European Technology Platform
Food for Life

European Technology Platform on Food for Life

Implementation Action Plan

Acknowledgement

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European Technology Platform
Food for Life

CIAA
Confédération des industries agro-alimentaires de l'UE
Confederation of the food and drink industries of the EU

For more information on the ETP, visit our website http://etp.ciaa.eu

Foreword

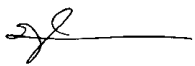
The European Technology Platform (ETP) Food for Life was created under the auspices of the Confederation of the Food and Drink Industries of the EU (CIAA) in 2005 to strengthen the European-wide innovation process, to improve knowledge transfer and to stimulate European competitiveness across the food chain. The vision of the ETP, published in July 2005, identified the need for an effective integration of strategically-focussed, trans-national, concerted research in the nutritional-, food- and consumer sciences and food chain management so as to deliver innovative, novel and improved food products for, and to, national, regional and global markets in line with consumer needs and expectations.

These products, together with recommended changes in dietary regimes and lifestyles, will have a positive impact on public health and overall quality of life ('adding life to years'). Targeted activities will support a successful and competitive pan-European agro-food industry having global business leadership securely based on economic growth, technology transfer, sustainable food production and consumer confidence. The ETP unites a wide variety of stakeholders around this common vision including agriculture, food processing, supply and ingredient industry, retail, catering, consumers, academia, funding bodies and policymakers. This direct connection with consumer needs and expectations makes it unusual amongst all other ETPs, and provides an unique opportunity to integrate the natural sciences and humanities into the activities laid out in this document.

This Implementation Action Plan (IAP) explains how the research priorities that were identified in the Strategic Research Agenda (SRA) of the ETP Food for Life, published in September 2007, can be implemented most effectively. The SRA was finalised after extensive consultation with stakeholders throughout the Europe and focussed on the scientific and technological research requirements initiated by Working Groups on Food and Health, Food Quality and Manufacturing, Food and Consumer, Food Safety, Sustainable Food Production and Food Chain Management. An additional Working Group developed an outline for needs in Communication, Training and Technology Transfer, whilst the Horizontal Activities Working Group focussed, amongst other issues, on optimising internal and external contacts and cooperation. The IAP focuses on the three multi-disciplinary Key Thrusts that were derived from the key research challenges of the SRA, and which reflect the most important priorities for European investment. Like the SRA, it has been subjected to stakeholders' consultations and illustrates activities required by the ETP and its stakeholders to facilitate the process required to address these Key Thrusts. While the SRA focused on topics and themes, this IAP focuses on activities and actions.

In the course of developing the SRA and IAP, good links have been established with other ETPs, especially those addressing agriculture and biotechnology. These links will ensure that the knowledge-based bio-economies of the EU Framework Programme 7 can combine to address effectively the serious challenge of global competition that Europe currently faces.

We are convinced that ETP Food for Life represents a unique opportunity for the stakeholders in the European food chain to increase their competitive strength and ensure the continuing well-being and welfare of consumers across Europe. Success will, however, require the long-standing commitment of all these stakeholders.



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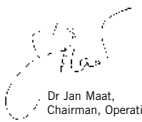

Dr Jan Maat,
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Executive Summary

Introduction

The food and drink sector is the largest manufacturing sector in Europe and employs some 3.8 million people. It is open to world markets and, therefore, challenged by them. Many external markets have the benefit of scale; in addition they are very important suppliers of raw materials and have lower operating costs than Europe. More and more of these countries are developing important food manufacturing operations. European industry is lagging behind in productivity[1] and unless there is a continued focus on value-addition there will be a worsening of Europe's competitive position in the future.

In order to ensure that the Lisbon Strategy is fully realised the European Technology Platform Food for Life (ETP) seeks to ensure that competitiveness is enhanced through technological solutions that build on existing strengths, or seek to open up new fields which the industry sector sees as providing good opportunities for exploitation. Concurrently, the ETP will address the growing health and social problems that will need to be tackled by a society that is ageing, and where a healthy diet can play a pivotal role in optimising human health and ensuring the population has a reduced risk, or a delayed onset of long-term, diet-related diseases. The agro-food industry is increasingly moving towards a system of production that is sustainable and meets ethical values, and the ETP has identified work that must be undertaken to ensure the achievement of these objectives economically and ensure that SMEs can also benefit from the changes in production methods that this will imply.

The ETP published its *Vision Document*[2] in July 2005 and its Strategic Research Agenda (SRA)[3] followed in September 2007. Extensive consultations were held with all relevant stakeholders through face-to-face meetings across Europe and via web-based activities. The process for developing the Vision Document, and for effectively engaging with stakeholder communities across Europe, grew out of initially identifying six science-driven areas: *Food and Health*, *Food Quality and Manufacturing*, *Food and Consumer*, *Food Safety*, *Sustainable Food Production* and *Food Chain Management*, which offered key challenges if the goal of ensuring a more competitive European food chain sector were to be realised. Small trans-sectoral Working Groups were established in these areas and provided inputs into the draft Stakeholders' SRA, which was open for consultation during 2006. A similar process was adopted for *Communication, Training and Technology Transfer*, issues considered to have a more 'horizontal' relevance. This approach was deemed to be less appropriate for the Implementation Action Plan (IAP) because it:

- limited interdisciplinarity,
- constrained key inputs from the socio-economic sciences and humanities,
- inhibited effective interactions, and
- resulted in overlaps and gaps.

As a consequence a process was developed around three Key Thrusts, described below.

The SRA[4] outlined three key research thrusts that were needed to ensure that European resources were effectively targeted on those areas most important to the future competitiveness of the sector. It also focussed on those areas which would help meet the European consumer's desire for healthy, safe, varied and affordable food as well as addressing society's increasing concern about the environment. The Key Thrusts were defined as research that would lead to products, processes and tools that would:

- improve health, well-being and longevity,
- build consumer trust in the food chain, and
- support sustainable and ethical[5] production.

The detailed research agenda that would need to be pursued if each of these Key Thrusts were to be effectively met are defined in this IAP.

The outputs of the ETP have already had a major impact on:

- bringing together a wide cross-section of the European research community and other stakeholders to recognise the most important challenges that the sector faces in the next decade or so,
- establishing an active network of National Food Platforms, and
- influencing the priorities for research within recent calls for proposals under the Food, Agriculture and Fisheries, and Biotechnology theme of the Cooperation pillar of Framework Programme 7 (FP7).

(1) CIAA. Benchmark Report on Food and Drink Industry Competitiveness, 2006.
(2) European Technology Platform on Food for Life. The vision for 2020 and beyond. http/etp.ciaa.be
(3) European Technology Platform on Food for Life. Strategic Research Agenda 2007-2020. http://etp.ciaa.be
(4) For those coming to the ETP for the first time, it is recommended that the Vision, Strategic Research Agenda (SRA) and Implementation Action Plan (IAP) are read in this order.
(5) The ethical dimension is explicitly stated for this Key Thrust. However, all activities described in Parts II and III of this IAP will be pursued within an overarching context of ethical best practice. Contacts will be developed with national and European expert bodies and ethics committees and, where necessary, discussions will be held to inform particular areas of activity. If appropriate, additional members will be invited to join the Horizontal Activities Working Group, specifically to advise and comment on the ethical dimension of proposed activities.

Through its extensive consultation process with influential industrialists, key research workers throughout Europe, representatives of consumer organisations and the national public bodies that support research, this ETP is also influencing the future direction of national research activities.

It is important to consider the extent to which the prioritised research activities defined by the ETP will require additional resources, new instruments for funding, complementary activities in education and training, and other actions that are necessary for transferring new or existing knowledge into innovation and social benefit. The IAP also addresses these issues.

A recent report on competitiveness of the European food industry[6] summarised the sector's strengths and weaknesses. Many of the weaknesses identified could be solved technologically but there are also issues that need to be addressed concurrently to ensure future competitiveness; these issues include the:

- limited economy of scale of the sector,
- lack of technological resources in some parts of the sector,
- need for greater integration, and
- impact of legislative issues.

These issues will need specific policy actions, apart from the implementation of this IAP, if Europe is to become more competitive.

Background and aim

The IAP outlines the next steps that are necessary to realise the proposals and the potential opportunities described in the SRA. Key activities are defined for each of the three Key Thrusts established in the SRA. The resource requirements are approximated and indications are given of the timescale for achieving success and the type of funding that will be required to ensure the goals are achieved.

The structure of the food industry in Europe is unique amongst the manufacturing sector with the overwhelming proportion of the sector (96%) having less than 50 employees (SMEs and micro-enterprises). Few such companies have the resources to undertake anything other than quality control and assurance work, and they cannot be expected to participate in research where the payback is frequently long-term in nature. The needs of such companies must be met through larger conglomerations of research-based and industry-wide associations working closely with them. However, the sector does include a small number of very large, research-minded companies that are able to support joint public-private research projects or programmes in specific areas.

The collaborative activities necessary to pave the way towards achieving the ETP's vision for implementation of the most immediate priorities require funding of the order of € 400-500 million annually over the next five years, with a larger proportion of this required for Key Thrust 1. Since a significant amount of the research identified here would improve public health and is targeted on relevant long-term, basic research having a strategic goal, it is expected that a large proportion of this work would be supported by the public sector.

Existing resources could be mobilised and directed more effectively if the appropriate collaborative mechanisms are developed and effectively promoted. This could result in important achievements without the need for new resources. Nonetheless, there are significant hurdles to overcome to ensure greater coordination of national resources into European-wide initiatives. These resources are often not available for new investment in mission-orientated and coordinated multi-national programmes other than as co-funding for projects within the European Framework Programme.

There are extensive structural, social and political factors that impact on the food industry's ability to innovate. Activities are described to further develop the required 'innovation infrastructure'. In particular, this IAP gives attention to a number of infrastructure and enabling activities, including:

- structures necessary to optimise the use of existing and new resources (ERA-NETs, National Food Platforms and Mirror Groups),
- areas where new resources or instruments are required,
- activities that need to be tackled by public funding or by joint private-public funding,
- how best to engage with, and optimise the involvement of, small and medium-sized enterprises (SMEs),
- solutions for improving the management of the food supply and distribution system,
- requirements for stimulating education and training in areas relevant to the future competitiveness of the industry which will deliver an appropriately-skilled work force, and
- communication issues, particularly those impacting on consumers, that will effectively engage other stakeholders (including research scientists, industry and the media) and result in greater mutual confidence and trust.

The recent report of an *EU Expert Group on the European Research Area* (ERA)[7] has emphasised the engagement that needs to be made by Europe as a whole to commit the resources necessary to deliver a truly effective ERA. European action lies in increasing the value of the contribution that public and private sector research makes, and is seen to make, to Europe's economic, social and environmental goals. This Expert Group concluded that the central means to achieve this is to engage the research system in a pan-European response to a series of grand challenges which depend upon research but which also involve actions to ensure innovation and the development of markets and/or public service environments.

(6) DG Enterprise and Industry. Competitiveness of the European Food Industry: An economic and legal assessment. Brussels: EC, 2007. ISBN 978-92-79-06033-5.

(7) Challenging European research rationales for the ERA. Report of the ERA Expert Committee. DG Research, 2008. EUR23326.

The three Key Thrusts identified by ETP Food for Life meet all of the criteria required to stimulate innovation, create new markets and meet important social and environmental goals. The European food chain sector is, therefore, ready and willing to address these 'grand challenges'.

The three Key Thrusts[8] for the food sector

Key Thrust 1: Improving health, well-being and longevity

The important role that diet plays in determining population health outcomes, both adverse and beneficial, is well recognised. The challenges that remain to delineate the relationships between diet and health particularly as they affect susceptibility to the major illnesses associated with ageing are very great. In addition, there is mounting evidence of a relationship between early nutrition and later outcomes in terms of susceptibility to disease. The incidence of obesity and obesity-related disorders is a worldwide problem and shows no sign of abating.

The actions necessary to make a real impact on decreasing the incidence of these adverse health effects will require development on many fronts and are long-term in nature. They also require a coordinated investment in the relevant sciences, including the social sciences, and the European effort is trailing behind the huge resources available in coordinated programmes of research and community actions in, for example, the National Institutes of Health in the USA. In contrast, European activities are dispersed between national research activities funded by governments, the health charities and European research programmes funded by EU Framework Programmes. At the European level there are few joint initiatives between the relevant Directorates General, DGs (DG Research, DG Health, DG Sanco, DG Environment and DG Enterprise and Innovation), which bring together all components of the innovation system, together with an appropriate level of resources for such joint activities.

The food industry is a crucial stakeholder in ensuring that foods are available that will provide European consumers with the means to eat healthily. It is thus an essential partner in ensuring that advances in research are pulled-through to deliver products that consumers increasingly demand. Europe has established a good market in foods for health already but there is a much greater future potential that could be realised. Since the opportunities for patent protection are limited, even the largest manufacturers will not be able to finance the necessary research and it will be necessary to explore joint activities, such as public-private partnerships or private-private partnerships. However, if the necessary progress is to be made the public sector will have to assume the major role of investing in this sector.

The objective of improving a nation's health by preventive means is also the responsibility of the public sector. Failure to act in a coordinated way will significantly constrain the necessary progress and increasingly greater costs will fall on national health and social services as the European population ages. The resources that are needed to meet this challenge, although high, are low in comparison to the costs across the continent that will accrue if Europe fails to tackle the diet and health issue.

The individual Working Groups addressing Key Thrust 1 recognised that priorities would have to be set in order to immediately engage funding bodies and the industry. Three areas have been prioritised within the Key Thrust on health, well-being and longevity:

1. optimal development, wellness and ageing,
2. intestinal health and immune functions, and
3. weight management and obesity.

Each area requires a different level of support. All require some level of basic research independent of financial support from the industry, whilst there are particular areas where joint industry-public sector financing is considered appropriate.

Effective innovation requires the correct infrastructure to support it. Specific issues to be addressed include:

- how best to ensure that existing European instruments in the field of research and innovation in the food sector are delivering the tools the sector needs,
- how legislation can better support innovation, and
- how the decision making process can be improved in relation to requests for prior authorisation linked to innovation (such as novel foods) when manufacturers have had to cope with considerable delays.

Under the Sixth Framework Programme (2002-2006) progress was made in bringing about collaboration between leading national research teams within Networks of Excellence. The Network of Excellence on Nutrigenomics (NuGO) has ensured that the importance of this field has been recognised internationally and has pointed the way to the advances in 'omic' technologies and systems biology that will provide valuable tools for determining mechanisms of action of nutrients and bioactive compounds. A complementary Network of Excellence (EuroFIR) has been created to coordinate national programmes of food composition within, and beyond, the EU. Initiatives like these must continue since they provide the underpinning base from which more specific and targeted work can be undertaken through joint academic-industry collaboration. The ETP is well placed to identify the benefits of synergy that can accrue from bringing together such free-standing activities.

(8) Whilst these are presented separately in this IAP, every opportunity will be sought to optimise their interaction.

Key Thrust 2: Building consumer trust in the food chain

Food and drink manufacturing and distribution must ensure that products reaching the consumer have been subject to the highest standards of quality assurance and control. Consumers need total assurance that the food they are consuming is safe, and any evidence that manufactured foods are not of the highest quality standards will have a severe economic impact on individual producers in export markets just as much as European markets. It is, therefore, important that food producers operate strict quality assurance both on the raw materials and throughout the manufacturing, distribution and supply chain.

Attention must be given to the overall process of risk assessment, which is a fundamental part of the approval process for novel foods or chemicals used in food production. Because of the current focus on risk, rather than benefit, consumers are left to think that all manufactured foods pose a risk. The concept that all food poses a balance between risk and benefit, whether it is produced 'organically' or through using chemicals in its production, is not communicated well. This issue needs to be seriously addressed and new ideas and thinking are urgently needed.

Consumers often have strong views about the use of unfamiliar technologies and the sources of information that promote the benefit of these technologies. Thus technologists must be reassured that consumers understand the issues surrounding the manufacture of a product.

Three research challenges have been identified within Key Thrust 2:

1. evaluation of risks versus benefits,
2. system innovation methodologies in the food production chain, and
3. consumer studies.

There are areas in this Key Thrust, particularly in relation to food safety, where the consumer rightly expects any information about a food product to be from a source in which they can have trust. This usually means that the underpinning research will have to be funded by the public sector alone. But there are other areas where joint academic-industry funding collaboration is appropriate. Many consumers find it difficult to make their own judgements about the quality of scientific results. This leads to a situation in which consumers depend on media information, which in return can shape consumers risk perception into a direction that is no longer based on sound science.

An ERA-NET in food safety, bringing together national funding organisations across Europe, has been funded by the European Commission (SAFEFOODERA[9]) and this has clearly demonstrated the large overlap and duplication in research on certain food safety topics that exists in projects funded both by national governments and the EU. There is, hence, an urgent need to use these available resources more efficiently so as to address other areas of food safety research.

(9) http://www.safefoodera.net

Key Thrust 3: Supporting sustainable and ethical production

The provision of sustainable food chains remains a primary challenge for the sector. Food chains should operate in a way, which exploits and optimises the synergy between environmental protection, social fairness and economic growth. This will ensure that the consumer's needs for transparency and for affordable food of high quality and diversity are fully met. Progress in this area is expected to have significant benefits for the industry in terms of reduced uses of resources, increased efficiency and better governance.

The food chain sector is responsible for a large environmental impact at present. It is currently heavily dependent on non-renewable energy resources and on the use of chemicals for efficient production. Much remains to be done to optimise the efficient use of recycled raw materials and to ensure that the use of packaging contributes less to problems of recycling. The balanced integration of SMEs, the rural environment and developing countries into future global food chains that are fully sustainable is another crucial issue demanding greater attention.

Three sub-themes within Key Thrust 3 have been identified:

1. sustainability of European food chains,
2. solutions for sustainable food chains, and
3. food system efficiency and effectiveness.

Key Thrust 3 presents the greatest challenge in terms of resource management. SMEs could benefit very significantly from a direct involvement in these activities but, in general, they are unable to contribute significant resources. There is, thus, a strong need to energise research associations, acting on behalf of the industry, to take this topic forward. The area is appropriate for support by public-private funding in proportions that will vary according to the topic and whether or not the measures taken are primarily targeted at the SMEs.

Beyond the Implementation Action Plan

Through the networks that the ETP has built up with European industry, universities, research institutions, consumer organisations, funding bodies in individual EU Member States and the European Commission, it is envisaged that the momentum developed from the Vision and the SRA will continue and grow. The ETP will continue to work to ensure that the research and policy issues that have been identified are discussed with national and regional authorities, consumers and the public at large. Interactions and communication between these stakeholders and food manufacturers, including multi-national European industries and SMEs, and those engaged in national and European programmes of research, remain essential functions.

The ETP will investigate the possibilities of developing closer public-private partnerships such as a Joint Technology Initiative (JTI), which aims to achieve greater strategic focus by supporting common ambitious research agendas in areas that are crucial for competitiveness and growth. As such, they draw on all sources of R&D investment - public and private - and couple research tightly to innovation. The ETP has described the most important issues to address in developing innovative foods and, based on this, will make an important contribution to the work of the High Level Group on the Competitiveness of the Agro-Food Industry recently set up by the European Commission[10].

It is expected that the ETP, with its concern for transnational cooperation and broad consultation, will be the focal point for all activities that promote innovation in the European food and drink sector. In summary, the ETP will deliver:

- a platform for effective consumer-oriented food innovation,
- a forum for ensuring an effective approach to integrating multiple disciplines for consumer benefits,
- improved management of Europe's knowledge infrastructure,
- an enabling environment for pre-competitive research and for the formation of consortia,
- sustainable business models,
- education and training of persons in multiple disciplines relevant for the food and nutrition sector, and
- identification, adaptation and exchange of best practices.

Such activities will demand a continuing dialogue between the ETP and its stakeholders across Europe and effective communication and interaction with organisations and programmes, which are addressing common issues outside Europe.

