

D R A F T

EUROPEAN TECHNOLOGY PLATFORM

FOOD FOR LIFE



IMPLEMENTATION ACTION PLAN

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Acknowledgement

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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, improve knowledge transfer and stimulate European competitiveness across the food chain. The vision of the ETP, published in July 2005, aims at 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 and academia. The direct connection with consumer needs makes it unusual amongst all other ETPs, and offers a unique opportunity to integrate the natural sciences and humanities.

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, which was published in September 2007, can be implemented. The SRA focussed on the scientific and technological research requirements in *Food and Health, Food Quality and Manufacturing, Food and Consumer, Food Safety, Sustainable Food Production and Food Chain Management.* A further Working Group developed an outline for needs in *Communication, Training and Technology Transfer*, whilst the *Horizontal Activities Working Group* focussed on optimising internal and external contacts and co-operations amongst other responsibilities. The Implementation Action Plan focuses on three key thrusts that have been derived from the key research challenges of the SRA. The IAP has been subjected to stakeholders' consultations and illustrates activities required by the ETP Food for Life and its stakeholders to facilitate the process required to address the key thrusts. While the SRA focused on topics and themes, the **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 the 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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Chairman, Board ETP Food for Life

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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. They are very important raw material suppliers and have low operating costs compared with Europe. More and more of these countries are developing important food manufacturing operations. European industry is lagging behind in productivity (CIAA. Benchmark Report on Food and Drink Industry Competitiveness, 2006) 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 see 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 delay in 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 the work that must be undertaken to ensure the achievement of these objectives economically and ensure that SMEs can also benefit from the change in production methods this will imply.

The ETP published its *Vision Document*¹ in June 2005 and its *Strategic Research Agenda* (SRA)² followed in September 2007. Extensive consultations were held with all relevant stakeholders through both in face-to-face meetings and web-based activities.

The SRA outlined three principal research thrusts that it felt 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 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 provide;
- derive from sustainable and ethical production.

The detailed research agenda that would need to be pursued if each of these key thrusts were to be effectively met have been defined in this Implementation Action Plan.

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

¹ European Technology Platform on Food for Life: The vision for 2020 and beyond. <http://etp.ciaa.be>.

² European Technology Platform on Food for Life: Strategic Research Agenda 2007-2020. <http://etp.ciaa.be>.



- 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;
- influencing the priorities for research within recent calls for proposals under the Food, Agriculture, Fisheries and Biotechnology theme of the Cooperation pillar of FP7.

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.

In addition 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 necessary for transferring new or existing knowledge into innovation and social benefit. The Implementation Action Plan will address also these issues.

A recent report on competitiveness of the European food industry³ summarised the industry's strengths and weaknesses. Many of the weaknesses identified could be solved technologically but concurrently there are issues such as:

- limited economy of scale;
- lack of technological resource;
- the need for greater integration; and
- legislative issues.

that need to be addressed to ensure that the industry remains competitive in the future.

Background and aim of the Implementation Action Plan

The *Implementation Action Plan* (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 of the SRA. The resource requirements are approximated and indications are given for the timescale for achieving success and the type of the funding that will be required to ensure the goals are achieved.

The food industry structure in Europe is unique amongst the manufacturing sector with the overwhelming proportion of the sector consisting of SMEs (>99%). Few such companies have resources to undertake more than quality control and assurance work and cannot be expected to participate in research where the payback is not very immediate. Their needs must be met through larger conglomerations of research-based and industry-wide associations working closely with them. However, the sector does include a handful of very large, research-minded companies that can be expected to support joint public-private research projects or programmes in specific areas.

The collaborative activities for the most immediate priorities necessary to pave the way towards achieving the ETP's vision require funding **in the order of € 400-500 million annually in the forthcoming years**, where a larger part of this amount is required for key thrust 1, whilst key thrusts 2 and 3 will require a smaller part each to meet the objectives.

³ DG Enterprise & Industry. Competitiveness of the European Food Industry: An economic and legal assessment. Brussels: EC, 2007. ISBN 978-92-79-06033-5.



Since a significant amount of these latter is research that would improve public health and is targeted on relevant long-term, basic research having a strategic goal, it is expected that a larger 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. This could result in important achievements without the need for new resources. Nonetheless, there are significant hurdles to overcome to ensure that there is greater co-ordination of national resources into European-wide initiatives. These resources are not available for new investment in mission-orientated and co-ordinated multinational programmes other than as co-funding within European Framework projects.

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 has given 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),
- indications 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 small and medium-sized enterprises (SMEs),
- development of 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 and which will deliver an appropriately-skilled work force,
- communication issues particularly with reference to 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)*⁴ 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. The Expert Group emphasised 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.

The three key thrusts identified by the 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'.

⁴ Challenging European Research Rationales for the ERA. Report of the ERA Expert Committee. DG Research, 2008. EUR23326.

