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