Conclusions

ETP Food for Life recommends that:

- the specific actions needed to meet the priority research requirements defined in this IAP should be given a high priority by industry, national and regional policymakers, funding bodies and the research community,
- a clear strategy be adopted that will address the necessary horizontal actions highlighted in Part III,
- an analysis of national research programmes, that have successfully engaged with industry and the reasons for their effectiveness, be undertaken by the ETP Mirror Group and a set of best practices be developed and disseminated,
- the European Commission provide support for the establishment of ERA-NETs on Food and Health, and Sustainable Food Production/Food Chain Management,
- policies are put in place, implemented and benchmarked to encourage the integration of national research resources,
- more research organisations are encouraged to work closely with the industry sector in all aspects of innovation; in particular, to highlight best practices and promote their adoption,
- a clear strategy be developed to communicate the concept of risk-benefit to consumers and to critically evaluate the benefits of highlighting low-level risks,
- all stakeholders commit to activities that will promote the excitement, challenge and benefits of a career in food science and technology, so as to ensure the presence of the next generation of European academic and industry scientists, and entrepreneurs,
- mechanisms are put in place to support, coordinate, share and align multi-disciplinary[11] research projects in Europe,
- successful networks are continued; especially those centred on infrastructures, databanks, etc., and
- a case for establishing a European Institute on Food and Health be developed and actively promoted.

(10) Commission decision setting up the High Level Group on the Competitiveness of the Agro-Food Industry (2008/359/EC).

(11) In this context, 'multidisciplinary projects' are taken to mean those engaging scientists, technologists and social scientists.

Part I. Introduction

Introduction

In order to ensure that the Lisbon Strategy is fully realised in the food chain sector the European Technology Platform (ETP) on Food for Life[12] seeks to ensure that competitiveness is enhanced through technological solutions that build on existing strengths or seek to open up new fields which the industry see as providing new opportunities for exploitation. The ETP published its Vision Document in July 2005 and its Strategic Research Agenda (SRA) in September 2007. Prior to publication of the latter, extensive consultations were held with stakeholders across Europe both in face-to-face meetings and through web-based consultations.

Vision of the ETP Food for Life

(see Figure 1)

The European Technology Platform Food for Life seeks to deliver innovative, novel and improved food products for, and to, national, regional and global markets in line with consumer needs and expectations through an effective integration of strategically-focussed, trans-national, concerted research in the nutritional-, food- and consumer sciences and food chain management. These products, together with recommended changes in dietary regimes and lifestyles, will have a positive impact on public health and overall quality of life ('adding life to years'). Such targeted activities will support a successful and competitive pan-European agro-food industry having global business leadership securely based on economic growth, technology transfer, sustainable food production and consumer confidence.

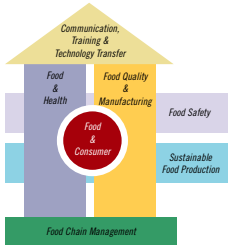


Figure 1. Schematic presentation of the research areas required to reach the vision of the ETP Food for Life.

The concerns and opportunities of all stakeholders have been the engine that has powered development of this ETP. In particular, four principal stakeholder sectors have been identified:

- consumers, society and policymakers,
- the agro-food industry (overwhelmingly SMEs and micro-enterprises),
- the research community, and
- national and European funding bodies.

Successful innovation will only occur if the proposals in the SRA are considered from the perspective of determining how, given the existing constraints, the research proposed can be implemented and how it will contribute to ensuring future market success by adding to the sector's strengths or tackling its weaknesses. The SRA presented the three principal research thrusts it saw as necessary to ensure that European resources were effectively targeted on those areas most important to the future competitiveness of the sector. It also focussed on areas that would help meet the European consumer's desires for healthy, safe, varied and affordable food as well as society's increasing concern about the environment.

These thrusts were defined as research that would lead to products, processes and tools that would:

- improve health, well-being and longevity,
- build consumer trust in the food chain, and
- support sustainable and ethical production.

(12) See Annex 1 for members of the ETP Food for Life Board, Operational Committee and Working Groups.

Through its extensive consultation process with influential industrialists, key research workers throughout Europe and the national public bodies that support research, the outputs of the ETP have already:

- influenced the priorities for research within recent calls for proposals under the Food, Agriculture and Fisheries, and Biotechnology theme of the Cooperation pillar of Framework Programme (FP) 7,
- influenced national research agendas, and
- brought together a wide cross-section of the European research community and other stakeholders to recognise the most important challenges that the sector faces in the next decade or so.

Nonetheless, it is important to consider the extent to which the priority research activities defined by the ETP will require additional resources, new instruments for funding, complimentary activities in education and training and other actions that are a key element of transferring new or existing knowledge into innovation and social benefit. This IAP is central to identifying the obstacles to the effective conversion of the information generated by research into innovation by ensuring that a market focus determines the agenda. Organisational, financial and political obstacles must be overcome if the agenda described in the SRA is to lead to a significant improvement in the competitiveness of the European food and drink industry.

The IAP also fulfils the important task of taking the key priority research thrusts of the SRA a stage further by considering the costs of the work proposed, the major funding mechanisms that must be adopted and the obstacles inhibiting research uptake by industry. In addition, it also addresses issues that relate to the growing health and social problems that will need to be tackled by a society that is ageing, and where a healthy diet can play a pivotal role in optimising human health and ensuring the population has a reduced risk or delayed onset of long-term, diet-related disease. Whilst solutions to these opportunities and problems will have to come from successful public health policies, there is no clear line that can be drawn between the role of the industry and the role of the public sector.

A strategy has to be adopted where industry works closely with the public sector and the consumers in those areas where industry can deliver products, processes or tools that will enable public health policies to be effectively implemented.

The food and drink market

The pressures on the market are evident. Costs are rising substantially - as is particularly evident over recent months. Markets in developing countries provide opportunities and challenges. In the developed world USA, Canada, New Zealand and Australia are also significant producers of manufactured foods at a very competitive cost whilst investment in the food industries of China, India and Brazil are self-evident. Taken together, these factors require the European industry to remain constantly on the alert to seek new market opportunities based on technological solutions that enable it to remain competitive.

The fact that the food and drink sector is such an important sector for employment and trade has not yet been reflected in the development of policies that ensure the industry's future is dynamic and competitive. This contrasts with other major European manufacturing industries, such as the automotive and aeronautics sectors, where strategic development plans have been implemented through multi-national cooperation and long-term investment.

A series of detailed insights into sectoral innovation have been produced under the auspices of the Innovation Watch - SYSTEMATIC project[13]. One on the food, beverage and tobacco sector concludes that qualified personnel, competition, government funding of R&D, regulation and customer orientation are all important for successful innovation. Future challenges to the sector lie in demand-oriented innovation that uses knowledge created at interfaces of industries, whilst environmental concerns and a push towards more ecological production may provide a huge opportunity for SMEs. Small firms may well have advantages over global multi-nationals in production of clean, safe and ecologically-produced food and through more transparent production processes.

Drivers of the market

A detailed study commissioned by DG Enterprise and Industry[6] has recently been published that focuses on issues relevant to the competitiveness of the European food industry and in which the ETP can play a pivotal role. This assessment identified the most important factors influencing the future of the food sector to be:

- lower growth of demand for processed food in the EU due to slow population growth,
- consumer desires for more convenient and healthy food,
- ethical issues such as environmental benefits, animal welfare and reduced chemical inputs, as attributes sought by consumers, and
- a cautious response on the part of many consumers to the benefits of technological inputs if there are no clear benefits to them.

In addition, price remains a critical factor determining the purchasing habits of many consumers in the EU and this becomes especially important as higher prices impact on household budgets. The importance of this driver varies amongst Member States and between social classes.

All of these drivers have implications for the research focus in Europe and are directly or indirectly addressed by the ETP Food for Life.

(13) Reinstaller A, Unterlas F. Sectoral Innovation Systems in Europe: The Case of Food, Beverage and Tobacco Sector. Part of the Europe INNOVA Innovation Watch SYSTEMATIC project synthesis report; What is the right strategy for more innovation in Europe? Drivers and challenges for innovation performance at the sector level, 2008. http://www.europe-innova.org/index.jsp?type=page&lg=en&from=child&classificationId=9882&classificationName=Synthesis%20Report&cid=9942&parentClassificationId=4963&parentClassificationName=Innovation%20Watch&parentContentId=5074

Strengths and weaknesses of the European food sector

The recent report on the "Competitiveness of the European Food Industry" has shown that the European food and drink sector has global strengths, specifically:

- it is able to attract sufficient capital and labour,
- it is open to world markets since it is has seen a growth in both imports and exports of about the same scale, and
- the cultural differences between regions and the presence of specialised SME enable benefits from economies of scale to be realised.

However, in terms of ensuring its future competitive position the sector has the following weaknesses:

- it suffers from lack of economy of scale especially in terms of the large number of SMEs who lack the capacity to challenge the dominant power of the retail sector. Economy of scale also would improve export potential; this problem affects both the agricultural supply chain and the food manufacturing sector,
- labour productivity is poor compared with other industries,
- it is failing to respond to the European consumer's increasing desire to purchase locally produced foods in terms of price, healthiness, freshness and environmental concerns,
- food science and technology needs to attract the brightest students. Much more effort needs to be made to demonstrate to students the potential that is open to them by following careers in the field. The overall R&D spending as proportion of turnover in the sector is currently very low (0.24 %). The curriculum should give greater emphasis to those areas that will determine future technological advance and are of social concern. This would meet the aspirations of many young people who seek to engage in work that has both an economic and social benefit. In turn this would ensure industry has a highly skilled workforce,
- the research and technology sector is insufficiently integrated and resourced to meet the challenges facing the sector, and
- it is investing too little in influencing opinion formers and in political debate at the national and European level.

These weaknesses are examined in detail below whilst actions and measures to address them are highlighted in Part III of this document.

Economies of scale

Market analysis shows that Europe is not as efficient in economies of scale as, for example, the USA, nor is it growing as rapidly as other trading blocks. Most food commodities in Europe show low demand elasticity and the European market is mature and shows signs of saturation. Export-driven opportunities must be sought and this requires the products to be highly price competitive. Because of the global supply chains of supermarkets, which are the major outlets for the food production sector, there is a growing need for European suppliers to be highly competitive in order to maintain or increase market share in supplying cost-sensitive retailers.

The supply and manufacturing chain is dominated by small companies, few of which are organised so as to act together, pool resources and build up sufficient economic potential to compete effectively with the relatively few retailing and manufacturing companies who are increasingly dominating the market. The lack of scale in production, research, marketing and distribution invariably means that if they were to directly retail their products, or enter the export market, their products would have to command higher prices. Nor are these small companies able to operate at a technologically sophisticated level to anticipate changes in market demand and react quickly to change.

Labour productivity

A detailed analysis is required on how improvements in productivity in the agricultural and food SMEs might be realised. Further analysis of the barriers to improvement is necessary and practical solutions should be proposed to address the problems.

Consumer concerns

There is a growing consumer interest in purchasing locally grown products at an affordable price. However, this market potential is not fully realised due to structural and social factors that currently limit outlets through local markets or local large retailers. The focus should be on how these products can be supplied to consumers, or local supermarkets, at competitive prices. The proposals highlighted in Key Thrust 3 should help to provide potential solutions.

Educational issues

A detailed survey of the perceived needs of employers (according to the size of the business)

is necessary[14]. It will be important to analyse whether these needs are being effectively met and to define what actions might be undertaken to stimulate a greater interest in food science and technology. An emphasis on the skill needs of smaller manufacturing industries should be the first priority.

A successful food market requires the interplay of a wide range of skills. An understanding of consumer and behavioural science issues, nutrition, food safety issues, information technology, food processing technologies and management of the food chain all underpin the success of an enterprise. Where such a wider range of skills cannot be employed within an enterprise easy access to these is needed through, for example, regional centres of technology transfer who can deliver them.

Many research centres in Europe who focus on the food sector are also unable to offer such a wide-ranging input of skills to their industries or are not closely enough aligned with their server communities. There remains a real challenge to most Member States to ensure that research investment is determined by:

- scientific developments,
- recognition of the market need,
- a focus on the export opportunities for potential products, and
- a greater integration with neighbouring Member States or those with similar markets.

The model for engaging the production and research sectors, which has been adopted by some of the Northern European countries should be analysed and its potential applicability to other countries, considered.

Development of markets

The European consumer has a growing interest in purchasing locally produced foods at the right price and food products that fit into a healthy and varied diet. The ETP has formulated a Lead Market Initiative (LMI) by identifying healthy foods, addressed here within Key Thrust 1, as a sector where the greatest market growth opportunities and stakeholder benefits lie. Analysis of the issues facing this sector will cover areas that, in addition to R&D issues, require future action for market success. Nutritional improvements of a large range of food products would also have a great potential for public health improvement and will give an impetus to new product development in the food sector.

The LMI offers the possibility to continue the work of the ETP in areas where there are dynamic markets at present. It is important, however, to consider the other two Key Thrusts of the ETP. These will need the detailed analysis that LMI funding would permit, and which has not yet been possible to achieve within the currently funded ETP programme.

Integration of resources

The IAP has considered in detail the resource constraints that are presently limiting innovation in the food and drink sector in Europe. Effective market success will involve a resolution of the problem of:

- multiple sources of regional funding. Within the Directorate-General for Research there are separate divisions and budgets dealing with e.g. health, food quality and safety and the environment. This leads to a dispersion of investment and a lack of focus on the key societal issues where food and health have a major impact both in terms of production and distribution and consumption,
- multiple sources of national funding. Many countries can have independent research councils covering health, the social sciences, agriculture and food, and the physical sciences. There are few examples of joined-up activities around major societal challenges. Similar considerations apply to government departments who may have budgets for research and development, and are responsible for the promotion of industrial competitiveness.

The problems in effectively coordinating national resources to address key issues remain to be resolved in the majority of EU Member States. The Mirror Group and food-related ERA-NETs are structures that can tackle this issue but there will have to be a political will as well as financial inducements to bring about such changes.

The creation of a truly European Research Area and a European Industrial Development Policy for the food sector are far from being achieved. It is essential that policies are put in place that encourage integration, to encourage more innovative research organisations that work closely with the industrial sector, and where best practices are highlighted and encouragement given for their adoption. An effective, and ongoing, dialogue must be established with opinion formers and policy makers at national and European levels.

(14) The 2008 call of the Food, Agriculture and Fisheries, and Biotechnology theme of the FP7 Cooperation pillar addressed exactly this requirement.

Communication issues

The Key Thrusts discussed in Part II highlight the overall requirement to improve consumer trust in food. Particular issues that need to be considered are:

- how the role of scientists in the media are influencing consumer attitudes positively or negatively,
- how actions at governmental level are influencing opinion,
- what actions the industry need to undertake to improve consumer confidence, and
- what role might consumer organisations play in improving communication.

The specific actions that need to be encouraged at the national and international levels also must be defined.

Successful innovation will only occur if the research proposals in the SRA are considered from the perspective of how they can be implemented, given the existing constraints. Future market success will only be assured by adding to the sector's strengths and by tackling its weaknesses.

Agenda to be implemented

The function of this IAP is to turn the proposals made in the Strategic Research Agenda into strategically-focused, multi-disciplinary and collaborative activities that will create the right structures for research and innovation in Europe. It has focussed on the areas of highest priority, those that need to be addressed urgently. Indications are given of the overall resources that are needed to achieve the activities proposed and where the balance lies between public and private funding. It is hoped the IAP will act as the catalyst for influencing the priorities of funding bodies and as a basis for further discussions between collaborators on specific projects in the light of national and international calls for proposals. The ETP will investigate the possibilities of developing closer public-private partnerships that could eventually result in a Joint Technology Initiative (Part III).
The resource requirements are estimated approximately. Assessments are made for the time frame needed to achieve success and for the type of funding 'mix' that will be required to ensure that the goals are achieved.

It is estimated that funding of the order of € 400-500 million annually will be required in the forthcoming years for the most immediate priorities necessary to pave the way towards achieving the ETP's vision. Since a significant amount of the work represents research that would improve public health and is targeted on relevant long term, basic research (but with a strategic goal), it is not expected that this work will be supported on a shared basis by the public and private sector. Significant new resources would not be needed for this work if it were possible to utilise the existing resources more effectively and develop the appropriate collaborative mechanisms. Nonetheless there are significant hurdles to overcome to ensure a greater coordination of national resources into European-wide initiatives. No mechanism yet exists to ensure these resources are available for new investment in mission-orientated and coordinated multi-national programmes, other than as co-funding in European Framework R&D projects.

There are extensive structural, social and political factors that impact on the food industry's ability to innovate. Future infrastructure and enabling activities are required to develop the required 'innovation infrastructure'. These include:

- structures necessary to ensure the best use of existing resources (ERA-NETs, National Food Platforms and Mirror Groups),
- analysis of where new resources or instruments are required,
- areas of activity that need to be tackled by public funding or by joint private-public funding,
- how best to engage the involvement of the SMEs,
- requirements for stimulating education and training in areas relevant to the future competitiveness of the industry and for building up an appropriately skilled work force, and
- communication issues, particularly with reference to their impact on consumers, that will effectively engage all other stakeholders (research scientists, the industry and the media) in developing more confidence and trust between each of them.

The three Key Thrusts initially identified in the SRA and developed further in this document meet all the criteria required to stimulate innovation, create new markets and meet important social and environmental goals.

Part II. Key Thrusts

Introduction to the implementation of the key thrusts

This IAP defines priority research areas for themes that are of major importance for the food industry. Priorities for each individual WG area have already been defined in the Strategic Research Agenda. The IAP integrates these priorities and focuses on those that require the most immediate steps to be taken. For each priority, a set of activities is proposed that need to be followed to enable the goals described in the Vision and Strategic Research Agenda to be achieved in a timely and efficient manner.

The requirements and the time frame for each activity are also presented in graphical form in order to assist understanding and facilitate comparisons within and between each Key Thrust. The subsequent sections provide reasons for choosing an activity, its expected outcomes, the contribution to be made to closing the knowledge gap and other relevant information. For diagrams, the following symbols are employed [15]:

Icon	*Description*
Source of funding 	*The boxes indicate the source of funding expected from public and private sources.* *Orange represents public inputs, blue that from private sources.*
Project type	***Different types of projects might be needed depending on the envisaged activity:***
	***Research projects:*** *Projects ranging from frontier/basic research to applied, pre-competitive research, the primary aim of which is to generate scientific and technical knowledge which can be further used for the development of new innovative products and/or improving the sustainability of existing production. These projects will benefit from collaboration efforts and networks.*
	***Demonstration or pilot projects:*** *Projects having the aim of demonstrating the industrial and economic feasibility, and the sustainability of a concept.*
	***Studies:*** *These projects, including surveys, feasibility studies, Life Cycle Analyses or eco-efficiency analyses, and will generate knowledge or information allowing stakeholders and decision-makers to make informed choices.*
	***Network or coordination activities:*** *These will allow better coordination between stakeholders in a field, interdisciplinary cooperation, exchange of information and coordination between European and Member States levels.*
	***Training:*** *Exchange/mobility of researchers, courses, projects influencing curricular programmes in Member States.*
Human resources 	*Activities require human resources with adequate training and expertise. A blue symbol indicates that sufficient research expertise is, or is likely to be, available in Europe; an orange symbol means that such a skill base needs to be actively developed for a sufficient number of researchers.*
Funding 	*Provides a scale indicating the required resources for the total duration of the activity:* *1 stack of coins: < 10 million €* *2 stacks: 10 - 50 million €* *3 stacks: > 50 million €*

(15) These icons correspond with those icons used in the Implementation Plan of the ETP on Sustainable Chemistry. http://www.suschem.org

Key thrust 1: Improving health, well-being and longevity

Scope

This Key Thrust describes the research requirements in key areas of consumer, nutrition and the food sciences. A number of areas have been identified by a broad range of stakeholders in which research investments are urgently needed to address knowledge gaps and, in the longer term, to provide European consumers with high quality, wholesome and nutritious foods that will contribute to their health and well-being. Furthermore, this Key Thrust will contribute to ensuring that the European food and drink industry will remain in a leading position by mobilising the full potential of larger industries and of many SMEs.

Over the years, much high-quality research in the food and health area has been carried out in Europe; however, although much effort has been expended, industry has been unable to fully exploit these results. This IAP describes how relevant activities and disciplines in the agro-food area, and especially the food and health sector, can be more effectively integrated and exploited.