The three major thrusts 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 the 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 world-wide 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. They also require a co-ordinated investment in the relevant sciences, *including the social sciences*, and the European effort is trailing behind the huge resources that are available for investment in co-ordinated programmes of research and community action in other regions (such as the National Institutes of Health in the USA). In contrast, European activities are dispersed between national research activities funded by governments and the health charities and European research programmes funded by EU Framework Programmes. At the European level there are few joint initiatives between the relevant DGs (DG Science, DG Health, DG Sanco, DG Environment and DG Enterprise & Innovation), which bring together all components of the innovation system, together with an appropriate level of resources in joint activities between the relevant Directorates General.

The food industry is a crucial stakeholder in ensuring that foods are available that will provide European consumers with the tools 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 very 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 preventative means is also the responsibility of the public sector. Failure to act in a co-ordinated 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 little in comparison to the costs across the continent if Europe fails to tackle the diet and health issue.

The Working Groups addressing Key Thrust 1 recognised priorities that would have to be set in order to develop a pragmatic mechanism 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 of these three sub-themes requires different levels 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 an effective infrastructure to support it. Specific issues that will need 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
- The need to improve the decision making process 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 6th Framework Programme was made in bringing about collaboration between leading national research teams in Networks of Excellence (NoEs). The NoE on Nutrigenomics (NuGO) has ensured that the importance of this field has been recognised internationally and it 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 complimentary network has been created in co-ordinating national programmes of food composition (EuroFIR). 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.

Key Thrust 2: Building consumer trust in the food chain

Food and drink manufacturing and distribution must ensure that the product reaching the consumer has 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 standards quality will have a severe impact on the overall market and on individual producers. This impact will be severe economically and will affect 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. innovation, quality and manufacturing,
2. sustainable safety of European food systems, and
3. consumer trust in the food system.

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 a source in which they can have trust. This usually means that the research will have to be funded by the public sector alone. But there are other areas within each of these sub-themes where joint academic-industry funding collaboration is appropriate. Individual consumers are unable 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 which is no longer based on science.

An ERA-NET in food safety exists (SAFEFOODERA⁵) and has already 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 an urgent need to use these available resources more efficiently so as to address other areas of food safety research.

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 where there is synergy between environmental protection, social fairness and economic growth and that 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 resource use, increased efficiency and better governance.

The food chain sector is responsible for a large environmental impact at present. It is currently heavily dependant 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.

Again three sub-themes within Key Thrust 3 have been identified. They are:

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

Key Thrust 3 presents the greatest challenge in terms of *resource management*. The SMEs could benefit very significantly from a direct involvement in these activities but, in general, 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.

The future of ETP Food for Life

Through the networks that the ETP has built up with European industry, universities and research institutions, consumer organisations and funding bodies in individual EU Member

⁵ See <http://www.safefoodera.net>.



States, and the European Commission, it is envisaged that this 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 they have identified are discussed with, national and regional authorities, consumers and the public at large. Interactions and communication between these stakeholders and food manufacturers, including multinational European industries and SMEs and those engaged on national and European programmes of research, remains an essential function.

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 much, 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 aspects to consider 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 Commission⁶.

It is expected that the ETP, with its concern for trans-national co-operation 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 precompetitive 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,
- identification and exchange of best practices.

Such activities will demand a continuing dialogue between the ETP and its stakeholders across 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,
- a clear strategy be adopted that will address the necessary horizontal actions highlighted here,
- 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 actions proposed that reflect best practice. The ETP would promote these to assist other EU Member States to identify and gain benefits by their adoption and implementation,

⁶ Commission decision setting up the High Level Group on the Competitiveness of the Agro-Food Industry (2008/359/EC).



- the European Commission consider the need for further funding of the ERA-Net (SAFEFOODERA) and 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; most importantly, 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 very low level risks. The necessary research should be given a high priority.
- the ETP Board plays an active role in:
 - challenging the ETP to create tangible benefits for its industries,
 - engaging with their equivalents in other industry sectors to better promote the ETP and identifying opportunities for cooperation and synergy,
 - having high level and regular meetings with the European Parliament and European Commission,
 - taking the lead in discussions with organisations such as EUREKA, European Investment Bank, insurance companies and venture capitalists to optimise private sector funding for the ETP, and
 - agreeing on a common position on how the ETP might secure funding from CIP, the Competitiveness and Innovation Programme, put in place alongside FP7 specifically to promote innovation and support risk-taking.



PART 1.

Introduction

INTRODUCTION

In order to ensure that the Lisbon Strategy is fully realised the European Technology Platform on 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 see as providing new opportunities for exploitation.

The ETP Food for Life published its Vision Document in June 2005 and its Strategic Research Agenda (SRA) in September 2007. Extensive consultations were held with all relevant stakeholders across Europe both in face-to-face meetings and through web-based consultations.

Vision of the ETP on Food for Life (see also Figure 1)

The **European Technology Platform on 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-focused, 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.

European Technology Platform Food for Life

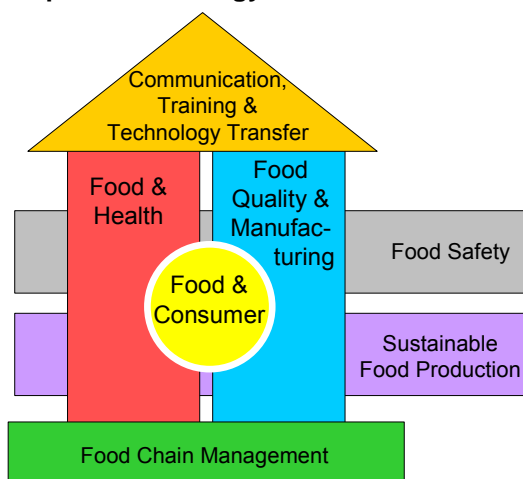


Figure 1. Schematic presentation of the research areas required to reach the vision of the ETP Food for Life.

The concerns and opportunities of all stakeholders have been the engine that has powered development of the ETP Food for Life. In the process of consultation, **three principal stakeholder sectors have been identified**. These are:

- **the consumers, society and public policies,**

- **the agro-food industry** (which are overwhelmingly SMEs), and
- **the research community**.

Successful innovation will only occur if the proposals in the ETP's SRA are considered from the perspective of determining how the research proposed can be implemented, given the existing constraints, and how it will contribute to ensuring future market success by adding to the sector's strengths or tackling its weaknesses.

The SRA outlined the three principal research thrusts that it felt 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 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
- derive from sustainable and ethical production.

The detailed research agenda that would need to be pursued if each of these key thrusts were to be effectively met has been defined.

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 had a major impact on:

- influencing the priorities for research within recent calls for proposals under the food, agriculture, fisheries and biotechnology theme of FP7,
- influencing the national research agendas, and
- 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.

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 **Implementation Action Plan** (IAP) is key 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 addressed if the agenda described in the SRA is to lead to improving the competitiveness of European industry.

The IAP fulfils the important task of taking the key priority research thrusts 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. But it also addresses the 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 delay the 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. Markets in developing countries provide opportunities and challenges. In the developed world USA, Canada and Australia are also significant producers of manufactured foods at a very competitive cost. This requires 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 based on multi-national co-operation and investment.

Drivers of the market

A detailed study commissioned by DG Enterprise and Industry^j 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 report identified the most important factors influencing the future of the food sector as:

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

Strengths and weaknesses of the European food sector

The recent report on the "Competitiveness of the Food Industry" has shown that the European food and drink sector has **strengths** globally. They are that:

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

In terms of ensuring its future competitive position the sector's **weaknesses** are:

1. The sector 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. (This issue is further addressed in Part 3, Enabling Activities).
2. Labour productivity is poor compared with other industries.
3. The sector 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.
4. Food science and technology needs to attract the brightest pupils. 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 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.
5. The research and technology sector is insufficiently integrated and resourced to meet the challenges posed by the sector.
6. The sector is investing too little in influencing opinion formers and in the political debate at the national and European level.

These weaknesses are examined in detail below.

Economies of scale

Analysis of the market shows that Europe is not as efficient in economies of scale as for example the US, nor is it growing as rapidly as other trading blocks. As most food commodities in Europe show low demand elasticity and are basic necessities, 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 the supply chain of supermarkets is globalised, and these 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.

A characteristic of the industry is that the supply and manufacturing chain consists in the main of SME's few of whom are organised in such a way that they can 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 enter into retailing their products, or the export market, their products would have to command higher prices. Nor are they able to operate at a technologically sophisticated level to anticipate changes in market demand and react quickly to change.

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 the 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 (Support for sustainable and ethical production) should help to provide potential solutions.

Labour productivity

Another area where detailed analysis is 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 to address the problems proposed.

Educational issues

A detailed survey of employers perceived needs (according to size of the business) is necessary. It should consider whether these needs are being effectively met and analyse 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 regional centres of technology transfer who can offer 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 in ensuring that research investment is determined by a) scientific developments, b) recognition of the market need, c) a focus on the export opportunities for potential products and d) greater integration with the 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 smaller Northern European states 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 lie. Analysis of the issues facing this sector will cover areas that, in addition to R&D issues, will 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 major 'renovation' activities in the food sector. These actions are likely to have more general applicability to overall market success.

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 have not been possible to achieve within the currently funded ETP programme.

Integration of resources

Wider considerations also apply to the overall resources that are focussed on food research and innovation in Europe. The ETP Food for Life's Implementation Action Plan effectively demonstrates that the resources that will be necessary to effectively stimulate market success will involve an effective resolution of the problem of:



- multiple sources of funding internationally. Within DG Science there are separate divisions and budgets dealing with e.g. health and 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 funding nationally. 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.