Food and drink, in the right amounts and proportions, are important for the development, well-being and healthy ageing of citizens. Future changes in both population demographics and life span demand that European public health policies focus on 'healthy ageing', which not only includes the prevention of diseases but also delaying the deterioration of health status. The challenge for the long-term will be to influence an individual's rate of ageing and to deliver a personal regime of nutrients, lifestyle and advice for healthy longevity or, in the words of the Vision Document, 'adding life to years'.

The availability of new foods that will assist the population to live a healthy and active life remains a major challenge especially, as knowledge of the differing responses of population groups to specific foods gathers pace. European food and drink industries have a major opportunity to develop foods that meet the specific needs of population groups ('personalised nutrition').

There is a lack of understanding of the mechanisms underlying the effects of food intake on health. However, new and advanced technologies that are now available, including genomics, post-genomics and high-throughput tools, and novel insights to be gained as a result of their application will provide mechanistic explanations for effects of foods. An improved understanding of the mechanisms underpinning the physiological functionality of food components is required.

The effective delivery of this research to improve consumer health will require important and complementary inputs from the consumer sciences and from the humanities, particularly in relation to attempts to influence changes in habits and motivate healthier eating, and to ensure inclusion of all populations, including ethnic minorities. Whilst it is evident that many consumers find considerable difficulties in changing their habitual diets, this process will be made easier by extending the range of healthy food products. The food industry needs to find new ways to introduce foods that are tasty, affordable and contribute to a healthy lifestyle.

It is clear that progress in food and health research will require strong support of many of the technologies that are increasingly helping to advance knowledge across the biomedical and social sciences fields.

Key research challenges

Three research priority areas are identified in which the development of new processes, products and tools that improve health, well-being and longevity is most needed and expected to be most successful. These are:

- optimal development, wellness and ageing,
- intestinal health and immune functions, and
- weight management and obesity.

Overall, the key challenge is to deliver a healthier diet by developing new, quality food products that consumers will choose because it is *the healthy and easy choice*.

The individual objectives are to:

- develop new and effective food-based strategies to optimise human health and to reduce the risk or delay the onset of diet-related diseases,
- provide all consumers with the right type of food at the right time and in the right place, and
- improve consumer confidence and trust in foods by communication and effective dialogue between food producers, governments and consumers, so that effective strategies to induce healthy eating can be implemented.

Major constraints

The agro-food industry is mainly populated by SMEs that produce highly diverse products but lack the resources and personnel to invest in research and innovation. Furthermore, the return on investment and margins of profit are low and it is difficult to patent food products. Therefore, knowledge built up in the priority areas is aimed at reformulating a wide range of foods and designing new foods, and making them eligible for health claims. Nutritional improvements of a wide range of food products would also have a great potential for public health improvement.

What needs to be done and why?

The healthy foods sector has been identified as the one having the greatest opportunities for market growth and scientific breakthroughs, and it will contribute effectively to the consumer's desire for healthy foods that are safe, affordable and fit within a balanced and varied diet.

The nutritional sciences now stand at an important turning point. In the past, nutrition was above all a question of ensuring food intake and remedying dietary deficiencies, and was based largely on observational research. With recent advances in genomic- and molecular technologies, the ability to link the impact of food to health at a cellular level, as well as at a whole body level, creates a new horizon for the food industry and offers benefit to the individual consumer. The focus of the food industry has shifted from producing safe and flavoursome foods to producing safe, flavoursome *and healthy* foods.

The effective exploitation of such technologies can change general nutritional guidelines into more targeted, nutritional advice and may, in the long-term, lead to more personalised nutritional guidelines for high-risk groups. Furthermore, the benefits can be made visible on food products by health claims based on sound scientific evidence, which is required as part of a legislative framework developed in Europe.

Consumers are becoming increasingly aware of the relationship between food intake and health, and also the relationship of inappropriate diets with major chronic diseases such as obesity, type 2 diabetes, cardiovascular diseases, cancer, sarcopenia (muscle wasting) and osteoporosis. Providing foods for healthy ageing will be one of the key topics in the research efforts for the coming years.

Priority Research Challenge 1: Optimal development, wellness and ageing

There is no health without mental health. Good mental health is important for individuals as well as for society. At the individual level good, mental health enables people to realise their intellectual and emotional potential, and to find and fulfil their roles in social, educational and working environments. At the level of society good mental health is a resource for social cohesion and better social, and economic welfare, and it facilitates the transition of the EU into a knowledge society.

Cognitive decline with ageing and conditions such as Alzheimer's disease, Parkinson's disease and dementia, are emerging areas for nutritional research. Several studies indicate that diet can influence brain and cognitive development *in utero* and in neonates, infants and young children. Food intake can also affect brain function (in all age groups) in terms of cognitive processes, mood and brain performance. Reciprocally, brain function can affect components of food intake such as the type of food and the amount of energy consumed. Although the relationships between brain function and nutrition are still relatively poorly understood, it is generally accepted that the former does impact significantly on overall health and well-being.

Priority Research Challenge 2: Intestinal health and immune functions

Intestinal and immune functions are strongly related to nutrition, starting at the first contact of ingested food within the gastrointestinal tract. The largest portion of our immune system is found in the intestine. There is an urgent need to develop and validate a series of biomarkers and diagnostic tests, which accurately measure and inform on how the human gut microbiota can affect human health. Given recent advances in life science technology, including developments in intestinal metagenomics, a focussed research approach will have the potential to deliver significant breakthroughs that will lead to diet-induced immune modulation and improved quality of life.

The intestine, which possesses a metabolic activity equivalent to the liver, is regarded as the key organ able to maintain health and influence resistance to disease and immune function in relation to food. The intestinal tract is the primary site for food intake and is colonised from birth by a microbial community that contributes to food conversion, produces host-active compounds and stimulates a variety of relevant functions, including the immune system. It has, however, proven difficult to define a 'healthy intestine', because of its complexity, the large interindividual variability and the active interactions between the host, its microbes and the diet.

An optimal immune system is pivotal for a person's health, preventing acute and chronic disorders and determining how the body reacts to and copes with environmental stimuli and physiological and psychological stresses. A common factor in most of the currently important diet-related chronic diseases is low-grade chronic inflammation. Food is an important factor able to affect immune reactions in either a negative (e.g. allergy) or positive manner (e.g. prebiotics and probiotics). The immune system is intimately involved in several pathophysiological processes, including cancer development and ageing.

Priority Research Challenge 3: Weight management and obesity

One of the major nutrition-related health threats for the coming decade is obesity with all its related metabolic impairments, such as type 2 diabetes, cardiovascular diseases and metabolic syndrome. Arguably, obesity will be the greatest single challenge for the food industry in the coming years. Therefore, the need for improved knowledge of the metabolic function at all ages associated with obesity and related diseases must have a high research priority.

Some of the metabolic alterations linked with ageing, such as decreases of insulin sensitivity, bone quality (e.g. mineral density) and muscle mass (sarcopenia), and increase of body- and visceral fat are associated with increased systemic inflammatory activity. Dietary measures and lifestyle modifications, including physical activity, that could counteract these ageing-related metabolic disorders would be a real breakthrough in an ageing society.

Maternal and post-natal nutrition is not only central to the growth and development of infants but may also condition health later in life (programming/imprinting). The alarming increase in the incidence of overweight and obese children has renewed interest in determining the influence of the maternal and infant diet on the risk of developing excess fat mass and metabolic disorders later in life. The relationships between early nutrition and increased obesity risk are only poorly understood and not well established in humans. Research should deliver dietary recommendations for both mothers and infants and provide a basis for optimising nutrition during the critical period of rapid *in utero* and post-weaning development.

Food components and mouthfeel influence the consumer's acceptability of foods and thus impact on the dietary intake of a range of bioactive compounds. For example, the bitterness and astringency exhibited by some phytonutrients can reduce the intake of these compounds and impact negatively on fruit and vegetable consumption. Conversely, the positive organoleptic properties of saturated fat, sugar and salt have contributed to increased intakes of these components, leading to adverse health effects such as cardiovascular diseases and obesity. There is at present limited knowledge of how in-mouth events alter the structure and composition of foods and interact with physiological and physicochemical determinants of food preference.

What progress needs to be made?

Better understanding of how to assess consumptions patterns and sustainability of various food chains will give directions for selecting the most desirable future developments. Food chains possessing enhanced sustainability will require improvements in understanding how such complex issues can most effectively be communicated to consumers. To reach these goals in the coming years a number of nutrition-related infrastructures are required and specific enabling technologies must be developed (these are addressed in Part III).

Intelligent strategies will be developed to modify the intake of key dietary components taking into account regional and national dietary habits as well as between-subject physiological diversity at a European level.

Opportunities for the industry and other stakeholders

Knowledge and research investment will lead to new and innovative products with added value, and so contribute substantially to market success. Tailor-made, personal nutrition will provide better, healthier foods, ingredients or supplements that will form part of a diet with improved health attributes. Consumers' expectations for a more efficient use of the world's resources, environmental protection and animal welfare will be met through a more sustainable approach to food production. All consumers will have a greater choice of healthy food and drink options that are appealing and safe, and will promote healthy ageing. Society as a whole will benefit from the improvements in the health status and thus the quality of life of European citizens will be enhanced.

Careers in food and nutritional sciences and industrial research will be stimulated and an increased interaction between science and society will take place leading to a greater understanding of science by society and a high quality research infrastructure; taken together these will, in turn, attract more trans-national companies to invest in research in Europe.

Priority Research Challenges

Research in Key Thrust 1 is organised in three pillars: 1) optimal development, wellness and ageing, 2) intestinal health and immune functions, and 3) weight management and obesity. The proposed research aims at achieving breakthroughs in nutritional and food science and food technology, which will subsequently be implemented in food products (Food Quality and Manufacturing) and introduced to the market, which will require knowledge of consumer sciences and consumer behaviour (Food and Consumer).

	Optimal development, wellness and ageing	*Intestinal health and immune functions*	*Weight management and obesity*
Food and Health	To chart the scope of diet and individual nutrients and non-nutrients to influence brain health and performance. To interpret these results and maximise the impact, mapping will be required of the underlying mechanisms through which dietary components are capable of modulating brain development, cognitive performance and preventing depression and ageing-associated cognitive decline.	To enhance knowledge and study the mechanism of the relationship between the immune system and the intestine, including its microbiota, and other organ systems, such as the brain and the endocrine system, and their relationship to diet and physical activity.	To understand the genetic background of individual metabolic profiles in relation to body weight control and the risk for development of co-morbidities such as type 2 diabetes and metabolic syndrome with increasing weight.
	To increase understanding of the neural pathways controlling functions such as food intake, hunger and satiety so as to provide powerful new insights to combat the obesity epidemic.	To study foetal and neonatal nutrition in relation to immunological (de-) regulation during later life by metabolic/ immunological imprinting.	To develop effective food ingredients and dietary strategies to prevent (re-) gain of weight.
	To understand the role of bio-logical determinants in food choice (including the role of genomics and brain functions).		To define the effects of diets and nutrients early in life for health outcomes in later years.
Food Quality and Manufacturing	To understand relationships of food structures across the nano- to macro scales with respect to product and process design, and to develop new processing principles for improved PAN (Preference, Acceptance, Needs) profiles.		
	To identify and incorporate bioactive food constituents from plant, animal and microbial sources, and beneficial micro-organisms into foods, and understand and optimise their mechanisms of action.		
	To provide improved PAN functions through the redesign and optimisation of food processing and packaging.		
	To develop convenient, tailored personalised food products to meet all consumer preferences, acceptances and needs.		
Food and Consumer	To develop and validate more comprehensive models of food intake behaviour, thereby integrating knowledge from various disciplines; the role of advertising and marketing on food choices; the role of subconscious processes in food choice behaviour; the role of biological (e.g. genetic predisposition, neuroscience), emotional-, and economic drivers; socio-economic and cultural determinants in family decision-making, and ethical considerations.		
	To understand the process of food habit formation and the key motivators triggering or hampering behavioural change towards healthier eating behaviour.		
	To understand consumer knowledge of nutritional concepts and responsiveness to communication formats, including health schemes (e.g. pyramids), health claims, simplified labelling (e.g. sign-posting) as well as targeted, more personalised food recommendations (e.g. from advances in nutrigenomics).		
	To develop a 'best practice toolbox' for effective communication with consumers on health and sustainability of food.		

Priority research challenge 1: Optimal development, wellness and ageing[16]

	Source of funding	*Project type*	*Human resources*	*Funding amount*
Major research challenge 1	To chart the scope of diet and individual nutrients and non-nutrients to influence brain health and performance. To interpret these results and maximise the impact, mapping will be required of the underlying mechanisms through which dietary components are capable of modulating brain development, cognitive performance and preventing depression and ageing-associated cognitive decline.			
Deliverable 1	Diet and cognitive function: understanding the impact of nutrition on brain and cognitive development *in utero* and in neonates, infants and young children; achievement of healthy ageing by nutritional strategies in childhood; establishing the relationship between nutrition and learning abilities and other cognitive attributes.			
Implementation		    		
Description	This research will discover and validate biomarkers based on epidemiological studies, cellular- and physiological studies (including the outputs of systems biology) and intervention studies. A skill base must be developed for sufficient numbers of researchers in the fields of neuroscience IT, psychology and imaging technology.			
Deliverable 2	Mood and optimal performance: mapping the impact of specific food ingredients on mood and mental performance through enhancing understanding of the mechanisms underpinning these effects.			
Implementation		  		
Description	Required expertise: molecular biology, molecular neuroscience.			
Deliverable 3	Understanding of the molecular and cellular mechanisms associated with the neuro-protective effects of dietary compounds.			
Implementation		  		
Description	Required expertise: molecular biology, molecular neuroscience.			
Deliverable 4	Prevention of cognitive decline and other disturbances of brain function (e.g. hearing loss): mapping the scope of diet to reduce or prevent the decline in cognitive functioning with ageing and charting underlying mechanisms which may eventually lead to a decline in incidence of Alzheimer's or Parkinson's disease or dementia.			
Implementation		   		
Description	Required expertise: biostatistics, gerontology, molecular biology (ageing), imaging technology.			
Major research challenge 2	To increase understanding of the neural pathways controlling functions such as food intake, hunger and satiety, so as to provide powerful new insights and techniques to combat the obesity epidemic.			
Deliverable 1	Brain conditioning: understanding how early exposure to dietary compounds leads to taste perception and food preferences later in life.			
Implementation		 		
Description	Required expertise: paediatrics, psychological and behavioural science.			
Deliverable 2	Nutrition and inter-organ signalling with a key emphasis on the brain: understanding the mechanism of gut-central nervous system interaction.			
Implementation		  		
Description	Required expertise: paediatrics, psychological and behavioural science.			
Deliverable 3	Food intake regulation and hunger/satiety: identification of brain pathways that regulate hunger/satiety and of dietary components that can facilitate control of food intake.			
Implementation				
Description	Research will include salivary phenomena. Required expertise: biochemistry, oral physiology, consumer behaviour science, imaging technology, bioinformatics.			
Major research challenge 3	To understand the role of biological determinants in food choice (including genomics and brain functions).			
Deliverable	A quantified framework model for the role and relative importance of biological determinants in consumers' food choice, including brain functions and genomics, together with the identification of potential intervention routes to affect these biological determinants.			
Implementation				
Description	Required expertise: systems biology, consumer science, genetics, psychology.			

(16) See page 16 of this document for explanation of the symbols used.

Priority research challenge 2: Intestinal health and immune functions

	Source of funding	*Project type*	*Human resources*	*Funding amount*
Major research challenge 1	To enhance knowledge and study the mechanism of the relationship between the immune system and the intestine, including its microbiota, and other organ systems, such as the brain and the endocrine system, and their relationship to diet and physical activity.			
Deliverable 1	Knowledge and tools to positively modify systemic inflammatory activity by diet-gut interaction, especially with regard to the intestinal system such as Irritable Bowel Syndrome and metabolic disorders such as type 2 diabetes, cardiovascular diseases and the ageing process.			
Implementation				
Description	Required expertise: systems biology, consumer science, genetics, psychology.			
Deliverable 2	Improvement of the allergome databases of plant- and animal-derived foods, knowledge of allergen post-translational modifications and allergenicity modulation, and persistence after cooking; detection of allergens derived from human gastrointestinal or hepatic metabolites.			
Implementation				
Description	Investigations of interactions and subsequent development of biomarkers for preventative medicine requires access to large volumes of human biomaterial, including blood, urine and faecal samples. The ideal solution would be a global biobank; while this would represent a major undertaking, its potential returns make it attractive to both food and pharmaceutical industries in collaboration with governments. Required expertise: food technology, immunology, toxicology, microbiology.			
Major research challenge 2	To study foetal and neonatal nutrition in relation to immunological (de)regulation during later life by metabolic/immunologic imprinting.			
Deliverable	Determination of a healthy diet in terms of type and timing of introduction of specific dietary constituents with regard to the mother, before and during pregnancy and lactation, and with regard to the newborn during early life, in order to optimise immune function, intestinal colonisation and decrease the risk of allergy.			
Implementation				
Description	Required expertise: paediatrics, genetics, microbiology, immunology, gynaecology.			

Priority research challenge 3: Weight management and obesity

	Source of funding	*Project type*	*Human resources*	*Funding amount*
Major research challenge 1	To understand the genetic background of individual metabolic profiles in relation to body weight control and risk of development of co-morbidities such as type 2 diabetes and metabolic syndrome with increasing weight.			
Deliverable 1	Early biomarkers of metabolic syndrome.			
Implementation		  		
Description	Required expertise: analytical chemistry, biostatistics, informatics, molecular biology.			
Deliverable 2	Knowledge of individual variations in metabolic energy efficiency, including the contribution of gut microbiota, and susceptibility to high energy intake and sedentary lifestyle.			
Implementation		   		
Description	Required expertise: microbiology, physiology, (meta)genomics.			
Deliverable 3	Identification of food components alleviating chronic low-grade inflammation associated with obesity and determination of their impact on the prevention of insulin resistance and metabolic syndrome.			
Implementation		   		
Description	Required expertise: immunology, endocrinology.			
Deliverable 4	Knowledge on the contribution of epigenetic events on chronic diseases later in life and the contribution of nutrition.			
Implementation		  		
Description	Required expertise: genetics, epidemiology.			
Deliverable 5	Understanding drivers (diet, genes) that regulate habitual levels of physical activity.			
Implementation		   		
Description	Required expertise: exercise physiology genetics.			
Major research challenge 2	To develop effective food ingredients and dietary strategies to prevent (re-) gain of weight.			
Deliverable 1	Intervention strategies to align research on exercise physiology/physical activity and obesity/metabolic syndrome.			
Implementation		    		
Description	Required expertise: public health, health education, physical activity programming.			
Deliverable 2	Specific food components for regulating food intake and increasing diet-induced thermogenesis.			
Implementation				
Description	Research will include how in-mouth physiological mechanisms interact with food to determine consumer behaviour and their intake of dietary compounds.			
Deliverable 3	Greater insights into the effects of meal composition, size and frequency on appetite regulation and energy intake.			
Implementation				
Description	Required expertise: physiology, endocrinology.			
Major research challenge 3	To define the effects of diets and nutrients early in life for health outcomes in later years.			
Deliverable	Maternal and infant dietary recommendations for optimal metabolic health.			
Implementation				
Description	Required expertise: endocrinology, paediatrics.			

Food Quality and Manufacturing research

Priority research challenge	**Food Quality and Manufacturing research for optimal development, wellness and ageing, intestinal health and immune functions, and weight management and obesity**			
	Source of funding	*Project type*	*Human resources*	*Funding amount*
Major research challenge 1	To understand relationships of food structures across the nano- to macro scales with respect to product and process design, and to develop new processing principles for improved PAN (Preference, Acceptance, Needs) profiles.			
Deliverable 1	Quantitative methods to assess process-structure-property relationships, such as extrusion based cereal structure processing for satiety profile adjustment.			
Implementation		  		
Deliverable 2	Structure-property functions and their relationships with formulation and processing.			
Implementation		  		
Description	Combinations of new and conventional technologies, including packaging technologies, for novel and traditional foods will lead to process optimisation and sustainable food processing.			
Major research challenge 2	To identify and incorporate bioactive food constituents from plant, animal and microbial sources, and beneficial micro-organisms into foods, and understand and optimise their mechanisms of action.			
Deliverable 1	*In vitro* assays and biomarkers to predict *in vivo* functionality of bioactive components.			
Implementation		   		
Deliverable 2	New product functions arising from new ingredients or from processing via biotechnology, separation technology or nanotechnology, understanding and predicting a) impact of bioactive compounds in food and beneficial micro-organisms on human health, b) effect of food matrix formulation (structure, components) on the activity, delivery and transfer of bioactive compounds and beneficial micro-organisms.			
Implementation		   		
Deliverable 3	Targeted delivery of bioactive compounds and micro-organisms with beneficial properties.			
Implementation		   		
Major research challenge 3	To provide improved PAN functions through the redesign and optimisation of food processing and packaging.			
Deliverable	New PAN function-driven sustainable food processing in synergy with new packaging technologies, point of use processing systems developed for timely delivery of freshly produced personalised food.			
Implementation		  		
Major research challenge 4	To develop convenient, tailored personalised food products to meet all consumer preferences, acceptances and needs.			
Deliverable	New tailor-made, personalised foods targeted at specific consumer groups.			
Implementation				
Description	Research leading to an understanding of the dynamics of a) sensory perception from receptor to brain, including cross-modal interaction of the senses, flavour release and structure breakdown, and b) gastrointestinal mechanics, nutrient interactions and bioavailability.			

Food and Consumer research

Priority research challenge	**Food and Consumer research for weight management and obesity, optimal development, wellness and ageing, and intestinal health and immune functions**			
	Source of funding	*Project type*	*Human resources*	*Funding amount*
Major research challenge 1	To develop and validate more comprehensive models of food intake behaviour, thereby integrating knowledge from various disciplines including the role of advertising and marketing on food choices; the role of subconscious processes in food choice behaviour; the role of biological (e.g. genetic predisposition, neuroscience), emotional-, and economic drivers; socio-economic and cultural determinants in family decision-making, and ethical considerations.			
Deliverable	A pan-European multi-disciplinary food consumer science resource initiated to overcome fragmentation and build the necessary critical mass.			
Implementation		  		
Major research challenge 2	To understand the process of food habit formation and the key motivators triggering or hampering behavioural change towards healthier eating behaviour.			
Deliverable	A pan-European multi-disciplinary food consumer science resource initiated to overcome fragmentation and build the necessary critical mass.			
Implementation		   		
Major research challenge 3	To understand consumer knowledge of nutritional concepts and responsiveness to communication formats, including health schemes (e.g. pyramids), health claims, simplified labelling (e.g. sign-posting) as well as targeted, more personalised food recommendations (e.g. from advances in nutrigenomics).			
Deliverable	Improved knowledge of consumer understanding of nutritional concepts and communication formats, including health schemes (e.g. pyramids), claims and labelling (e.g. sign-posting).			
Implementation		    		
Major research challenge 4	To develop a best practice tool for effective communication with consumers on health and sustainability of food.			
Deliverable	A set of validated methods, models, practices and tools for effective consumer information and education regarding food and nutrition in a multiple actor context.			
Implementation		   		

Key thrust 2: Building consumer trust in the food chain

Scope

Europe has an absolute necessity for a secure, safe, nutritious and cost-effective food supply; this is an imperative for health and social- and economic stability. Food in Europe is more convenient, more varied and safer than ever, and the European consumer is better informed and more aware of food-related issues. Despite this, consumers show a general lack of trust in the food supply. Globalisation of the trade in raw materials and end products, and increased competition both within and outside the EU, have had a profound impact on how producers and consumers perceive quality and safety. The balancing of costs with the regulatory and consumer protection environment means that new solutions for the making and selling of foods are crucial to gain and maintain competitiveness. Improvements in packaging and in process design and control will always be needed to improve on the industry standards of food quality, safety, functionality, diversity and convenience, in the light of demographic trends and the changing needs of consumers and of society as a whole.

The creation of tailor-made food products that incorporate consumer preferences, acceptances and nutritional needs will be the governing concept of food manufacture in the future, requiring a redesigning of the way food is currently produced. Food in 2020 will be tailor-made to the specific Preference, Acceptance and Needs (PAN) of consumers. Consumer science will deliver reliable information on consumer preferences and acceptances, and provide a basis for new product development. The European food and drink industry must be equipped with a full armory of innovative approaches and technologies to allow it to increase competitiveness and thus to capitalise on its historical position as a world leader.

It is clear that food safety is also a competitive issue both at the company level, where the costs of compliance can threaten survival, and at the level of society as a whole. For instance, the costs of salmonellosis alone have been estimated to be of order of 2 billion dollars (€ 1.4 billion) per year in the USA. This gives some idea of the economic dimension for a single pathogen and does not take into account the considerable costs associated with the measures which are in place to control this pathogen in the food chain, including analyses, specific management and hygiene measures, research and surveillance. The

economic issues related to food safety are far wider than simple costs of prevention measures versus costs of damage otherwise suffered. Specific food safety concerns are also more and more centred on the consumers and their perception of how safe the food supply is. The food sector itself has a very clear interest and a responsibility in addressing food safety challenges. Properly targeted, well-coordinated and well-executed research programmes will, when successfully communicated, form the basis of this response.

The European food and drink industry's response must be to develop an integrated and holistic approach to food quality, innovation and safety, and within this the total food chain has to be taken into account. An effective response will require the integration of our know-how and interventions along the 'research to market' continuum.

Key research challenges

The main objective is to provide the knowledge and tools to allow the widespread implementation and use of innovation processes to create value-added food products and exploit new marketing concepts and novel ways of selling products to provide the consumer with the right type of food at the right time and in the right place to enhance the competitiveness of the EU food industry.

In the risk-benefit evaluation of innovated processes and products, a key challenge is to improve consumers' awareness and understanding

of any hazards and the risks they represent at the different steps in the food chain, e.g. the knowledge base needed to support the rational application of control measures and the development of new methods and systems. Benefits inherent to process- and product innovations must also be evaluated and weighed against any risks involved. In this way risk assessment will evolve eventually to risk-benefit evaluation for innovative processes, products and ingredients.

New knowledge and solutions must be found to further secure the food chain, e.g. the development of systems and technologies for continuously improving the safe production and supply of foods. Knowledge and tools should be provided to enable the successful engagement of the consumer with other stakeholders in the maintenance of food safety in Europe.

Major constraints

The following major problems have been identified:

- the emergence of new and under-recognised biological hazards,
- uncertainties concerning the importance of low-level chemical contaminants and allergens in the food chain,
- piecemeal and uncoordinated approaches to food allergen management,
- immature tools for risk and risk-benefit studies,
- consumer engagement and trust levels are low, thereby impeding the introduction of novel safety- and quality-driven solutions,
- fragmented financing of research on food safety and quality, leading to areas which are not addressed and other areas which are exhaustively and repetitively studied,
- insufficiently-developed interfaces between natural science disciplines and economic and social sciences, and
- a lack of transparency in prioritising research.

What needs to be done and why?

In developing and evaluating the technological and economic feasibility of the innovations described below, it will be crucial to have access to industrial and pilot-scale facilities so as to test the new technologies under real or almost real conditions and improve them while reducing the development time.

Risks represented by food hazards should be fully understood; this will require the development and exploitation of innovative measurement tools and new approaches for data analyses and for predicting emerging hazards.

For an effective enforcement of the European food law, measuring tools, including analytical methodologies, must be prioritised and harmonised across the EU. The drafting of international standards and the establishment of commonly-agreed performance criteria for analytical methods are necessary.

Strategies and technologies must be developed for the rational (cost-competitive) control of food risks via new and improved solutions for process logistics and packaging, and improved detection, monitoring, tracking and tracing.

The engagement of consumers in relation to food quality and safety is crucial in order for them to make informed personal choices and to understand how best to participate in their own protection (practices and acceptances of technologies).

What progress needs to be made?

Research, which addresses the European food industry's needs over the coming years in relation to food product and process innovation, quality and safety, will be applied through this integrated and holistic approach from raw materials to the tailor-made end products. Such targeted research will provide a framework for rapid incorporation into practice in a manner, which will optimise impact and benefit.

Priority Research Challenges

Key Thrust 2 is organised in three pillars: 1) Evaluation of risks versus benefits, 2) System innovation methodologies in the food production chain, and 3) Consumer studies. The proposed research aims at securing breakthroughs in food science and technology, with a strong link to food safety and consumers' perception of innovation and safety. The research described here is focussed primarily on aims that are achievable within the next ten years.

	Evaluation of risks versus benefits	*System innovation methodologies in the food production chain*	*Consumer studies*
Food Safety	To describe and understand how micro-organisms respond to the various environmental stimuli and stresses associated with food matrices, and to predict the effects on resistance and persistence.	To develop new methods to support chemical food safety (non-destructive technologies for on-line and off-line screening, 'total toxic charge', novel biomarkers for exposure to key contaminants).	To gather data on food composition and consumption patterns including ethnic and traditional foods, building on existing initiatives such as EuroFIR[17] and on epidemiological, analytical, toxicological and physiological data.
	To enhance understanding of behaviour and virulence traits of food-borne pathogens and the mechanisms of emergence.	To develop the next generation of predictive/probabilistic models for food microbial stability and safety, and their translation into easy-to-use tools for the end-user.	To validate models and methods for effective public participation of and engagement with consumers on food safety governance.
	To generate data on the dynamics of priority chemical hazards: structural changes, interaction effects, process-generated contaminants and migration from food-contact packaging and data on the levels of such chemicals occurring in specific product types.	To develop technologies for the reduction or the elimination of hazards at the level of primary production (including breeding) and during processing.	To identify and quantify determinants of consumer trust and confidence in the food provision system (including trust in actors and institutions) for an understanding of consumer confidence and its changes over time (monitoring).
	To describe and understand the effects of chemical hazards in humans.		To understand consumers' perception of risk issues, particularly in the context of risk-benefit trade-offs and the amplification of risk perceptions beyond the available scientific evidence.
	To develop and validate a quantitative risk assessment approach for allergenic foods.		To develop allergen management, communication and monitoring strategies to minimise the risks and optimise the quality of life of allergic consumers.
	To develop and validate scientific approaches to carry out risk versus benefit evaluations along the food chain.		
Food Quality and Manufacturing	To develop innovative, sustainable and safe food packaging for implementation into integrated food chain concepts.		
	To introduce scaleable and flexible food manufacturing techniques and their intelligent in-line control.		
Food Chain Management	To develop track and trace systems with improved information accessibility for all the stakeholders in the food chain.		
	To develop effective methodologies for tracking and tracing of microbes, contaminants and allergens along the food chain.		

(17) EuroFIR (European Food Information Resource Network) is an FP6 Network of Excellence on food composition databank systems, which will establish the first comprehensive pan-European food information resource to allow effective management, updating, extending, exchange and comparability of food compositional data. As such it provides essential underpinning of much of the food research described in this IAP

Priority research challenge 1: Evaluation of risks versus benefits[18]

	Source of funding	*Project type*	*Human resources*	*Funding amount*
Major research challenge 1	To describe and understand how micro-organisms respond to the various environmental stimuli and stresses associated with food matrices, and to predict their effects on resistance and persistence.			
Deliverable	Knowledge of the ecological behaviour of priority food pathogens. Scientific data using advances in 'omics' technologies describing the ecological behaviour of priority food pathogens and spoilage micro-organisms at different stages of the food chain will facilitate development of new technologies or optimisation of the efficiency of existing technologies.			
Implementation		 		
Major research challenge 2	To enhance understanding of behaviour and virulence traits of food-borne pathogens and the mechanisms of emergence.			
Deliverable	Biological models for studying virulence and microbial behaviour in infection including functional mammalian cell culture systems; artificial organs, both cell culture-based and mechanical (computer-aided). Validated protocols to study microbial behaviour in such infection models. Methodologies for studying microbial behaviour in these model systems.			
Implementation		  		
Major research challenge 3	To generate data on the dynamics of priority chemical hazards: structural changes, interaction effects, process-generated contaminants and migration from food-contact packaging and data on the levels of such chemicals occurring in specific product types.			
Deliverable 1	Knowledge of the dynamics of priority chemical hazards. Investigation of a) bioavailability and structural changes, interactions with other molecules or substrates, b) process-induced contaminants from inoffensive precursors (establishing a procedure for prioritisation and 'top 10' setting; identifying mitigation strategies, and c) food packaging migrants: identifying concerns and providing alternative packaging solutions.			
Implementation		   		
Deliverable 2	Research on the impact of technological, economical, legislative, climatic and social conditions on agricultural practices (including transport and warehousing the raw material) to support strategies for the management of priority chemical hazards. Examples of technological impact will include biotechnology, energy, safe drinking-water management.			
Implementation		    		
Major research challenge 4	To describe and understand the effects of chemical hazards in humans.			
Deliverable	Data allowing effective hazard characterisation for determining the risks of priority chemical hazards including risks at very low levels of exposure. This subject should receive high priority and a first preliminary list of priority chemicals should be established within two to three years and reviewed after five years. A set of well-described exposure biomarkers and a subsequent database of epidemiological data organised in a population-disaggregated manner (taking into account gender associations).			
Implementation		  		
Major research challenge 5	To develop and validate a quantitative risk assessment approach for allergenic foods.			
Deliverable	Tools, protocols, including user-friendly software and decision support systems for comparative risk analysis.			
Implementation		   		
Description	Using appropriate and validated quantitative risk assessment tools and models (*in vitro*, *in vivo*, *in silico*) to generate data required for food allergen risk assessment and tools to analyse such data, including epidemiological and population-based approaches. This work should be carried out in close collaboration with the Joint Research Centre of the European Commission.			
Major research challenge 6	To develop and validate scientific approaches to carry out risk-benefit evaluations along the food chain.			
Deliverable	Validated approaches to carry out risk-benefit evaluations along the food chain.			
Implementation				

(18) See page 16 of this document for explanation of the symbols used.

Priority research challenge 2: System innovation methodologies in the food production chain

	Source of funding	*Project type*	*Human resources*	*Funding amount*
Major research challenge 1	To develop new methods to support chemical food safety (non-destructive technologies for on-line and off-line screening, 'total toxic charge', novel biomarkers for exposure to key contaminants).			
Deliverable	Validated analytical techniques and sampling plans for priority chemical contaminants including a) reference/precision techniques, for research and anticipation, and confirmatory purposes, b) rational/accessible and simple techniques for direct field application, and c) in-line methods for continuous safety management in food processing.			
Implementation		   		
Major research challenge 2	To develop the next generation of predictive/probabilistic models for food microbial stability and safety, and their translation into easy-to-use tools for the end-user.			
Deliverable	Predictive and probabilistic models for food microbial stability and safety.			
Implementation		 		
Major research challenge 3	To develop technologies for the reduction or the elimination of hazards at the level of primary production (including breeding) and processing.			
Deliverable 1	Agronomical research for developing plants more resistant to toxigenic moulds and formation of mycotoxins. Agronomical research for better understanding the mechanism of uptake of heavy metals by plants and mechanisms for reduction of these.			
Implementation		  		
Deliverable 2	Development of novel/natural preservation and mild processing methodologies based on hurdle/combination preservation concepts, including the roles of, and opportunities for food refrigeration and the cold chain.			
Implementation		   		

Priority research challenge 3: Consumer studies

	Source of funding	Project type	Human resources	Funding amount
Major research challenge 1	To gather data on food composition and consumption patterns including ethnic and traditional foods, building on existing initiatives such as EuroFIR and on epidemiological, analytical, toxicological and physiological data.			
Deliverable	Harmonised national databases on food composition and consumption patterns, including ethnic and traditional foods.			
Implementation		 		
Major research challenge 2	To validate models and methods for effective public participation of and engagement with consumers on food safety governance.			
Deliverable	Effective public participation of and engagement with consumers on food safety governance as part of an integrated strategy for risk mitigation.			
Implementation		   		
Major research challenge 3	To identify and quantify determinants of consumer trust and confidence in the food provision system (including trust in actors and institutions) for an understanding of consumer confidence and its changes over time (monitoring).			
Deliverable	Insights into how public perception of risk develops in interaction between consumers, media and stakeholders, followed by effective communication strategies.			
Implementation		   		
Major research challenge 4	To understand consumers' perception of risk issues, particularly in the context of risk-benefit trade-offs and amplification of risk perceptions beyond the available scientific evidence.			
Deliverable	Harmonising and elaborating existing national databases on food composition and consumption patterns including ethnic and traditional foods.			
Implementation		   		
Major research challenge 5	To develop allergen management, communication and monitoring strategies to minimise the risks and optimise the quality of life of allergic consumers.			
Deliverable	Harmonising and elaborating databases on food composition, including ethnic and traditional foods, and the prevalence of allergens in foods.			
Implementation		  		

Food Quality and Manufacturing research

Priority research challenge	**Food Quality and Manufacturing research for evaluation of risks versus benefits, system innovation methodologies in the food production chain, and consumer studies**			
	Source of funding	***Project type***	***Human resources***	***Funding amount***
Major research challenge 1	To develop innovative, sustainable, and safe food packaging for implementation into integrated food chain concepts.			
Deliverable	Novel intelligent packaging including the use of nanotechnology for monitoring food quality and safety during transport, storage and processing, from producer to consumer, such as using tags s miniaturised analytical tools with wireless communication. New active packaging reducing food degradation and for controlled delivery of functional components.			
Implementation				
Major research challenge 2	To introduce scaleable and flexible food manufacturing techniques and associated intelligent in-line control.			
Deliverable	Development of sensors yielding complex food structure information and for *in situ* control of process variables, such as pH for high pressure and temperature for pulsed electric field treatment. Application of artificial intelligence methods for data mining, pattern recognition and software sensors leading to sensor networks recording fluctuations of quality and safety.			
Implementation				

Food Chain Management research

Priority research challenge	**Food Chain Management research for evaluation of risks versus benefits, system innovation methodologies in the food production chain, and consumer studies**			
	Source of funding	***Project type***	***Human resources***	***Funding amount***
Major research challenge 1	To develop track and trace systems with improved information accessibility for all the stakeholders in the food chain.			
Deliverable	Track and trace systems with improved information accessibility for all the stakeholders in the food chain.			
Implementation				
Major research challenge 2	To develop effective methodologies for tracking and tracing of microbes, contaminants and food allergens along the food chain.			
Deliverable	Validated technologies for tracking and tracing, and their integration into management systems			
Implementation				
Description	Research will include the development of robust analytical tools with adequate sensitivity and specificity to support risk management of microbes, contaminants and food allergens, and monitoring and validation of equipment sanitation. This work should be performed in close collaboration with the Community Reference Laboratories.			

Key thrust 3: Supporting sustainable and ethical production

Scope

At present the European food chain exhibits a number of unsustainable features which need to be addressed by research focusing on the sustainability of the food chain, involving assessments of present systems, developing knowledge on future possibilities and on methods and technologies for practical improvements.

European food chains face major challenges to remain competitive taking into account changes in the sector's economic and non-economic environments, changes in lifestyles and consumer needs, structural problems with many SMEs in the sector and the globalisation of the food markets. These challenges cannot be met by any individual enterprise but require concerted actions and coordination of initiatives. Changes might focus on operational improvements or on strategic development perspectives where an important consideration will be the need to integrate and balance the interests of all stakeholders in the food chains.

Key research challenges

The challenges of Key Thrust 3 are to identify, promote and provide support for the implementation and operation of future sustainable food production systems based on synergetic solutions between environmental protection, social fairness and economic growth that serve consumer needs for transparency and for affordable food of quality and diversity.

Major constraints

A number of factors contribute to deficiencies in sustainability of the food chains today. These chains are heavily dependent on the input of non-renewable resources such as fossil fuels and there is a substantial environmental impact of the production methods used, including the use of chemicals. The balanced (or fair) integration into the emerging global food chains of SMEs, the rural environment and developing countries is still insufficient. The movement towards greater sustainability within chains as well as the communication with consumers on sustainably-produced goods requires appropriate signals and rules. The globalisation of food markets challenges the competitiveness of the European food system.

What needs to be done and why?