At this stage the problems of effectively co-ordinating national resources to address key issues are complex. 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.

Communication issues

Key Thrust 2 (Building consumer trust in the food chain) highlights the overall requirement to improve consumer trust in food. This issue has been highlighted by the ETP Food for Life as a key research thrust for the future. 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
- What role might consumer organisations play in improving communication

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

Successful innovation will only occur if the proposals in the ETP's SRA are considered from the perspective of determining how the research proposed can be implemented, given the existing constraints, and how it will contribute to ensuring future market success by adding to the sector's strengths or tackling its weaknesses.

Agenda to be implemented

The function of this Implementation Plan is to turn the proposals made in the ETP's Strategic Research Agenda into strategically focused, multi-disciplinary and collaborative activities that will lead to creating the right structures for research and innovation in Europe. The plan has focussed on the areas of highest priority and which need addressing 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. The IAP will act as the catalyst for influencing the funder's priorities and as a basis for further discussions between collaborators on specific projects that they wish to develop in the light of national and international calls for

proposals. The ETP Food for Life will investigate the possibilities of developing closer public-private partnerships that potentially eventually result in a Joint Technology Initiative.

The resource requirements are estimated roughly, the time frame for achieving success and the type of the funding that will be required to ensure the goals are achieved.

The collaborative activities for the most immediate priorities necessary to pave the way towards achieving the ETP Food for Life vision require funding in the order of € 400-500 million for five year annually in the forthcoming years. Since a significant amount of the work is research that would improve public health and is targeted on relevant long term, basic research but with a strategic goal, it would not be expected that this work should be supported on a shared basis by the public and private sector. It is not expected that significant new resources would 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 that there is greater co-ordination of national resources into European-wide initiatives. These resources are not available for new investment in mission-orientated and co-ordinated multinational 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. Activities are envisaged to further develop the required 'innovation infrastructure' required. Particular attention will be given to a number of infrastructure and enabling activities. These include:

- Structures necessary to ensure the best use of existing resources (ERANETs; National Food Platforms and Mirror Groups);
- Indications 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 that will be relevant to the future competitiveness of the industry and at building up an appropriately skilled work force;
- 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 identified by the ETP Food for Life's SRA meet all of the criteria required to stimulate innovation, create new markets, and meet important social and environmental goals.



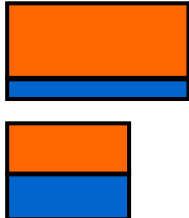


PART 2.

Key Thrusts






INTRODUCTION TO THE IMPLEMENTATION OF THE KEY THRUSTS

The Implementation Action Plan (IAP) of the ETP defines priority research areas for themes that are of major importance for the food industry. Priorities are already defined in the Strategic Research Agenda. However, the IAP integrates these individual Working Group priorities and focuses on those which 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 set forth in the Vision and Strategic Research Agenda to be achieved.

The requirements and the time frame for each activity are also presented in graphical form in order to facilitate visualisation. Beyond this graphical summary of activities, the subsequent sections provide reasons for choosing an activity, its expected outcomes, the contribution to gap closure and other relevant information. For diagrams, the following symbol keys are employed⁷:

Icon	Description
<p>Participants / contribution</p> 	<p>The length of the boxes describes the duration of the project. The boxes indicate the source of funding expected from public and private sources. Orange represents public inputs, blue that of private sources.</p>
<p>Project type</p>  	<p>Different types of projects might be needed depending on the envisaged activity:</p> <p>Research projects: Projects ranging from frontier/basic research to applied, pre-competitive research, <i>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.</i> These projects will benefit from collaboration efforts and networks.</p> <p>Demonstration / Pilot projects: Projects with the aim of <i>demonstrating the industrial and economic feasibility, and the sustainability of a concept.</i></p>

⁷ These icons correspond with the icons used in the IAP of the ETP on Sustainable Chemistry, <http://www.suschem.org>

  	<p>Studies: These projects, including surveys, feasibility studies, LCA or eco-efficiency analysis, and will <i>generate knowledge/information allowing stakeholders and decision-makers to make informed choices.</i></p> <p>Network / Coordination: Networks and coordination projects will allow <i>better coordination between stakeholders in a field, interdisciplinary cooperation, exchange of information and coordination between European and Member States levels.</i></p> <p>Training: <i>Exchange/mobility of researchers, courses, projects influencing curricular programmes in Member States.</i></p>
<p>Human resources</p> 	<p><i>Activities require human resources with adequate training and expertise. A blue symbol depicts 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.</i></p>
<p>Funding</p> 	<p>Provides a scale indicating the required resources for the total duration of the activity:</p> <p>1 stack of coins: < 10 million € 2 stacks: 10 - 50 million € 3 stacks: > 50 million €</p>

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 \(cordis.europa.eu/fp7\)](http://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 has done little in other areas.