The research on sustainability of food chains is a new field of research and requires intensive cooperation between scientists of many different areas of expertise, including the environmental, economic and social sciences. For the implementation of solutions to more sustainable food chains there has to be an input from food technology, safety, health and other scientific disciplines. Cooperation with research groups involved in the other Key Thrusts and ETPs will be necessary. Within Key Thrust 3 the major research challenges are organised into:

- Priority Research Challenge 1, Sustainability of European food chains: the focus is to meet the need to better understand and analyse the sustainability of the food chains as the most sustainable option can be difficult to identify. This research will lead to the identification of directions for research into more sustainable materials, technologies and systems.
- Priority Research Challenge 2, Solutions for sustainable food chains: this will focus on research to improve sustainability in the different parts of the food chain. Scenario technologies will help to identify future improvements along the food chain. Solutions will focus on technological and managerial approaches and will include consumer studies.
- Priority Research Challenge 3, Food system efficiency and effectiveness: focusing on research where the influence of the actions of the various actors in the food chain need to be analysed. Improvement potentials for technical and managerial solutions in each step of the chain need to be identified and framework strategies defined to address institutional, social and entrepreneurial challenges. Research to improve organisational management and cooperation along the food chain, with transparency and responsiveness as important design parameters, will also be a priority. Special emphasis should be on the behaviour of consumers and how best to communicate information on sustainable options to them.

What progress needs to be made?

Better understanding of how to assess sustainability of various food chains and consumptions patterns will provide directions for selecting the most appropriate future developments. The identification of improved technical and managerial solutions to sustainable food chains will facilitate and speed up their introduction. The road to improved sustainable food chains will be supported by, for example, an enhanced understanding of how to communicate information about more sustainable options to consumers and other stakeholder communities.

Opportunities for the industry and other stakeholders

Improvements in sustainability have long-range benefits for the food industry in terms of reduced use of resources, increased efficiency and better governance. Improvements of efficiency of the entire food chain will also benefit the other stakeholders in the chain, e.g. through improvements in network cooperation and use of resources.

	Sustainability of European food chains	*Solutions for sustainable food chains*	*Food system efficiency and effectiveness*
Sustainable Food Production	To develop a methodology for describing the essential parameters.	To develop viable approaches and innovations to produce resource-friendly, to improve utilisation of food raw materials and to reduce waste.	To develop methods for value chain analysis of entire food chains.
	To identify relevant factors in the future that will affect or improve sustainability.	To identify and evaluate novel primary food chains.	To develop dynamic modelling tools to determine and demonstrate the sustainability frontiers.
	To identify and analyse the major environmental, social, and economic pressures in primary food production.	To understand how consumers behave and how responses differ between different consumer groups.	To use scenarios to study "what if?" alternatives.
	To analyse and monitor the sustainability of emerging lifestyle trends.		
Food Chain Management	To determine and prioritise opportunities for innovations and improvements in processes in production, logistics and management.	To design transparency schemes that serve the transparency needs of food networks.	To design organisational network alternatives that combine efficiency and responsiveness to changing consumer demands for quality and diversity.
	To understand and utilise success factors for supporting food system dynamics in times of globalisation and change.	To design and support knowledge communities for SME support.	To deliver suitable approaches for functional cooperation that will fulfil needs and overcome integration barriers.
Food Quality and Manufacturing	To provide improved PAN (Preference, Acceptance, Needs) functions through the redesign and optimisation of food processing and packaging.		
	To develop innovative, sustainable, and safe food packaging for implementation into integrated food chain concepts.		
Food and Consumer	To develop better tools for communication with consumers, including insights from semiotics and persuasive and interactive communication through different media.		

Priority research challenge 1: Sustainability of European food chains[19]

	Source of funding	*Project type*	*Human resources*	*Funding amount*
Major research challenge 1	To develop a methodology for describing the essential parameters.			
Deliverable	System analysis of sustainability performed for a range of regional and sectoral food chains.			
Implementation		  		
Description	The varieties of European regional and sectoral food chains require the development and exploitation of system analysis. The different food chains occurring in different countries with extremely different land and climatic backgrounds, different food cultures and differing ways of preparing and cooking foods could lead to different outcomes in the identification of the sustainability hot spots. It is important, therefore, to understand the differences between the regional and sectoral food chain in different countries by involving the primary producers, both SMEs and big industries, through the use of pilot projects to analyse 'pilot commodities' and 'pilot food chains'.			
Major research challenge 2	To identify relevant factors in the future that will affect or improve sustainability.			
Deliverable 1	Development of scenarios of food production and supply chains based on existing general scenarios.			
Implementation		 		
Description	Scenarios on food production and supply systems must be based on existing scenarios for development of the global society, including demographic, social, economic, trade and environmental developments. The consequences of these prospected developments in the scenarios must be translated to possible developments in the European food production and supply chains, as well as to issues of European food supply security. Methodology for incorporating assessment of sustainability in the developed scenarios will be included. Recently presented agricultural scenarios (SCAR Foresight study and ESF/COST Forward Look) will be used as a platform for this task.			
Deliverable 2	Elaboration of scenarios for future food chains illustrating the consequences of different development options.			
Implementation				
Description	Scenarios for future European food production and supply systems will be developed where factors affecting the sustainability of these developments are assessed. A number of 'possible futures' will be employed for scenario building, including effects of global warming, dramatic energy price increase, major reforms in economic policies (CAP and CFP) and trade agreements, and of social developments, including increased population mobility. The consequences of alternative developments on sustainability will provide a basis for identifying improvement potentials and scenarios with improved sustainability.			
Major research challenge 3	To identify and analyse the major environmental, social, and economic pressures in primary food production.			
Deliverable	Establishment of a knowledge base to optimise existing primary food chains and to underpin its sustainable management.			
Implementation		    		
Description	Principles, parameters and indicators are required to guide and monitor changes of current systems towards sustainable primary food chains (crops, livestock and fish). The indicators must be 'location specific' as they must take into account widely differing environmental and socioeconomic conditions and their complex interactions that determine the design of the actual production system. Required adjustments towards sustainable practices need an interactive learning process with (groups of) farmers, researchers and other stakeholders, using both formal (quantifiable) and non-formal knowledge. This knowledge will be used to design, test and disseminate appropriate farming systems in such an interactive mode.			

(19) See page 16 of this document for explanation of the symbols used.

	Source of funding	*Project type*	*Human resources*	*Funding amount*
Major research challenge 4	To analyse and monitor the sustainability of emerging lifestyle trends.			
Deliverable	Analysis of the influence of lifestyle trends on sustainability of the food chain.			
Implementation				
Description	The direction of changes in consumer behaviour and food production depends on the adaptive capabilities of coupled human-ecological systems, which primarily shape the behaviour of individuals. In turn, adaptive capabilities operating at the system level are to a certain extent affected by day-to-day choices of consumers who display similar and consistent preferences for a better quality of life. Environmentally, a diet with more meat exerts a disproportionate pressure on resources. Consumers, in contrast, are increasingly concerned by how far their food has been transported and under what conditions animals are kept. Therefore, multidisciplinary research into impacts of lifestyle trends on sustainable diets - explicitly addressing protein foods - is a necessity.			
Major research challenge 5	To determine and prioritise opportunities for innovations and improvements in processes in production, logistics and management.			
Deliverable 1	'Best practice' process organisation alternatives.			
Implementation				
Description	Specification of 'best practice' process organisation alternatives from primary production to food delivery at the retail stage (e.g. the reduction of waste) that will allow the potential for further improvements to be identified.			
Deliverable 2	'Hot spots' in process organisations.			
Implementation				
Description	Specification of 'hot spots' in process organisations that will allow improvements in the delivery of food through appropriately focussed developments and innovations and eliminate development and innovation barriers in processes and institutional environments.			
Deliverable 3	Priority 'landscape' for the initiation of activities.			
Implementation				
Description	Specification of a priority 'landscape' for the initiation of activities that reduce barriers and support process development, process innovation and institutional change.			
Major research challenge 6	To understand and utilise success factors for supporting food system dynamics in times of globalisation and change.			
Deliverable 1	Dynamic framework of critical success factors and performance indicators.			
Implementation				
Description	Specification of a dynamic framework of critical success factors and performance indicators for performance evaluation of horizontal and vertical organisational alternatives in food value chains.			
Deliverable 2	'Hot spots' in process organisations.			
Implementation				
Description	Identification of 'best practice' reference models for value chain organisation and development linked to different performance perspectives (both economic and non-economic) and their development over time.			
Deliverable 3	Priority 'landscape' for the initiation of activities.			
Implementation				
Description	Specification of 'performance maps', based on a dynamic framework of critical success factors and performance indicators and best practice' reference models for value chain organisation and development, that a) link performance indicators to organisational alternatives and organisational development paths derived from deliverable 1 'best practice' reference models and reference models determined through modelling research (deliverable 2), and b) provide support for decisions on value chain developments for all stakeholders.			

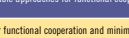
Priority research challenge 2: Solutions for sustainable food chains

	Source of funding	Project type	Human resources	Funding amount
Major research challenge 1	To develop viable approaches and innovations to produce resource-friendly, to improve utilisation of food raw materials and to reduce waste.			
Deliverable 1	Development of more sustainable food processing, preservation, packaging and transportation operations.			
Implementation				
Description	The strategic goal is to strengthen the sustainability of the European food sector throughout the entire chain for processing, packaging, warehousing, distribution, retail and household handling of food commodities by dramatically increasing the process efficiency of using natural resources (e.g. raw agricultural materials, energy and water). A number of optimised, emerging and novel food production and storage (refrigeration) technologies, equipment and logistics should be developed for environmentally-benign, energy-efficient and consumer-friendly manufacturing and handling of a wide range of foods of plant or animal origin. The huge potential of advanced information, communication and space technologies should extensively be exploited for process optimisation; intelligent equipment design; continuous food chain traceability; ubiquitous real-time sensing, on-line monitoring and control of food quality and sustainability parameters throughout the chains by applying for example process analytical technology (PAT) and chemometric.			
Deliverable 2	Improved utilisation of food raw materials and reduced waste throughout the food chain, including the development of systems for reprocessing to add value to food waste.			
Implementation				
Description	Contemporary food chain technologies are far from economically optimal in term of resource utilisation. Large quantities of raw food materials are lost during post-harvest and post-mortem processing of plant or animal food, while the restaurant sector, catering services and individual households are continuously generating a huge amount of edible food waste and co-products are major contributors to environmental contamination and need urgent Europe-wide measures for their drastic reduction and recycling. Planned research, development and demonstration activities should therefore focus on advanced technologies to minimise and reuse food waste along the entire food chain (with special emphasis on the primary production and consumption sectors). Suitable techniques should be developed for efficient management, reprocessing and utilisation of by-products and disposals to add value to food waste and to formulate new environmentally-friendly products, which are demanded for different applications in the food or non-food sector. New, more efficient methods are needed to manage, preserve and process raw materials in the entire food chain.			
Major research challenge 2	To identify and evaluate novel primary food chains.			
Deliverable	Identification of novel primary food chains and assessment of their sustainability.			
Implementation				
Description	Radically different food products and production systems can be developed based on innovative concepts and advanced biotechnologies. These may dramatically improve the efficient use of natural resources. Emphasis should be on maximising the formation of desired products (full-product concept), on fully utilising by-products (zero-waste concept) and on optimising resource flow within the production system (zero-loss concept). Sustainability criteria are an intrinsic component in designing these innovative systems and should be continuously monitored during implementation and adjusted to changing demands. Issues on food security will also be considered. Strong links will be developed with other KBBE (Knowledge-Based Bio-Economy)-ETPs.			

	Source of funding	*Project type*	*Human resources*	*Funding amount*
Major research challenge 3	To understand how consumers behave and how responses differ between different consumer groups.			
Deliverable 1	Understanding and modelling of how consumers and consumer groups are prepared to pay for foods produced in a sustainable manner.			
Implementation		 		
Description	Many aspects influence the considerations of the consumer in selecting food purchases. In addition to culinary aspects, health aspects are very important today. However, ethical and sustainability considerations are increasingly influencing purchase decisions. In view of the complexities of food choices, research is needed into value-related purchasing motives and into how sustainability can become a central part of consumer preferences. This will require multidisciplinary research to better understand how preferences are formed and to model how consumers can be informed and encouraged to adopt more sustainable patterns of food consumption.			
Deliverable 2	Analysis of consumer behaviour as affected by socio-economic policy options of sustainable food production.			
Implementation		 		
Description	An interesting and novel way of eliciting more sustainable patterns of food consumption is to focus on the opportunities offered by local food economies currently arising in metropolitan areas. Such urban food economies may relate to restaurants, catering, schools and shops to local producers, with a concomitant advantage of creating a green 'buffer zone' around the city. Such an approach adds a stimulating and innovative context to more traditional socioeconomic instruments, such as labelling at the product level. A multi-level approach will provide greater insight into the optimal conditions to involve different groups of consumers.			
Major research challenge 4	To design transparency schemes that serve transparency needs of food networks.			
Deliverable 1	Reference models for networks for tracking, tracing and food quality transparency for networks.			
Implementation		  		
Description	Reference models for integrated and flexible networks for tracking, tracing and food quality transparency that serve different user groups and transparency needs, identify organisational, managerial, technological, and economic alternatives, outline flexible development paths and specify suitable information sources.			
Deliverable 2	Reference models for flexible multi-layer transparency networks.			
Implementation		  		
Description	Reference models for flexible multi-layer transparency networks that build on tracking, tracing and quality transparency assurance needs but add transparency layers supporting chain efficiency, chain governance, and innovation dynamics. Identification of suitable (consumer-focused) information clusters (sources of information, information integration, reliability, trustworthiness, usability, etc.) that serve different user groups and transparency needs. The alternatives are characterised by their 'transparency value' (benefit) for consumers and the costs of information generation.			
Major research challenge 5	To design and support knowledge communities for SME support.			
Deliverable 1	SMEs' knowledge needs and 'best practice' experiences in knowledge exchange.			
Implementation		  		
Description	Specification and mapping of SMEs' knowledge needs and 'best practice' experiences in knowledge exchange in global or regional food chain activities.			
Deliverable 2	Reference models for knowledge generation and dissemination networks.			
Implementation		  		
Description	Specification of reference models based on SMEs' knowledge needs and 'best practice' experiences in knowledge exchange for knowledge generation and dissemination networks that identify sources of knowledge, requirements for their utilisation, and organisational, managerial and technological implementation alternatives. The reference models need to specify the growth from core network implementations ('backbone') towards dynamically evolving comprehensive knowledge networks through linkages (interfaces) with other solutions that might develop (open network architecture).			

Priority research challenge 3: Food system efficiency and effectiveness

	Source of funding	Project type	Human resources	Funding amount
Major research challenge 1	To develop methods for value chain analysis of entire food chains.			
Deliverable	Development and implementation of methods for value chain analysis of entire food chains explicitly incorporating sustainability assessment.			
Implementation		  		
Description	Current techniques to analyse the total food chain are primarily focussed on end product quality and competitiveness. However, it is necessary to develop suitable methods for complex system analysis, which directly involve sustainability indicators for assessing food chains as a whole, rather than their separate units. The integral approach should inherently encompass several interdisciplinary research fields (engineering, environmental, managerial, market and consumer-related aspects) to provide a powerful instrument for ubiquitous value chain analysis of food commodities across Europe. Such tools for integral assessment will be capable of revealing critical chain elements, processes and operations with poor sustainability, which require measures to improve the existing situation Europe-wide.			
Major research challenge 2	To develop dynamic modelling tools to determine and demonstrate the sustainability frontiers.			
Deliverable	Appropriate sustainable indicators developed.			
Implementation		  		
Description	The three pillars of sustainability require the identification, selection and development of sustainability indicators applicable to food systems. Such work needs the application of a range of tools originating from both the natural and socio-economic sciences. The creation of a toolbox where environmental methodologies (LCA; IO-LCA, Input-Output Life Cycle Assessment; etc.) leading to environmental indicators could share the information with economical and social analysis (LCC, Life Cycle Costing; TCA, Total Cost Assessment; SLCA, Social Life Cycle Assessment; etc.) is a pre-requisite to reach this goal. Both applied and basic techniques are needed to assess the food systems in a life cycle perspective in a globalised food market context.			
Major research challenge 3	To use scenarios to study 'what if?' alternatives.			
Deliverable 1	Development of novel and alternative food chains demonstrating sustainability benefits.			
Implementation		  		
Description	Novel and radically different food production methods can deliver substantial improvements in sustainability, for example by dramatically improving use of natural resources (perhaps according to the bio-refinery concept. Such alternative systems are developed in other areas of the ETP. The task here is to assess the sustainability of novel food chains built on these novel concepts in the form of scenarios for the future, and to direct the development efforts towards sustainability benefits. Cooperation across the ETP is essential as with other ETPs, especially with ETPs Plants for the Future, Aquaculture and Biofuel.			

	Source of funding	*Project type*	*Human resources*	*Funding amount*
Major research challenge 4	To design organisational network alternatives that combine efficiency and responsiveness to changing consumer demands for quality and diversity.			
Deliverable 1	Separable functions along the food chain.			
Implementation				
Description	Identification and analytical analysis of functions along the food value chain that could be separated for individual process optimisation 'in their own right' together with specification of possible linkages with other functions for the creation of value chains and the formulation of appropriate standards for connectivity.			
Deliverable 2	'Best practice' experiences in the realisation of separable functions.			
Implementation				
Description	Identification and analysis of 'best practice' experiences in the realisation of separable functions, of major weaknesses in those functions requiring developments and innovation, and of regulations or barriers from institutional, legal, cultural or any other environment that limit the efficient integration of functions into value chains.			
Deliverable 3	Simulation and optimisation models that support flexible adjustments of global production and logistics networks.			
Implementation				
Description	Based on functions along the food value chain that could be separated for individual process optimisation and 'best practice' experiences in the realisation of separable functions, design of generic simulation and optimisation models that support flexible adjustments of global production and logistics networks in case of changing customer and consumer demands or as a result of disruptions in the production base, production ability or delivery and distribution networks.			
Major research challenge 5	To deliver suitable approaches for functional cooperation that will fulfil needs and overcome integration barriers.			
Deliverable 1	Approaches for functional cooperation and minimising integration barriers.			
Implementation				
Description	Specification of best practice cooperation concepts and reference models for suitable and optimal cooperation alternatives, taking into account financial feasibility, transition costs, benefits, etc., for different integration scenarios (for example institutional environment), different chain relationships (regional, global), and different regions and product lines.			

Food Quality and Manufacturing research

Priority research challenge	**Food Quality and Manufacturing research for sustainability of European food chains, solutions for sustainable food chains, and food system efficiency and effectiveness**			
	Source of funding	***Project type***	***Human resources***	***Funding amount***
Major research challenge 1	To provide improved PAN (Preference, Acceptance, Needs) functions through the redesign and optimisation of food processing and packaging.			
Deliverable	Quantitative methods to assess process-structure-property relationships including assessment and optimisation of sustainability.			
Implementation			  		
Major research challenge 2	To develop innovative, sustainable, and safe food packaging for implementation into integrated food chain concepts.			
Deliverable	Production, use and disposal of eco-friendly packaging for perishable, diverse and complex foods such as fresh, living, composite or traditional foods. Packaging for monitoring food quality and safety during transport, storage and processing to meet the goals of sustainability of the food chain.			
Implementation			  		

Food and Consumer research

Priority research challenge	**Food and Consumer research for sustainability of European food chains, solutions for sustainable food chains, and food system efficiency and effectiveness**			
	Source of funding	*Project type*	*Human resources*	*Funding amount*
Major research challenge 1	To develop better tools for communication with consumers, including insights from semiotics and persuasive and interactive communication through different media.			
Deliverable	A set of validated methods, models, practices and tools for effective consumer information and education regarding sustainability, efficiency and effectiveness of food chains.			
Implementation				

Part III. Enabling Activities

Furthering the agenda for ETP development

The first two parts of this IAP have indicated the main thrusts requiring coordinated European-wide research, estimated the approximate scale of the resources needed and suggested a mechanism for its support through combinations of public and private funding. This third part proposes possible actions and/or solutions to other issues that must be addressed if a truly effective ERA for the food sector is to be created. An overview of funding opportunities for the ETP Food for Life can be found in Annex 2.