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 co-ordination 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; this 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.



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 addition, the ETP has asked the European Commission to support the establishment of two more on *Food and Health*, and *Sustainable Food Production/Food Chain Management*⁸. ERA-NETs are a means of coordinating nationally-funded research and link to the ETP's Mirror Group.

National Governments

94% of the funding for scientific research comes from national governments across Europe, the remainder from 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 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,

⁸ The Commission's FAFB Reflection Document, dated 25/2/08, does not mention these and includes two new ERA-NETs both addressing primary production. The delay of the call for establishing a *Food and Health ERA-NET*, in particular, until 2010 will delay effective implementation of the SRA to an unacceptable level.



- 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.ilsilife.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 Organization as a non-governmental organisation (NGO) and has specialised consultative status with the Food and Agriculture Organization 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 its European partners. The main goals of ILSI Europe 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,
- 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, and
- 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 not been 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 Capacities pillar offers funding to research providers to support small consortia of multinational SMEs as well as SME associations.

DEVELOPING THE AGENDA FOR INDUSTRIAL DEVELOPMENT

Task Force development

An **SME Task Force** Developer and chaired by András Sebők, could serve as a model for other activities. Task Force members would be drawn from the Board, Horizontal Activities and other ETP Working Groups and individuals co-opted on the basis of specific knowledge/contacts.

Other task forces to be developed include:

- **FP7 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.
- **Funding Task Force:** this should be charged to report to the Board about potential funding sources, should make contact with appropriate bodies and prepare the way for detailed discussions.
- **Innovation Task Force:** it is crucial that contacts are established at senior level with DG Innovation and Enterprise, who reported unfavourably on innovation in the food sector in 2007 (without any reference to Food for Life), who will be establishing their own activities to address this situation and who have money to finance (non-scientific) activities relevant to the ETP's area of operation.
- **Training Task Force:** to identify and promote structures and mechanisms for training new entrants into the food and drink sector, and retrain existing personnel, to provide the flexible workforce needed to drive innovation.
- **Mirror Group Task Force:** this is key to bringing together national funding bodies to exchange information on strategic programmes, exchange best practice and results, minimise overlaps and duplication and optimise synergies.
- **Food/Pharma Task Force:** to drive forward the links between the food and pharma sector and to promote joint funding opportunities.
- **International Task Force:** ETPs should facilitate capture and exploitation of S&T knowledge irrespective of where it is produced. The recent EU-Canada agreement on interaction of FP and national programmes in the bio-products area⁹ has shown that there

⁹ Interactions and synergies across complementary bio-product projects funded by FP7 and Canadian national programmes will be optimised through targeted EU funding.



are benefits to be gained from linkage of ongoing projects with similar objectives¹⁰. 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).

Contacts with the European Parliament

ETP Plants for the Future and CIAA each have excellent links with the European Parliament including its Research Committee, which should be exploited by ETP Food for Life. Multinationals also have established channels for meeting representatives of the European Commission and Parliament on a regular basis and of discussing issues of common concern, and contacts available through these should also be exploited. Exactly the same contact making, discussions and dialogue will be promoted at national level through national platforms.

KEY THRUST 1: IMPROVING HEALTH, WELL-BEING AND LONGEVITY

Scope

This Key Thrust describes the research requirements in key areas of *consumer, nutrition and food sciences*. Based on the Vision document, a number of areas have been identified by a broad range of stakeholders in which research investments are urgently needed to further the knowledge and, at the longer term, to be able to provide the European consumers with high quality, wholesome and nutritious foods that will contribute to their health and well-being. Furthermore, it will contribute to ensuring that the European food and drink industry will remain in a leading position by mobilising the full potential of not only the larger industries but also of the many SMEs.

Over the years, much high-quality research in the above areas has been carried out in Europe, but although many efforts were made, industry has been unable to fully exploit these results. This Implementation Plan describes how relevant activities and disciplines in the agro-food and especially the food and health area, can be 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 *a delay in the deterioration of health status*. The key challenge for the long-term will be to influence an individual's state of ageing and to deliver a personal regime of nutrients, lifestyle and advice for healthy longevity or to 'add 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*

¹⁰ FOODforce and Australian researchers have identified opportunities for closer interaction between FP and national projects in the areas of food and health. An initial link between European and Australian researchers will be sought through the International Research Staff Exchange Scheme, IRSES, within the FP7 People pillar.

groups to specific foods gathers pace. There is 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. A better 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 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 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 field.

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 priority areas are:

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

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 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,
- to provide all consumers with the right type of food at the right time and in the right place, and
- to 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 launched.

Major problems

The agro-food industry is mainly populated by SMEs. These SMEs produce highly diverse products and lack 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 large 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 sector with 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 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 largely based 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*. For the food industry the paradigm shifted from producing taste and safe foods to producing tasteful, safe but also healthy food.

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 is 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 individual level good, mental health enables people to realise their intellectual and emotional potential and to find and fulfil their roles in social, school and working life. At society level good mental health is a resource for social cohesion, a better social and economic welfare and it facilitates the transition of the EU into a knowledge society.

Cognitive decline with ageing and diseases such as Alzheimer's 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 type of food and 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 function is strongly related to nutrition, starting at the first contact of ingested food within the gastrointestinal tract. Until now it has been difficult to study this important interaction due to a lack of valid biomarkers and diagnostic tests. Given the recent advances in life science technology, a more focussed research approach will have the

potential to deliver great 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 proven difficult to define a 'healthy intestine', because of its complexity, the large inter-individual 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.

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 that could counteract these ageing-related metabolic disorders would offer 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 obesity reported in 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 poorly understood and not well established in humans. Research should deliver dietary recommendations for both mothers and infants and provide the basis for optimising nutrition during the critical period of rapid development both *in utero* and post-weaning.

What progress needs to be made?

Better understanding of how to assess sustainability of various food chains and consumptions patterns will give directions for selecting the most desirable future developments. The identification of improved technical and managerial solutions to sustainable food chains will facilitate and speed-up the introduction of more sustainable solutions in the food chains. The road to improved sustainable food chains will be supported by the improved understanding how to communicate the information 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 3).

Opportunities for the industry and other stakeholders

Knowledge and research investment will lead to new and innovative products with added value. This will contribute substantially to market successes. It is important for the European food industry to become a leading industry with a strong European market. 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.

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, which will attract international 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 & Manufacturing) and introduced to the market, which will require knowledge of consumer sciences and consumer behaviour (Food & Consumer).

	Optimal development, wellness & ageing	Intestinal health & immune functions	Weight management & obesity
Food & Health	To chart the scope of diet and individual 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 the knowledge and study the mechanism of the relation between the immune system and other organ systems such as the brain, the endocrine system and the intestine and their relation 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 fetal and neonatal nutrition in relation to immune (de)regulation during later life by metabolic/immunologic imprinting.	To develop effective food ingredients and dietary strategies to prevent (re-)gain of weight.
	To understand the role of biological 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 & Manufacturing	To understand relationships of food structures from molecular via nano- to macro scale with respect to product and process design, and to develop new processing principles for improved PAN profiles.		
	To identify and incorporate bioactive food constituents from plant, animal and microbial sources, and beneficial micro-organisms and their mechanisms of action.		
	To provide improved PAN (Preference, Acceptance, Needs) functions through the redesign and optimisation of food processing and packaging.		
	To develop convenient, tailored personalised food products to meet all consumer preferences, acceptance and needs.		

























Food & Consumer	To develop and test 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 motivations that trigger or hamper behavioural change towards healthier eating behaviour.
	To understand consumer knowledge of nutritional concepts and responsiveness to communication formats, including health schemes (e.g. pyramids etc.), 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 tool box for effective communication with consumers on health and sustainability of food.
Safety	
Sustainability	To develop environmentally-friendly sustainable food processes.
Supply chain integration	
CT3	












Optimal development, wellness and ageing¹¹

Priority research challenge 1	Optimal development, wellness and ageing			
	Participants, contribution and timeline	Project type	Human resources	Funding amount
	0 5 10 15 years 			
Major research challenge 1	To chart the scope of diet and individual 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 <i>in utero</i> 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.			

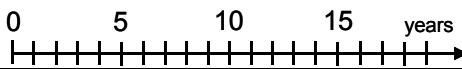
¹¹ See pages 23 and 24 of this document for explanation of the symbols used.

Implementation	 	   		
Description	<p>This research aims at discovery and validation of biomarkers based on epidemiological studies, cellular- and physiological studies (including the outputs of systems biology) and intervention studies. A skill base needs to be developed for sufficient numbers of research in the field of neuroscience IT, psychology, imaging technology.</p>			
Deliverable 2	<p>Mood and optimal performance: mapping the impact of specific food ingredients on mood and mental performance through building an understanding of the mechanisms underpinning these effects.</p>			
Implementation	 	  		
Description				
Deliverable 3	<p>Understanding of the molecular and cellular mechanisms behind neuro-protective effects by dietary compounds.</p>			
Implementation	 	  		
Description	<p>Required expertise: molecular biology, molecular neuroscience.</p>			
Deliverable 4	<p>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 of incidence of Alzheimer disease or dementia.</p>			



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 will provide powerful new insights to combat the obesity epidemic.			
Deliverable 1	Brain conditioning: understanding of how early exposure to dietary compounds leads to taste perception and food preferences later in life.			
Implementation				
Description	Required expertise: pediatrics, psychological 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				
Deliverable 3	Food intake regulation and hunger/satiety: identifying the brain pathways that regulate hunger/satiety and identifying dietary components that can help control food intake.			
Implementation				

				
				
Description				
Major research challenge 3	To understand the role of biological determinants in food choice (including the role of 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.			


