In contrast to many other ETPs, every single consumer in Europe is a stakeholder in this Technology Platform; moreover, securing the food supply is central to the economies of all European countries and beyond. Concerns about the quality, safety and – increasingly – the affordability of food products has heightened consumer interest and enhanced industrial opportunity. The development of the SRA was based upon extensive discussion and debate, involving a broad range of stakeholders across Europe, and an additional result of this process has been the establishment of the National Food Platforms listed in Annex 3.

In developing and managing this IAP it will be even more important to ensure that there is effective communication with stakeholder communities and that changing interests and concerns are rapidly identified and incorporated, so that economic opportunities can be enhanced within and across the continent.

Amongst the structures developed to facilitate the involvement of differing stakeholder communities are:

- Task Forces,
- Mirror Group, and
- National Food Platforms

The resources, financial, human and time, to be expended in these and other areas are all finite and so particular attention is paid both to using them most effectively and to ensuring that overlap and duplication is kept to a minimum. This will require a much better awareness of the activities ongoing at national and European level, the political will to cooperate beyond national boundaries and the development of well-trained and flexible employees within industry, the research communities and government.

The ETP will need to ensure that it operates in a clear and transparent manner, and that attention is paid both to its internal communication and to the external promotion of its activities and goals. Other ETPs amongst the Knowledge-Based Bio-Economy (KBBE) 'family' are more experienced at dealing directly with policymakers and opinion formers and improvements in these areas at national and European level will be needed.

From the time when the individual Working Groups were established in late 2005 to prepare for the first open consultation on what was to become the SRA, it was evident that, even if significant knowledge were to be generated from the programmes of the six science-driven Key Challenges, without significant and concommitant improvements in the quality of the training and technology transfer available across Europe, the ETP's overall impact would be limited. For this reason, particular attention is focussed on communication, training and technology transfer within and between different stakeholders.

Improving stakeholder commitment and resource utilisation

SME Task Force

This Task Force develops recommendations for measures and activities to improve the competitiveness of food industry SMEs through enhancing their innovative capacity and increasing their involvement in the innovation process. These measures and activities will be implemented through the ideas developed in the Communication, Training and Technology Transfer and other Working Groups, and through National Food Platforms. The main activities include:

- finalising the recommendations for the report on "Measures for enhancing the innovation activities of SMEs in the food industry",
- developing a regularly updated inventory of innovation funding schemes relevant to SMEs in collaboration with the National Food Platforms,
- exploiting cooperation opportunities with the European clustering initiatives on innovation and competitiveness, and
- developing additional recommendations to ensure efficient project management, financing of innovation, commercialisation and in networking supporting services for the implementation of innovation projects by food industry SMEs.

Measures for enhancing the innovation activities of SMEs in the food industry include:

- developing ideas for enhancing innovation within SMEs segmented according to the innovation behaviour and experience of the companies,
- capacity building of SMEs through training, practical demonstrations and transfer of knowledge. Training will not be limited to technical subjects, but will include techniques for managing innovation, commercialising the outputs of R&D projects, business skills, financing innovation and developing and exploiting techniques for improving market access,
- training mediators and researchers on technology transfer, business support, project management and knowledge management techniques,
- highlighting the potential of national food platforms to improve access to SMEs at national level; this will include establishing and monitoring national food industry technology transfer centres,
- ensuring predictable and reliable financial support for SMEs across all stages of the innovation process at EU, regional and national level. Funding schemes to enhance the innovation of SMEs will give priority to innovation experience rather than research excellence *per se*,
- supporting innovation within SMEs through identification of services for project management, business development, financing of innovation and commercialisation of R&D results; to be achieved by a combination of collective assistance and personal coaching.

Mirror Group

A Mirror Group, bringing together national and other funding bodies from across Europe, is a necessary stage in:

- exchanging best practice and information about the topics included in national strategic programmes of research, leading to the identification of overlaps and duplication, and the sharing of results. In the longer term, opportunities will be explored for aligning research programmes and developing joint calls (for example, through ERA-NETplus activities), and
- identifying opportunities for, and partners in, ERA-NETs.

The European Commission states that 95% of European research funding derives from national sources, with only 5% being funded by FP7. However, national research funding in Europe is coordinated to a very limited extent, so overlapping research will take place. In addition, better exchange of information about national and European priorities will be required as the discussions on the overall structure and priority themes for FP8 increase in intensity and focus.

The ETP Mirror Group was established in September 2007 with eighteen National Food Platforms appointing members at this first meeting. It is the aim to have all Member States represented either as full members or, perhaps initially, as observers. Members will be in close dialogue with, or will belong to national food research agencies, ministries or equivalent funding bodies. The Mirror Group has created three Activity Groups to:

1. develop a strategy and respond to the current FP7 call for Enhanced cooperation in food and health with a view to strengthening the European Research Area,
2. identify overlapping research areas and sharing results, and
3. prepare an overview of funding opportunities.

The Mirror Group will be a driver for trans-European dialogue between bodies funding food research, and between these and the ETP to encourage the stakeholders to optimise research funding avoiding duplication and thereby releasing funding for shared strategic goals.

National Food Platforms

The National Food Platforms, which have been established or under development in 33 countries throughout Europe and in Israel, Russia and Ukraine (see Annex 3) have a key role in conveying the programme of the ETP to the national industry, especially to SMEs, the research community and to the other stakeholders in the national language(s). The main task is to strengthen and develop further the networking activities of the national food platforms and exploit the potential for their collaboration.

They are also important for dissemination, information gathering, training, technology transfer and fostering innovation, and in collecting national feedback to ETP proposals and inputting into position papers. Their collaboration and networking activity is contributing significantly to:

- the exchange of experience,
- the collation of best practices,
- ensuring that a joint, coherent research programme on food is realised in each country, and
- ensuring that their programmes are harmonised with the programmes of other European countries.

Activities include:

- maintaining and extending the collaboration of National Food Platforms in sharing experiences, to assist the formation of new national platforms and to improve the operation of the existing ones with a focus on fostering innovation,
- providing input for the identification of the priorities of national and regional R&D and innovation programmes and the provision of national feedback to ETP proposals and position papers. This process is achieved by establishing and maintaining regular national dialogue between the food industry, the research community and other stakeholders,
- developing best practices and guidelines for enhancing technology transfer. This includes tools, procedures and business development and project management supporting services, adjusted to the specific regional and national industry culture and business environment, with emphasis on SMEs, and
- establishing national, regional and international networks and clusters of food industry SMEs with research providers and other food chain members to foster the development of innovative products, processes and services. Since each National Food Platform will reflect the economic importance of the national food and drink industry sector, and the state of maturity of stakeholder interactions at national level, each will be structured and organised differently. Knowledge, experience and support will be offered to countries such as those in European Neighbourhood States, the Western Balkans and members of the MEDA GO TO EUROPE (www.medagotoeurope.org) Mediterranean Food Platform to become familiar with the issues being discussed.

National Food Platforms[20]

	Source of funding	Project type	Human resources	Funding amount
Priority activity 1	To develop and promote best practices and guidelines for enhancing technology transfer, including tools, procedures and business development and project management supporting services, adapted to specific regional/national industry needs and culture and business environment, with particular emphasis on SMEs.			
Deliverable 1	National and European surveys and studies for developing methods and models for elimination of barriers of food industry innovation, paying particular attention to SMEs.			
Implementation				
Deliverable 2	Recommendations and establishment of business planning and development and project management services to support innovation projects.			
Implementation				
Priority activity 2	To establish national, regional and international networks and clusters of food industry SMEs with research providers and other food chain members to foster the development of innovative products, processes and services.			
Deliverable 1	Networks, panels and clusters for shared cost and joint R&D and innovation projects.			
Implementation				
Deliverable 2	Organisational solutions, including national and regional technology transfer centres, for collecting research needs of the industry and the available expertise at international and national level and matching and supporting these.			
Implementation				
Priority activity 3	To maintain and extend the collaboration of national food platforms to exchange best practices, and share experiences; to assist the formation of new national platforms and improve the operation of existing ones for fostering innovation.			
Deliverable 1	Regular European and regional meetings to exchange views and experiences.			
Implementation				
Deliverable 2	Communication tools for promoting the concept and effectiveness of the national food platforms and disseminating success stories.			
Implementation				
Deliverable 3	Best practice guides to operate national food platforms.			
Implementation				
Priority activity 4	To provide input to identify the priorities of national and regional R&D and innovation programmes, and provide national feedback to ETP proposals and position papers through establishing and maintaining effective national dialogue between the food industry, the research community and other stakeholders.			
Deliverable 1	National surveys on changing R&D needs of the food industry with specific focus to SMEs.			
Implementation				
Deliverable 2	Regular meetings with stakeholders at national level.			
Implementation				
Deliverable 3	Development and revision of national R&D strategies and their implementation plans.			
Implementation				

(20) See page 16 of this document for explanation of the symbols used.

ERA-NETs

As part of its policy towards the creation of a European Research Area (ERA) the European Commission has introduced a programme of support for the coordination of national research at a European level - ERA-NETs, which bring together representatives of national funding bodies to exchange information about priorities of strategic national programmes, discuss opportunities for harmonisation, share results and, eventually, organise and manage joint calls. In the food sector only one such network, SAFE-FOODERA, has been formed which addressed the coordination of food safety research. Significantly, this has shown that there is considerable duplication of effort in certain areas of food safety across Member States. It would be expected that a similar situation will exist in other areas of food research. SAFEFOODERA has initiated two joint calls for proposals so far on several topics in food microbiology and food toxicology research, with funding made available by a selection of the Member States participating in this ERA-NET.

The period of EU support for SAFEFOODERA has now come to an end and it is important that the experience and information gained from this project be exploited for the effective cooperation of other food chain-related ERA-NETs.

The ETP has proposed that the European Commission consider support for the establishment of two more ERA-NETs on:

- Food and Health, and
- Sustainable Food Production/Food Chain Management.

ERA-NETs are an established means of coordinating nationally funded research. The ETP Mirror Group, above, will act as a conduit for promoting these and for presenting the case that ERA-NETs would have an even greater impact if the European Commission were to consider providing matched funding for any ERA-NET that resulted in a successful call for proposals from a multi-national consortium.

International links

Many of the key issues described in this IAP are shared with other regions. It is evident that strategic programmes of research are being undertaken in these regions and that these overlap with what is being proposed by the ETP Food for Life. Preliminary contacts with researchers and stakeholders in Australia, Brazil and New Zealand have indicated a readiness to share information and, where appropriate, to consider common participation in research, training and other activities. The rapid economic development of China and India suggests that early contacts be made with key players in these countries, as well as other countries which are signatories to Science and Technology Agreements with the EU; the offices of EU National Contact Points and representatives of EU-based businesses and universities in these countries will be invaluable in facilitating this process.

Opportunities for enhanced cooperation between New Zealand and EU food researchers and industry have been stimulated through funding of the FP6 FOOD-FRENZ project[21], which facilitates cross-sectoral collaborations incorporating consumer needs into food safety, personalised foods, sustainable food production and innovative and emerging technologies, all of which are represented in this IAP, together with animal health and welfare for food production. Follow-up mechanisms to extend this cooperation are being sought and a FOOD-FRENZ conference (Budapest, September 2008) will provide a unique opportunity to establish a durable link between the ETP and the New Zealand food chain community.

In 2008, the work programme of the People pillar of FP7 included a new IRSES (International Research Staff Exchange Scheme) call which has the aim of strengthening research collaborations with the rest of the world, exchanging researchers and identifying areas for common, rather than competitive activity. This, and other opportunities within the Cooperation, People and Capacities pillars, will be exploited to support and promote durable and mutually-beneficial links with countries outside Europe, especially those countries that have signed Science and Technology Agreements with the EU.

Whilst international cooperation did not initially have a high priority within ETPs the Third Status Report on European Technology Platforms[22] concludes that "it is essential (for ETPs) to establish appropriate relations with entities from third countries on a mutually-beneficial basis (exchange of experience, definition of strategic research needs). Such international contacts are expected to help platforms better position their research strategies and identify more accurately the promising areas, such as opportunities for potential lead markets".

Recently the report of the ERA Expert Committee[23] into international cooperation in science and technology has been published and concludes (p. 43) that "The further development of the

(21) www.foodfrenz.com.
(22) European Commission, 2007. EUR 22706.
(23) Opening to the world: international cooperation in science and technology. http://ec.europa.eu/research/iscp

international dimension both in ETPs and Joint Technology Initiatives should be carefully monitored. Considering their size and possible impact the role of international RTD cooperation in these important new European initiatives certainly deserves further close attention and is also an important aspect to be considered in the course of the development of a European strategy for international RTD cooperation". ETP Food for Life puts a high priority on developing mutually-beneficial contacts and cooperation with third countries and will explore with DG Research[24] how this might best be done.

The ETP will work closely with the well-established network of National Contact Points (NCPs) around the world to promote this international dimension. An International Task Force will be set up (see page 50).

Maximising investments and returns

ETP Food for Life has considered the current strengths of the European food market that need to be encouraged from the perspective of the research needs, not only in terms of determining where Europe has a market strength, but also in terms of what must be done if these markets are to retain their growth potential in future years.

The European Commission's recent policy development of encouraging European Lead Markets (see page 53) has focussed attention not only on R&D needs but also on those issues that must be addressed to drive the market forward rather than simply to encourage and rely on technology push. It has challenged the food and drink sector to define its lead markets and to identify what other issues must be addressed to deliver a holistic approach to market success which involves the concerted involvement of all the actors influencing this market.

This IAP demonstrates clearly that the resources necessary to effectively stimulate market success will involve a step change in re-orientation of strategic and applied research in Europe. A clear articulation of what strategic food research has to be undertaken at the European level must be agreed by Member States. A series of European strategic research programmes should link national research activities and ensure resources are effectively coordinated and targeted, whilst ensuring that some of the resources released are directed towards essential complementary activities. At the present time *ca* 95% of funding for scientific research comes from national funds whilst the remainder comes from support from the Framework Programme.

This issue is particularly acute in the agro-food sector since there are:

- multiple sources of funding internationally (including DG Research, DG Enterprise and Industry, COST, ESF). Within DG Research there are separate divisions and budgets dealing with, for example, health, agriculture, food quality and safety, the environment and science/society issues. This leads to a dispersion of investment and a lack of focus on those key societal issues where food and health have a major impact. These embrace production and distribution, consumption, environmental impact and communication with society.
- multiple sources of funding nationally. EU Member States can have independent research councils covering health, the social sciences, agriculture and food, and the physical sciences. There are few examples of joined-up activities around major societal challenges involving food production, nutrition and health. Similar considerations apply to government departments who may have budgets for research and development, and are responsible for the promotion of industrial competitiveness.

At this stage the problems of effectively coordinating national resources to address key issues are complex and slow. As a result, the creation of a truly pan-European Research Area and a European Industrial Development Policy for the food sector are far from being achieved and national resources are less than optimally utilised. It is essential that policies are put in place that promote integration so as to encourage more innovative research organisations that work closely with the industrial sector, to highlight best practices and to encourage and promote their adoption. *This single issue is the most important limitation for effective innovation.* The ETP Mirror Group as well as the Commission (through an expansion of the ERA-NETs) must deal with this issue as a matter of priority.

(24) Directorate D, International Cooperation, Unit D2, Analysis and monitoring of research policies around the world.

Task Forces

A Task Force focussed on identifying and prioritising the needs of the SME sector was set up during the development of the SRA and the IAP. It is proposed that similar Task Forces be established, targeted on specific issues, which will be disbanded once their goals had been achieved.

The SME Task Force will serve as a model for other activities. Task Force members will be drawn from the Board, Horizontal Activities and other ETP Working Groups, and individuals co-opted on the basis of specific knowledge and contacts.

Task Forces will be developed in the following areas:

- FP7/Funding Task Force: to identify, agree and implement activities to ensure that FP7 calls (across all pillars, not just Cooperation) are best suited to the needs of industry and innovation, to report to the Board about potential funding sources, to make contact with appropriate bodies and catalyse more detailed discussions leading to project elaboration.
- Training Task Force: to identify and promote structures and mechanisms for training new entrants into the food and drink sector, to retrain existing personnel, and to provide a framework for a flexible workforce needed to drive innovation.
- JTI Task Force: to explore the opportunities to establish a Europe-wide public-private partnership for the food and drink sector, building on the ETP Food for Life SRA.
- International Task Force: to facilitate, capture, adapt and promote the development of innovation and best practice in the exploitation of S&T relevant to the European food sector. The recent EU-Canada agreement on interaction of the Framework Programme and national programmes in the bio-products area[25] has shown that there are benefits to be gained from linkage of ongoing projects with similar objectives. Europe can additionally gain S&T knowledge, experience (for example, of accessing Pacific Rim markets) and best practice (for example, of knowledge transfer to industry).

Facility sharing

Facility sharing is a key topic for industry and research organisations. The high costs of state-of-the-art equipment, its accessibility to foreign experts and enterprises, the harmonisation of research approaches, the development of integrated, multi-disciplinary food research, the provision of the critical mass required for optimal activity and the educational and training opportunities for new and more experienced personnel, are just a few of the key benefits of a joint European facility sharing strategy for the food chain sector.

The twin objectives will be:

- to develop a European strategy for facility sharing, and
- to establish a European forum of key facility providers.

A logical approach would be to:

- identify Networks of Excellence in which facility sharing is a key topic,
- identify European Projects focusing on novel technologies for nutrition, processing and consumer R&D programmes,
- identify scientific needs and industrial opportunities for novel technologies and facilities,
- develop an outline for joint and regionally-focused facilities (e.g. for SMEs and start-up companies),
- benchmark against initiatives beyond Europe,
- demonstrate best practices (at regional, national and European levels),
- develop formats for the best and most efficient use of facilities, and
- develop organisational structures for joint facility sharing initiatives (at scientific and management level).

Anticipated outcomes would include:

- a shared vision and strategy on facility sharing,
- initial examples of best practices, and
- optimising European facility and infrastructure resources.

(25) Interactions and synergies across complementary bio-product projects funded by FP7 and Canadian national programmes will be optimised through targeted EU funding.

Facility sharing[26]

	Source of funding	*Project type*	*Human resources*	*Funding amount*
Priority activity	To develop a vision and strategy on facility sharing in Europe.			
Deliverable 1	Shared vision and strategy on facility sharing.			
Implementation		 		
Deliverable 2	Description of best practices.			
Implementation		 		

Infrastructures

Within FP6, new instruments were introduced to facilitate capacity building and generation of critical mass in areas necessary for Europe's future scientific and economic development. A number of these Networks of Excellence (NoEs) were funded in the food chain area. Implicit in the structuring and programme of these NoEs was a requirement that they address the issue of how their activities would be funded and managed beyond the period of FP6 funding (that is, their sustainability).

Many such networks are beginning to reach the end of their FP6 funding and it is clear that the challenge of ensuring continuing funding has proved very considerable. The human and financial investment into these networks is such that consideration should be given to short-term funding from FP7 (perhaps through a Specific Cooperation Action) to assist NoEs *that have already established new entities as part of their long-term sustainability planning*. An example of what might be achieved and what extra added-value is possible by bringing together areas of activities that are currently freestanding is the concept of a European Nutrition Research Infrastructure (ENRI).

As indicated in Key Thrust 1, the challenge of modern food and nutrition research is to identify food-based strategies, which maintain optimal health and well-being throughout life. Such research is increasingly complex because it exploits a multitude of biologically active compounds acting on a network of interacting physiological processes. Whilst it can profit enormously from the revolution underway in the biological sciences, nutrition research has very obvious discipline-specific requirements for analytical and bioinformatics procedures.

Within ENRI, all the elements needed to perform modern nutrition studies (genetics, transcriptomics, proteomics, biomarkers, metabolomics, functional assays, imaging technologies, food composition and food intake) will be tailored to nutrition research needs and embedded in an environment of standard protocols, annotations, modular data-basing, networking and integrated bioinformatics. Training will be available where needed. All these facilities are envisaged as an integrated toolbox, the 'nutritional phenotype database', which will serve both as a research environment and as a publicly available data and knowledge depository to maximise benefit by enabling integration and interrogation of data from multiple studies. As part of the infrastructure, a flexible IT-grid will be installed allowing distributed networking, owner-controlled data sharing and grid-computing. During the funding period, this grid will eventually expand to cover all major research sites.