Intestinal health and immune functions




























Priority research challenge 2	Intestinal health and immune functions			
	Participants, contribution and timeline 	Project type	Human resources	Funding amount
Major research challenge 1	To enhance the knowledge and study the mechanism of the relation between the immune system and other organ systems such as the brain, the endocrine system and the intestine and their relation 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: immunology.			
Deliverable 2	Improvement of the allergome databases of plant- and animal-derived food, 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	Required expertise: food technology, immunology.			
Major research challenge 2	To study fetal and neonatal nutrition in relation to immune (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 and decrease the risk for allergy.			
Implementation				


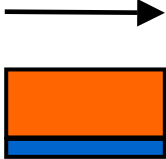






				
Description	Required expertise: pediatrics, genetics.			

Weight management and obesity

Priority research challenge 3	Weight management and obesity			
	Participants, contribution and timeline 0 5 10 15 years 	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 the risk for 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, IT, molecular biology.			
Deliverable 2	Knowledge of individual variations in metabolic energy efficiency, including the contribution of gut microbiota, and in susceptibility to high energy intake and sedentary lifestyle.			
Implementation	 	  	 	

				
Description	Required expertise: microbiology, physiology.			
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	Understanding drivers (diet, genes) that regulate habitual levels of physical activity.			
Deliverable 5	Understanding drivers (diet, genes) that regulate habitual levels of physical activity.			
Implementation	 	   	 	





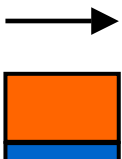



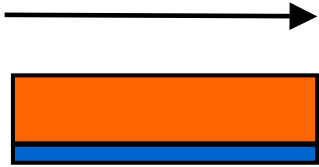



Description	Required expertise: exercise physiology genetics.			
Major research challenge 2	To develop effective food ingredients and dietary strategies to prevent (re-)gain of weight.			
Deliverable 1	Intervention strategies to align research on exercise physiology/physical activity and obesity/metabolic syndrome.			
Implementation	 	    		
Description	Required expertise: public health, health education.			
Deliverable 2	Specific food components for regulating food intake and increasing diet-induced thermogenesis.			
Implementation	 	  		
Description				
Deliverable 3	Greater insights into the effects of meal composition, size and frequency on appetite regulation and energy intake.			
Implementation	 	  		

				
Description				
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, pediatrics.			

Priority research challenge	Food Quality & Manufacturing research for weight management & obesity, optimal development, wellness & ageing, and intestinal health & immune functions
Major research challenge 1	To understand relationships of food structures from molecular via nano- to macro scale with respect to product and process design, and to develop new processing principles for improved PAN profiles.
Deliverable 1	Quantitative methods developed to assess process-structure-property relationships, such as extrusion based cereal structure processing for satiety profile adjustment.
Deliverable 2	Structure-property functions and their relationships with formulation and processing.
Major research challenge 2	To identify and incorporate bioactive food constituents from plant, animal and microbial sources, and beneficial micro-organisms and their mechanisms of action.
Deliverable 1	<i>In vitro</i> assays and biomarkers to predict <i>in vivo</i> functionality of bioactive components.
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.
Deliverable 3	Targeted delivery of bioactive compounds and micro-organisms with beneficial properties.
Major research challenge 3	To provide improved PAN functions through the redesign and optimisation of food processing and packaging.
Deliverable 1	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.
Deliverable 2	Process optimisation through combinations of new and conventional technologies with respect to process structure property relationships in new and traditional foods.
Deliverable 3	Process optimisation through combinations of new and conventional technologies with respect to process structure property relationships in new and traditional foods.
Major research challenge 4	To develop convenient, tailored personalised food products to meet all consumer preferences, acceptance and needs.
Deliverable	New tailor made, personalised foods targeted at specific consumer groups.

Priority research challenge	Food & Consumer research for weight management & obesity, optimal development, wellness & ageing, and intestinal health & immune functions			
	Participants, contribution and timeline	Project type	Human resources	Funding amount
Major research challenge 1	To develop and test 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.			
Deliverable	A pan-European multi-disciplinary food consumer science resource initiated which will overcome fragmentation and build the necessary critical mass.			
Major research challenge 2	To understand the process of food habit formation and the key motivations that trigger or hamper behavioural change towards healthier eating behaviour.			
Deliverable	Intervention strategies, integrating legislation, education/information and market/marketing influences, for inducing long-term behavioural change towards better dietary habits.			

				
Major research challenge 3	To understand consumer knowledge of nutritional concepts and responsiveness to communication formats, including health schemes (e.g. pyramids etc.), 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. signposting).			
				
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.			
				