ENRI will be embedded in related FP6 Networks of Excellence (NuGO and EuroFIR) and has an active dissemination and sustainability strategy. Its overall objective is to harmonise nutrition and health research to the benefit of (European) nutrition research, the food industry and the public. This infrastructure has the potential to develop into a more concrete Institute and will have a major impact on valorisation of the acquired knowledge to food industry, in their role to produce healthy foods. Although this proposal passed EC evaluation thresholds for a European Infra-structure, it was not funded in 2008 but clearly demonstrates the potential benefit of NoEs working together to build research infra-structures and enabling technologies in Europe.

EuroFIR has developed databanks on both the composition and biological effects of nutrients and non-nutrients with putative health benefits, which is a unique resource for Europe and should be maintained and updated continuously. EFSA has recently announced a tender for delivering a database on bioactive constituents in food which may provide some funding to maintain and further

(26) See page 16 of this document for explanation of the symbols used.

develop a database on bioactive constituents. An expansion of its current work, which underpins all areas of this IAP should also address:

- harmonising standardised European food databank systems, linked through the internet and maintained at the European level,
- promoting the standard for exchange of nutritional composition data in food ingredients and composite recipes as a new European standard through the newly established CEN/TC 387 - "Project Committee - Food Composition Data",
- adoption of certified processes and protocols for increased data quality on food data by national compilers in all EU countries,
- linkage of food databank systems with food intakes and epidemiology databases (the same should apply to consumer behaviour, including that of minority populations, regarding selection of foods that use bioactive compounds),
- expanding the classification of European foods and using LanguaL (a food description system) to ensure international harmonisation,
- linking food nutritional information with data on originality, post-harvest treatment and processing,
- linking European food databank systems and methodology of measurement with similar databases in other countries, especially those that export substantial quantities of major foodstuffs to Europe, and
- initiating scenario studies, also described as foresight studies, provide challenging visions of the future to ensure the effective targeting and focussing of research strategies by providing evidence to inform actions by governments, business and academia. They focus around key issues where scientific research is expected to provide solutions to a problem and ask feasible 'what if' questions. In addition they frequently address the policy framework that will be needed for a successful outcome, and their results will inform policy development.

It is very likely that other infrastructure possibilities will emerge and the ETP will be proactive in supporting their development.

Links with other ETPs

The Knowledge-Based Bio-Economy (KBBE) sector which corresponds to the interest base of the Food, Agriculture and Fisheries, and Biotechnology theme of FP7, includes ETPs which address: plant biotechnology, food chain, industrial biotechnology, animal breeding and reproduction, forestry, biofuels, agricultural engineering, global animal health and aquaculture. In addition, discussions are currently in progress about establishing an ETP on the animal feed production chain.

These existing KBBE Technology Platforms have joined forces to address synergies and gaps in their Strategic Research Agendas and a new FP7 project, BECOTEPS, to be coordinated by ETP Plants for the Future, will run from 2009 to 2010. The project will facilitate the ongoing collaboration and interaction of KBBE ETPs, define research challenges and optimise dissemination to national and European funding organisations and ministries. ETP Food for Life (represented by Kirsten Brandt, Newcastle University) will take overall responsibility for organising workshops on 'Trust and collaboration in the food and feed chains', 'Integrating non-food chains', and 'Cross-cutting sustainability issues'.

ETP Food for Life has benefited considerably in the development of its Vision Document, SRA and, now, its IAP from the experiences and best practice provided by more advanced ETPs and it now looks forward to passing on its experience and encouragement of other ETPs.

There are other ETPs and JTIs beyond the KBBE area, which are also relevant, for example, to the food and health issues described in this document. During the development of the ETP's SRA it became clear that there were issues and interests in common between the food and pharma sectors, even though the make-up of their industries are very different. An initial workshop[27], attended by 110 people, was jointly organised with the Alimentary Pharmabiotic Centre, Cork, and the Irish National Food Platform and included inputs from the perspective of the Innovative Medicines JTI.

A number of scientific, business and regulatory issues were identified which would benefit from a cooperative approach between the two sectors and constraints limiting such cooperation were identified and suggestions made about overcoming these. A follow-up meeting is planned later in 2008.

(27) The Workshop presentations and proceedings are now available to download from the ETP website, http://etp.ciaa.be

Promoting the ETP

Organisational and communication issues

The main channels of communication will be the ETP website and a quarterly electronic newsletter. As the IAP develops, the information to be circulated will become more diverse, and will include that relating to:

- the ongoing activities of the individual Key Thrusts and Communication, Training and Technology Transfer activities,
- individual Task Forces,
- the Mirror Group,
- the network of National Food Platforms,
- the progress of projects in which the ETP is involved,
- ETP contacts with countries and organisations outside Europe,
- funding opportunities at European and national level which are relevant to the IAP,
- opportunities for infrastructure and facility sharing, and
- conferences, workshops and other activities at which information about the ETP will be presented.

The information channels to be used by the ETP will be regularly reviewed and updated to ensure their continued fitness for purpose as the nature and extent of the information to be disseminated changes.

Information will be disseminated using existing information channels and networks, such as CORDIS, CIAA, National Food Platforms, consumer associations, NGOs, professional bodies (such as EFFoST, EuCheMS), European and National Parliaments, and trade and professional journals. Information about the ETP and presentations in English will be available on the website for direct use or prior translation into other languages.

Good contacts have already been established with FP7 National Contact Points (NCPs) in Europe and in some third countries and these will continue to be developed and exploited. The FP7 BECOTEPS project (page 52) linking the KBBE ETPs will facilitate transfer of information about the ETP's activities to those engaged in primary production, developing rural economies, the fisheries sector, etc. The effective contacts already established with the European Parliament by CIAA and ETP Plants for the Future will be invaluable in disseminating information about

the role of ETP Food for Life and also the broader roles of the KBBE ETPs. Finally, the ETP will respond positively to requests from the European Commission, COST, EUREKA, ESF etc. to provide information or to participate in missions and visits to promote European science and technology.

Lead Market Initiative

The ETP has responded to the Lead Market Initiative (LMI)[28] by identifying healthy foods, addressed within Key Thrust 1, as a sector where the greatest market growth opportunities lie and which reflects the increasing desire of consumers for a healthy and varied diet. Analysis of the issues facing this sector will cover R&D as well as areas requiring future action if market success is to be achieved. A call focussing on a lead market initiative for the food chain sector, paying particular attention to the needs of all stakeholder communities, was included in the 2008 call of the Food, Agriculture and Fisheries, and Biotechnology theme of the FP7 Cooperation pillar.

The LMI offers the possibility to continue the work of the ETP in areas where dynamic markets currently exist. It is important, however, also to consider the other two Key Thrusts of the ETP. Opportunities will depend on the results of detailed analyses of market growth that LMI funding would permit; such analyses have not been possible within the currently funded ETP programme.

The European Commission has recently announced that a High Level Group would be established to address issues related to the competitiveness of the agro-food industry and to address challenges such as food safety, health and the environment. The ETP is in a unique position to input into this group and to debate the need for specific funding mechanisms relevant to the structure of the industry and the varied potential sources of funding.

(28) A Lead Market Initiative for Europe. European Commission COM, 2007, 860.

Joint Technology Initiative

Joint Technology Initiatives (JTIs)[29] provide a way of supporting long-term research by combining private sector investment with national and European public funding, including funds from the Framework Programmes and, possibly, also loan finance from the European Investment Bank. These partnerships are focussing on technologies that are strategic to Europe's future. The rapid pace of technological change, the rising costs of research, the increasing complexity and interdependence of technologies, and the potential economies of scale to be gained by cooperation across Europe are all strong reasons for setting up long-term public-private partnerships. The European Commission expects this new model of public-private partnership to stimulate additional European research investment, build critical mass by uniting currently fragmented efforts and ensure effective and efficient programme management.

The Strategic Research Agenda (SRA) of the ETP Food for Life will require a significant research input from the private and public sector. The JTI concept is well positioned to contribute to this IAP and can build on the established public-private partnerships at the national level and joined collaborations at the international level. A strategic decision has to be made by key opinion formers, policy makers and representatives of the food industry whether or not to develop a JTI in the area of Food and Nutrition. Two scenarios may be envisaged, namely to create:

- an EU-wide public-private partnership, or
- a 'super league' of existing public-private partnerships.

The food industry should take the lead and drive this issue forward. This implies significant commitment and requires the willingness to initiate discussions with various governmental bodies.

Contacts with policymakers

In order to operate effectively, this ETP must engage with policymakers at European and national levels. ETP Plants for the Future and CIAA each have established excellent links with the members of the European Parliament and its Research Committee, which should be exploited by ETP Food for Life. Multinational agro-food companies also have established channels for meeting representatives of the European Commission and Parliament on a regular basis and for discussing issues of common concern, and these contacts should be exploited. Parallel contact-making, discussion and dialogue will be promoted at national level through National Food Platforms and by exploiting existing bilateral contacts between individual stakeholder sectors and national parliamentarians.

European Institute of Innovation and Technology (EIT)

The initial concept of the European Institute of Technology was one that the ETP was very supportive of, integrating as it does Education, Innovation and Research - the elements of the so-called 'Triangle of Knowledge'. However, its subsequent development has been associated with a narrowing of scope, at least in its initial phase. Realistically, there appears to be little chance of 'food' being included amongst the areas represented in the initial group of two or three Knowledge and Innovation Communities (KICs) within the renamed European Institute of Innovation and Technology[30]. The ETP will, therefore, follow the development of these KICs with interest and take opportunities to engage with the EIT's Governing Board so as to be best positioned to make future submissions about a food-related KIC. Given that decisions about the first phase of KICs are expected in 2010, this is unlikely to be before 2015.

Educating a new generation of food scientists and technologists

The 2008 call of the Food, Agriculture and Fisheries, and Biotechnology theme of the FP7 Cooperation pillar included a topic addressing the requirements for the next generation of European food scientists and technologists who will be employed mainly in industry (including SMEs), universities and research centres, NGOs and government departments and funding bodies[31].

A broad range of skills will be required, some of which will extend beyond the laboratory and professional expertise of past generations; in particular, flexibility, good communication and interpersonal skills, an awareness of the needs of different stakeholder communities, ethics, intellectual property and entrepreneurial activity,

(29) See http://cordis.europa.eu/fp7/jtis

(30) ec.europa.eu/eit

(31) It is important that consideration of these requirements also take account of the current gender bias found in some areas of science and technology. The ETP will assist in widening the base of future food scientists and technologists by identifying speakers best able to describe the challenges and excitement of a career in food science and technology to those at all levels of secondary and tertiary education. However, it should be noted that the best advocates are other young people.

trans-national cooperation and the benefits of true interdisciplinarity (including the social sciences and humanities). The ETP, and members of its Communication, Training and Technology Transfer WG in particular, have considerable experience and expertise in these areas and will seek to input into the discussions and deliberations of the successful partnership. Gathering information on stakeholder needs could be facilitated by inputs from National Food Platforms and from EFFoST.

Communication, training and technology transfer

Communication, Training and Technology Transfer are three distinct but deeply-interwoven areas of one fundamental element - maintaining a high profile for the European food industry to the benefit of this industry, its stakeholders and the society it delivers to.

A successful food market requires the effective interplay of a wide range of skills; an understanding of consumer and behavioural science issues, nutrition, food safety issues, information technology, food processing technologies and management of the food chain are necessary to underpin the success of an enterprise, whether large or small. Where such wide-ranging skills cannot be integrated and employed within an enterprise it is vital that easy access to these is needed through well-financed and effective regional centres of technology transfer.

Communication [32]

The communication element of the ETP requires a coherent and durable programme of initiatives since an effective communication strategy must establish trust and confidence which cannot be achieved in the short term, and its ultimate impact will depend upon the ETP having, and being perceived to have, independent credibility across all stakeholder communities. The communicative dimension can be structured according to the scheme outlined below. The logic of the scheme is relational, that is, establishing links among different aspects of effective communication.

Consumer-oriented communication initiatives

These will secure a steady and continuous relationship with the consumers via the 'umbrella role' of national and European consumers associations and assure an important societal dialogue with governments and non-governmental bodies on food-related issues.

Two lines of communication will be supported:

1. From consumers to companies: Facilitating information about the consumers' interests and what the consumers would like the companies to do to support these interests.
2. From consumers to researchers: Facilitating discussion and dialogue about consumers' interests, why consumers often distrust new developments in the food sector and what consumers would like researchers to do to support these interests, so as to educate researchers to focus their efforts on technologies and topics that consumers appreciate.

Objective

To guarantee an effective and continuous communication flow to and from consumers via associations and other channels.

Approach

- Ensuring that contributions from consumer organisations are integrated in national initiatives involving food companies, researchers and other stakeholders.

(32) Communication activities to optimise the ETP's activities and effectiveness are addressed on page 53.

- Organising meetings and conferences with emphasis on local/regional issues within each Member State. These initiatives will seek to explain issues of major concern for the end consumer to the industry and the research community.
- Identifying communication topics (food safety and health, consumer preferences etc.)
- Identifying communication channels (mass media, group communication, ICT design etc.)

Company-oriented communication initiatives

The dialogue with European food industries, both large and small, must be improved to motivate and support food companies in their exploitation of research and innovation results. The provision of reliable information and use of new and appropriate communication technologies, including direct contact at the national level, will create a 'partnership of trust' between the ETP and the national platforms.

It is vitally important that all participating companies gain clearly identifiable advantages from this newly conceived networking. In this way successes can be promoted and good practices spread. Information is one of the key benefits of a network and a successful communication system demands that initiatives be taken at company level. These should be primarily targeted at reinforcing existing networks by expanding them, improving their quality and delivery and building on existing best practices drawn from all parts of the world.

The relevant lines of communication are:

1. From companies to other companies: Exchanging information about common challenges, opportunities and experiences. One result would be the creation of clusters of companies, for example retailers and suppliers, better able to secure additional markets through working together.
2. From companies to consumers: Establishing independent communication channels where companies can explain and discuss with consumer organisations issues such as regulatory constraints that prevent them from meeting the consumers' demands; the aim being to identify joint interests to improve the food regulation locally and across the EU. In this respect existing best practices provide an example to be duplicated and reinforced.
3. From companies to researchers: Sharing and exchanging information about the problems, opportunities and other issues facing companies, in particular SMEs, which would benefit from research efforts, with particular emphasis on topics affecting many companies and the relation between companies and society.

Objective

- To develop and implement a communication management system.
- To provide food company-relevant information to food companies.
- To minimise barriers to innovation, especially those prevalent in the SME sector,
- To promote information exchange among companies.
- To promote best practices on the basis of a tutoring approach (large and medium-sized companies towards smaller ones).
- To promote diffusion of certified communication initiatives to consumers to explain the benefits and the diversity of different food types.

Approach

- Establishing national contact partners in each European country under the auspices of the national platforms.
- Realising a new ICT (Information, Communication Technology) system for company networking at the national and international level.
- Improving interaction and information transfer with the companies.
- Ensuring the active involvement of other stakeholders (funding bodies, innovation suppliers, consumer organisations, research groups).
- Developing national platform action plans for lobbying, tailored newsletters, consultations with associations, extension programmes, etc.
- Establishing a comprehensive inventory of providers of state-of-the-art data mining for ready adoptable technology-based solutions.
- National and country specific focused distribution and dissemination of exploitable results, including comparison of benchmarking data for trans-national service providers.

Researcher-oriented communication initiatives

The scientific community must be motivated to ensure that new knowledge will be more effectively and rapidly transferred to industry to develop products and services that contribute to the prosperity and well being of society at the national, European and global level.

The relevant lines of communication are:

1. From researchers to other researchers: Extending and promoting the academic value tradition of generating new knowledge with valorisation as a key distinguishing factor of scientific achievement. This could involve the

twinning and clustering of organisations experienced in such activities with those less experienced.

2. From researchers to consumers[33]: Establishing independent communication channels where researchers can explain and discuss with consumer organisations the context and aim of their work at as early a stage as possible, including regulatory constraints that prevent them from meeting the consumers' demands, with the aim to identify joint interests to improve the regulations locally and across the EU.
3. From researchers to companies: Establishing independent communication lines where researchers can explain and discuss with company organisations their ideas and work in progress with the aim of identifying joint interests to improve the focus in the academic community locally and across the EU.

Objective

To improve communication through revision of the academic value tradition in food science and technology.

Approach

- Allocating national research funds to institutions and projects in the food science area based not only on scientific and technological excellence but also on take up by industry and benefit to society.
- Establishing communication support facilities for researchers. These may comprise of targeted communication events, dedicated communication units, a popularisation service (expert support to rephrase scientific publications for relevant target groups).
- Establishing benchmarking facilities where end users (consumers and companies) can rank the quality of the service they received from research institutions.

Communication[34]

	Source of funding	*Project type*	*Human resources*	*Funding amount*
Priority activity 1	Consumer-oriented communication initiatives.			
Deliverable 1	Continuous communication flow to and from consumers via associations and other sources.			
Implementation				
Priority activity 2	Company-oriented communication initiatives.			
Deliverable 1	Communication management system for the use of national food SME networks for regular delivery of new information.			
Implementation		  		
Deliverable 2	Provision of food company-relevant information in the form of focussed and updated information.			
Implementation		 		
Priority activity 3	Researcher-oriented communication initiatives.			
Deliverable	Improved communication by revision of funding allocation principles.			
Implementation		 		

(33) Close contacts will be maintained with the Executive Agency for Health and Consumers, EAHC, (until July 2008 the Public Health Executive Agency, PHEA) which is managing Better Training for Safer Food, a Community training strategy in the areas of food and feed law, animal health and animal welfare rules, and plant health rules; www.ec.europa.eu/phea

(34) See page 16 of this document for explanation of the symbols used.

Training

Training is a key component for the extension of knowledge as well as for its transformation into competitiveness. The overall strategic goal is to increase the competitiveness of the European food industry through a well-trained, flexible and skilled workforce. There is one clear aim - to close the present 'innovation gap' between research and its application. This will be addressed by:

- making food science expertise accessible to the food industry and making it useable for its employees by appropriate training at all levels, and
- establishing a Europe-wide network resource of existing and emerging training resources for implementation of concerted training activities.

This is a very challenging and complex area and best practices and experience will be reviewed in an ongoing manner and an appropriate strategy adopted. A Training Task Force will be established to ensure that the widest range of opinion and expertise can be captured, exploited and directed.

Objective

- To canvass opinion and, if supportive, establish a European network facilitator diploma for Techno-Science Mediators (TSMs).
- To establish, update and improve training facilities for the food industry in all European countries.

TSMs should become an important resource for the innovation within the European food industry. A common position concerning the skills of TSMs has to be agreed through a mutually recognised system of certification for TSMs. Existing successful bottom-up initiatives taken in specific countries and regions must be supported by trans-national links to promote best practice, to ensure that resources are targeted towards topics with the best return (for companies) on (public and private) investment and to support rapid responses to new training needs.

Once the European Network Facilitator Diploma is established across all European educational institutions that can meet the accreditation standards set by a proposed European Foundation for Advanced Food Training and Technology Transfer (EFAFTTT), it will provide a number of fully-skilled professionals, who will apply their skills within individual countries. However, not all countries already possess a sufficient training infrastructure to fully exploit the potentials of the food companies, so the role of the EFAFTTT will subsequently change from setting standards to a more involved coordination role in support of national training activities to maximise their benefit for the industry. It is highly recommended that each country refers to existing best practices in the fields of food technology and the food supply chain. A Training Task Force will be set up (see page 50).

Approach

- Establishing a feasible design for EFAFTTT as a supra-national institution to act as a Standards Approval Board for the European network facilitator diploma for TSMs.
- Defining its task and activity programme to allow industry (sectors) to define its needs for better coordination of the existing training capacity.
- Defining standards and procedures for the accreditation of the European network facilitator diploma for TSMs, including integration with national curricula.
- Creating a feasible procedure to establish the diploma as a mutually-recognised training agreement taken at European level (European certification at technical schools and early educational training/university/postgraduate level).
- Using existing best practices to develop a suitable skill-based profile of these newly created professional mediators based on the outcome of benchmark facilities in existing institutions and analysis of company scorings.
- Defining and sustaining the adoption of national operative training and technology transfer programme inspired by the EFAFTTT guidelines and benchmarking of training providers.
- Maximising the utilisation of specialised training facilities through trans-national collaboration, twinning and clustering.

Training[35]

	Source of funding	*Project type*	*Human resources*	*Funding amount*
Priority activity	To establish the European Foundation for Advanced Food Training and Technology Transfer.			
Deliverable 1	Establishment of the European Foundation for Advanced Food Training and Technology Transfer and a facilitator diploma for Techno-Science Mediators.			
Implementation				
Deliverable 2	Updated and improved training facilities for the food industry in more than 30 European countries.			
Implementation				

Technology Transfer

Technology transfer, put simply, is the conversion of existing knowledge into an appropriate format so that it can be used by industry to develop new products, processing and services that deliver economic and social benefits. Because there is a demonstrable need to improve the success rate of innovation in the European food and drink industry, credible partners to support innovation through the identification and adaptation of appropriate solutions to technical and legislative challenges are essential for its future success.

By analogy with the previous elements, Communication and Training, two complementary approaches are proposed: firstly, by encouraging companies to act as innovation- driven units as part of a collective network of innovators, and, secondly, by creating, supporting and promoting a technology transfer resource network shaped by a customer- oriented philosophy, i.e. stimulating technology transfer providers to arrange their expertise, human capital and organisational structure as do real service providers.

Best practices and experience will be reviewed in an ongoing manner and an appropriate strategy adopted.

Objective

- To develop the TSM Networking Initiative.
- To elaborate recommendations for successful technology transfer at European and national level in consultation with individual national food platforms.

TSMs, qualified under the pan-European diploma, will provide a key resource to directly promote technology transfer to food companies at the national level; this will be a crucial tool for improved technology transfer activities. A flexible networking approach will be key to improved technology transfer.

No universal formula for successful technology transfer exists. As a number of transfer activities have been carried out so far, the ETP needs to learn from their history and their strengths and weaknesses. ETP Food for Life will critically investigate the successes and failures of transfer between research and industry by analysing the characteristics of initiatives that receive high or low satisfaction scores in the benchmarking data provided by the food industry, and will make recommendations on how to implement this information by providers of know how, researchers, training institutions etc. across the European food industry.

Approach

- Defining the network environment of the TSM for optimum promotion and benefit of the communication activities.
- Establishing a cluster of programme activities in the national countries by the National Food Platforms.
- Encouraging the creation of a group of leaders in technology transfer based upon the examples of the national best practices and long established support organisations reflecting the different European regions.
- Evaluating and ongoing monitoring of TSM basic programmes using established benchmarking facilities.
- Evaluating potential enlargement of networks to exchange information on international and national level.

(35) See page 16 of this document for explanation of the symbols used.

- Analysing characteristics distinguishing best and worst practice and case studies for establishing new formats for enhanced support of innovation in the food SMEs.
- Evaluating the effectiveness of SME partnership programmes and standardisation of activities to support them.
- Developing a dedicated funding scheme for enhanced collaboration between the food industry and knowledge providers.
- Developing national initiatives based on a general strategy for the food sector (as for instance the one represented by the Food and Nutrition Delta in the Netherlands).
- Developing formats for the best use of collective research, marketing and supply chain resource management activities for enhancing innovation at food SMEs.

All these activities will be carried out side by side with close exchange of information and results. This will lead to development of coherent results and a complementary input by EFAFTTT into the TSM networks.

Technology transfer[36]

	Source of funding	Project type	Human resources	Funding amount
Priority activity	To develop the Techno-Science Mediator networking initiative and to recommend on successful technology transfer at European and national level.			
Deliverable 1	Techno-Science Mediator networking initiative.			
Implementation		 		
Deliverable 2	Updated and improved training facilities for the food industry in more than 30 European countries.			
Implementation		 		

(36) See page 16 of this document for explanation of the symbols used.

ETP Food for Life: past, present and future

Since its inception in November 2004, the ETP has forged strong links with European industry, universities and research institutions, funding bodies in individual Member States, the European Commission and consumer groups. It has prioritised the major research needs for ensuring a successful and dynamic industry and has indicated what resources might be needed, where they might come from and what other non-research issues will have to be addressed to ensure the European Research Area for the food sector becomes a reality.

This means that there will need to be a serious and long-term commitment by the industry and the public sector to address the underlying problems that exist at present. Industry, especially the SME sector, will need to be convinced of the benefits to them of research through collaboration. National research funding bodies must be willing to commit greater resources to coordinated, multi-disciplinary projects on a greater scale than exists a present.

This IAP has assessed the resources and mechanisms that are needed to meet its objectives. It estimates that some 400-500 million euros annually over the next five years are required to ensure their priorities are successfully achieved; budgets beyond this period will be presented nearer the date. Of these resources approximately 50% will need to be focussed on the requirements for research listed in Key Thrust 1 (Improving health, well-being and longevity) with the balance equally spread between Key Thrusts 2 (Building consumer trust in the food chain) and 3 (Supporting sustainable and ethical production).

It is believed that with the right commitment to action much of this resource could be made available through existing investments but the obstacles that will need to be overcome to ensure these resources are effectively targeted, are substantial, and involvement at the highest level will be needed to ensure progress.

The ETP has facilitated interactions and communication between researchers and manufacturers, including multinational European industries and SMEs, funding bodies, government departments and academic institutions, as well as national and European programmes of research. This, in turn, has already led to a positive impact on the priorities for research in the call for proposals that have been published by the European Commission.

The ETP, with its approach to co-operation and consultation throughout Europe has arrived at a set of proposals for strategic, co-ordinated and multi-disciplinary initiatives designed to promote innovation in the food and drink sector in the future. The industry has shown a strong commitment in producing the ETPs Vision, SRA and IAP and acknowledges the financial support from the European Commission in enabling such progress to have been made. Nothing similar to this work has been undertaken at the European level before.

There is a strong desire on the part of the industry to continue work on the implementation phase of the ETP Food for Life and the ETP Board will be giving serious attention to how the work of the ETP Food for Life should continue in the future. Nonetheless the food industry is not in a position to transform attitudes in Europe. Consumers demand certain assurances on nutrition and health that require a heavy investment on the part of the public sector and much of the research and educational initiatives are driven by governments. It is clear that no government in Europe has the resources to address the challenges highlighted in this IAP. There must be a radical change in the organisation of strategic research such that there is a more collective planning and implementation process developed across Europe.

A truly *European* Research Area is far from a reality in the food sector. Without the continuation of an organisation like the ETP there will be no pressure on governments to change. The ETP is ready to take on this challenge and to make its views known through the High Level Group on the Competitiveness of the Agro-Food Industry recently set up by the Commission.

Annexes

Annex 1. ETP Food for Life Board, Operational Committee and Working Groups

The ETP Food for Life Board

Chair

Professor Peter van Bladeren; Vice-President for Research, Nestlé (CH)

Treasurer

Ms Mella Frewen, General Director of CIAA (BE)

Members

Professor Andrzej Babuchowski, Permanent Representative of the Republic of Poland (PL)

Dr Didier Bonnet, Director of Cargill European Technology Centre (FR)

Ms Kelly Duffin-Maxwell, Vice-President for R&D, Kraft Foods (USA)

Ms Roxanne Feller, Copa-Cogeca (BE)

Professor Michael Gibney, University of Dublin (IE)

Dr Birthe Jessen, Director of the Center for Advanced Studies (DK)

Dr Jürgen Kohnke, President of FEI (DE)

Professor Xavier Leverve, Scientific Director, INRA (FR)

Dr Lisbeth Munksgaard, Danisco A/S (DK)

Professor Peter Raspor, President of EFFoST (SI)

Mr Daniele Rossi, General Director of Federalimentari, Italy (IT)

Dr András Sebok, General Manager, Campden & Chorleywood Hungary (HU)

Professor David White, Chairman of FOOD*force* and Director of the Institute of Food Research, Norwich (UK)

Dr Jan Maat, Chairman Operational Committee (NL)

Advisors

Dr Herman Koeter, Acting Executive Director, EFSA (IT)

Representative from BEUC (BE)

Guests

Mr Michel Coomans, DG Enterprise, European Commission (BE)

Dr Timothy Hall, DG Research, European Commission (BE)

ETP Secretariat

Dr Virginie Rimbert (until 1 July 2008)

Ms Roberta Mancia (from 1 September 2008)

The ETP Food for Life Operational Committee

Chair

Dr Jan Maat, Unilever, Vlaardingen (NL)

Members

Dr Michele Contel, Progetto Europa PE, Rome (IT)

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ETP Food for Life Working Groups[37]

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Professor Klaus Grunert, School of Business, Aarhus (DK)
Dr Peter Leathwood, Nestlé, Lausanne (CH)
Ms Noëlle Vontron, EuroCommerce, Brussels (BE)

(37) These ETP Working Groups played a central role in developing the ETP's activities from its Vision Document to Stakeholders' Strategic Research Agenda (SSRA) and publication of the Strategic Research Agenda (SRA). Many Working Group members played key roles in securing trans-national discussions and debate on the SSRA and in the establishment of national food platforms. Currently, consideration is being given to the future role of these groups in the post-IAP phase of the ETP.

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Annex 2. Funding opportunities for ETP Food for Life

ETPs are, by definition, industry-led public-private partnerships. A workshop was held in January 2007 to examine opportunities for securing public/private partnership funding and several examples of successful food/health-related public-private partnerships were described.

Public funding

Framework Programme 7 (cordis.europa.eu/fp7)

Framework Programme 7 (FP7) runs from 2007-2013, has a budget of 50.5 billion € and funding is sought by open competition with defined deadlines and independent evaluation. The ETP has significantly influenced the calls within the Food, Agriculture and Fisheries, and Biotechnology theme of the Cooperation pillar, but progress in other areas has been limited.

FP7 has four areas of opportunity:

- Cooperation pillar (32.37 billion €): Support is given to the whole range of research activities carried out in trans-national co-operation, from collaborative projects and networks to coordination of research programmes. Industry involvement is generally necessary and increasingly international co-operation between the EU and third countries (so-called SICA - Specific International Cooperation Action) is an integral part of this action. Scientific support to policy work and emerging areas are also included under each of the themes. Key themes are Health (6.05 billion €); Food, Agriculture and Fisheries, and Biotechnology (1.94 billion €); Nano-production (3.5 billion €).
- Ideas pillar (7.46 billion €): An autonomous European Research Council (ERC) has been created to support investigator driven 'frontier research' carried out by individual teams competing at the European level in all scientific and technological fields, including life sciences.
- People pillar (4.73 billion €): The activities supporting training and career development of researchers, referred to as 'Marie Curie' actions, have been reinforced with industry-academic networks to optimise training and career development, and activities to develop sustainable links with countries outside Europe.
- Capacities pillar (4.22 billion €): Key aspects of European research and innovation capacities will be supported: research infrastructures; research for the benefit of SMEs; regional research-driven clusters; unlocking the full research potential in the EU's 'convergence' regions; 'Science in Society' issues; horizontal activities of international co-operation.

Joint Technology Initiative (cordis.europa.eu/fp7/art171_en.html)

Joint Technology Initiatives (JTIs) are legal entities, which are proposed as a new way of realising public-private partnerships in relevant industrial research and development fields at European level. JTIs arise primarily from the work of European Technology Platforms (ETPs). In a small number of cases (for example, fuel cells, innovative medicines, green air transport), ETPs have achieved such an ambitious scale and scope that they will require the mobilisation of public and private investments as well as substantial research resources to implement important elements of their Strategic Research Agendas. JTIs are proposed as an effective means of meeting the needs of this small number of ETPs.

Article 171 of the Treaty allows the European Community to set up any structure necessary for the efficient execution of research, technological development and demonstration programmes. It allows for a wide range of possible implementation structures for Community research and development programmes, of which the most prominent is a Joint Undertaking which offers the advantage of creating a strong and efficient coordination mechanism, able to structure and handle contributions coming from different sources. The European Commission has set out an identification process for JTIs involving the following criteria:

- strategic importance of the topic and presence of a clear deliverable,
- existence of market failure,
- concrete evidence of European Community value added,
- evidence of substantial, long-term industry commitment, and
- inadequacy of existing Community instruments.

(38) The European Commission has recently published a Practical guide to EU funding opportunities for research and innovation which addresses opportunities funded through FP7, Structural Funds and CIP. http://cordis.europa.eu/eu-funding-guide/home_en.html

ERA-NET
(ec.europa.eu/research/fp6/index_en.cfm?p=9_eranet)

These are partnerships of national funding bodies; there is already a SAFEFOOD ERA-NET (which will finish soon, and a proposal for further funding has been made to the European Commission by the ETP). In its SRA the ETP requested the European Commission to support the establishment of two more on Food and Health, and Sustainable Food Production/Food Chain Management. ERA-NETs are a means of coordinating nationally funded research and link to the ETP's Mirror Group.

National Governments

Around 95% of the funding for scientific research comes from national governments across Europe, the remainder from the FP. The Mirror Group and ERA-NETs provide mechanisms to identify priorities of national funding programmes, exchange results and best practice, minimise overlap and duplication, and identify opportunities for open- or joint calls.

Private funding

Competitiveness and Innovation Programme (CIP, http://ec.europa.eu/enterprise/enterprise_policy/cip/index_en.htm)

Competitiveness and innovation are the twin keys to unlocking Europe's potential for sustainable growth and more and better jobs. The European Commission will manage this new programme that spans the work of DG Enterprise and Industry, DG Information Society and DG Transport and Energy. The budget is € 3.6 billion over seven years. The CIP will:

- foster the competitiveness of enterprises, especially SMEs,
- promote all forms of innovation,
- support actions that develop the capacity of enterprise and industry to innovate,
- boost the use of Information and Communication Technology (ICT), environmental technologies and efficient and renewable energy sources.

It provides a comprehensive response to the call of the Lisbon mid-term review for simpler, more visible and more targeted EU action through three financial instruments: 1) the High Growth and Innovative SME Facility (GIF), which contributes to the establishment and financing of SMEs and the reduction of the equity and risk capital market gap, 2) the SME Guarantee Facility (SMEG), which provides counter- or co-guarantees for guarantee schemes, as well as debt financing, micro-credits etc., and 3) the Capacity Building Scheme (CBS), which improves the investment and technology expertise of funds investing in SMEs.

European Investment Bank
(europa.eu/institutions/financial/eib/index_en.htm)

The task of the European Investment Bank is to contribute towards the integration, balanced development and economic and social cohesion of the EU Member States. The EIB raises substantial funds on the capital markets, which it lends on favourable terms to projects furthering EU policy objectives. The EIB continuously adapts its activity to developments in EU policies. The EIB:

- enjoys its own legal personality and financial autonomy within the EU,
- operates in keeping with strict banking practice and in close collaboration with the wider banking community, both when borrowing on the capital markets and when financing capital projects.

EUREKA (www.eureka.be)

EUREKA is a pan-European network for market-oriented, industrial R&D which aims to enhance European competitiveness through its support to businesses, research centres and universities who carry out pan-European projects to develop innovative products, processes and services EUREKA offers project partners rapid access to a wealth of knowledge, skills and expertise across Europe and facilitates access to national public and private funding schemes. Within a EUREKA project, partners develop new technologies for which they agree the Intellectual Property Rights and build partnerships to penetrate new markets.

EUREKA Clusters play a key role in building European competitiveness, driving European standards and the interoperability of products in a wide range of sectors. The result is a clear demonstration of the strength of pan-European teamwork in the ERA.

EUREKA Umbrellas are thematic networks, which focus on a specific technology area or business sector. The main goal of an Umbrella is to facilitate the generation of EUREKA projects in its own target area.

EUREKA projects contribute to improved wellbeing, security, environment and employment in Europe and beyond. By encouraging and assisting businesses to innovate, the EUREKA

Initiative complements the European Union's Framework Programme in working actively towards the common European objective of raising investment in R&D to 3% of GDP by 2010.

The International Life Sciences Institute (ILSI, europe.ilsi.org)

This non-profit, worldwide foundation seeks to advance the understanding of scientific issues relating to nutrition, food safety, toxicology, risk assessment and the environment. By bringing together scientists from academia, government, industry, and the public sector, ILSI seeks a balanced approach to solving problems of common concern for the well being of the general public. ILSI is affiliated with the World Health Organisation as a non-governmental organisation (NGO) and has specialised consultative status with the Food and Agriculture Organisation of the United Nations.

ILSI Europe was established to identify and evaluate scientific issues related to the above topics through symposia, workshops, expert groups and resulting publications. ILSI Europe focuses on the specific needs defined by its European partners and its main goals are to:

- play a catalytic role in identifying and addressing critical scientific issues related to nutrition, food safety and the environment,
- provide coherent scientific answers to issues of public interest through scientific programmes that are of mutual concern to industry, government and academia, and
- support an active publication programme for the dissemination of scientific information to the broadest possible audience including the scientific community, international organisations and regulatory agencies.

To address these issues, ILSI Europe's members initiate projects, which are managed by specific task forces.

Industry in other forms

The insurance sector has an interest in maintaining health and wellbeing, and might be a source of funding for individual health-related projects. An informal approach confirmed this but the issue has yet to be taken further. Opportunities for seeking funding from the pharmaceutical sector (or from the FP7 Health theme) are being pursued through the Food/Pharma Workshop and its outputs.

SMEs

Funding to support SMEs is available through national channels and the FP7 Capacities pillar offers funding to research providers to support small consortia of multinational SMEs as well as SME associations.

Annex 3. National food platforms and their representatives

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Glossary

CBS	Capacity Building Scheme
CIAA	Confederation of the Food and Drink Industries of the EU
CIP	Competitiveness and Innovation Programme
COST	European Cooperation in the field of Scientific and Technical Research
DG	Directorate General
EFAFTTT	European Foundation for Advanced Food Training and Technology Transfer
EFFoST	European Federation of Food Science and Technology
EIB	European Investment Bank
EIT	European Institute of Innovation and Technology
ENRI	European Nutrition Research Infrastructure
ERA	European Research Area
ERC	European Research Council
ESF	European Science Foundation
ETP	European Technology Platform
EU	European Union
EuChemMS	European Association of Chemical and Molecular Sciences
FP	Framework Programme
GIF	Growth and Innovative SME Facility
IAP	Implementation Action Plan
ICT	Information and Communication Technology
ILSI	International Life Sciences Institute
IO-LCA	Input-Output Life Cycle Assessment
IRSES	International Research Staff Exchange Scheme
JTI	Joint Technology Institute
KBBE	Knowledge-Based Bio-Economy
KIC	Knowledge and Innovation Community
LCA	Life Cycle Assessment
LMI	Lead Market Initiative
NCP	National Contact Point
NGO	Non-Governmental Organisation
NoE	Network of Excellence
PAN	Preference, Acceptance and Needs
PAT	Process Analytical Technology
R&D	Research & Development
S&T	Science & Technology
SCAR	Standing Committee on Agricultural Research
SICA	Specific International Cooperation Action
SLCA	Social Life Cycle Assessment
SME	Small and Medium-sized Enterprise
SMEG	SME Guarantee Facility
SRA	Strategic Research Agenda
TCA	Total Cost Assessment
TSM	Techno-Science Mediators

Agro-food industry:
industries related to agriculture and food.

Agro-food sector:
the sector of the economy that produces agricultural and food products.

Bio-economy:
all industries and economic sectors that produce, manage and otherwise exploit biological resources (and related services, supply or consumer industries), such as agriculture, food, fisheries, forestry, etc.

Food chain:
interaction of all participants responsible for production, processing, refining, trading and consuming of an (agricultural) product.

FOOD*force:*
food forum for optimising research cooperation in Europe.

Primary sector:
production of agricultural raw materials (= primary products) for other industries. The primary sector involves the changing process of natural resources into primary products.

Sustainability:
an environmentally sound, economically viable and socially acceptable development.

For a more detailed glossary please refer to:

http://europa.eu.int/comm/research/biosociety/library/glossaryfind_en.cfm

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