				
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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; it is an imperative for health, 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, yet there is a general lack of trust. 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 both producers and consumers perceive quality and safety. The balancing of costs with the regulatory and consumer protection environment means that new solutions for 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 in order 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, acceptance 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 industry must be equipped with a full palette 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 also food safety is a competitive issue both at the company level, where the costs of compliance can threaten survival, and at level of society as a whole. For instance, the costs of salmonellosis alone have been estimated to be of order of 2 billion dollars per year in the US. This gives some idea of the economic dimension for a single pathogen. This figure does not take into account the considerable costs associated with the measures which are in place to control this pathogen in the food chain. These include 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 consumer and his or her 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 identified, co-ordinated and 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: the total food chain has to be taken into account. It requires 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 innovative processes, for the creation of value-added food products, employing 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 competitiveness of the EU food industry.

In the risk-benefit evaluation of innovated processes and products, a key challenge is to provide an improved understanding of any hazards and the risks they represent at the different steps in the 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. But also benefits inherent to the process and product innovations have to 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, in order to enable the successful engagement of the consumer with other stakeholders in the maintenance of food safety in Europe.

Major problems

The following major problems have been identified:

- The emergence of new and under-recognised biological hazards,
- Uncertainties concerning importance of low-level chemical contaminants in the food chain,
- Immature tools for risk and risk-benefit studies,
- Consumer engagement and trust levels are low thus impeding introduction of novel safety and quality driven solutions,
- Fragmented finance for research on food safety and quality leading to areas which are not addressed and other areas which are exhaustively and repetitively studied,
- Recent and insufficiently developed interfaces between natural science disciplines and economic and social sciences, and
- 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, it is crucial to have access to industrial and pilot-scale facilities in order to test new technologies under real or almost real conditions, and improve them while reducing the development time. Furthermore, risks represented by food hazards should be fully understood; therefore the tools for measuring, approaches for data analysis and approaches for predicting emergence of hazards must be further developed.

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



The engagement of the consumer in the question of food quality and safety in order to allow them to make informed personal choices and to understand how 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 well-focussed research will provide a framework for rapid incorporation into practice in a manner, which will bring maximum impact.

Priority Research Challenges

Research in 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 relations. The proposed research aims at achieving breakthroughs in food science and technology, with a strong link to food safety and consumers’ perception regarding innovation and safety. The research described here is limited in principle but not exclusively to aims achievable within the next ten years.

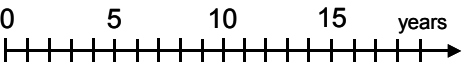
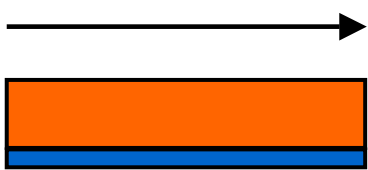



	Evaluation of risks versus benefits	System innovation methodologies in the food production chain	Consumer studies
	To describe and understand how micro-organisms respond to the various environmental stimuli and stresses which the food matrices represents and to predict the effects on resistance and persistence.	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)	data on food composition and patterns including ethnic and traditional foods, building on existing research such as EuroFIR and on chemical, analytical, toxicological and nutritional data.
	To enhance the understanding of behaviour and virulence traits of food-borne pathogens and the mechanisms of emergence	Validated technologies for tracking and tracing and their integration into management systems	
	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 occurring in specific product types.	Development of next generation predictive/probabilistic models for food microbial stability and safety AND their translation into easy-to-use tools for the end-user	Validated models and methods for effective public participation of and engagement with consumers on food safety governance



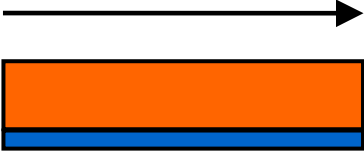











	To describe and understand the effects of chemical hazards in humans;	To develop technologies for the reduction or the elimination of hazards at the level of primary production and during processing	
	To develop and validate appropriate science based quantitative risk assessment tools and models (in vitro, in vivo, in silico) refinement of data required for food allergen risk assessment and tools to analyse such data.	To develop effective methodologies for tracking and tracing of microbes, contaminants and allergens along the food chain.	
	To develop and validate scientific approaches to carry out risk versus benefit evaluation along the food chain	To generate knowledge of the impact of technological, economical, legislative, climatic and social conditions on agricultural practices (including transport and storage of raw materials). Examples of technological impacts are biotechnology, energy and (safe) drinking water management	
Food quality and manufacturing	Risk-benefit balanced innovative, sustainable, and safe food packaging for implementation into integrated food chain concepts	To understand relationships of food structures from molecular via nano to macro scale with respect to product and process design, and to develop new processing principles for improved PAN profiles.	To integrate consumer-orientation in new product development, and to understand consumer responses to new products, processes and packaging technologies across different target groups.
	To develop environmentally friendly sustainable food processes, such as better utilization of side streams and innovations to avoid excessive packaging.	To develop and apply novel processes for the implementation of the PAN profiles through innovative product functions.	To develop convenient, tailored personalised food products to meet all consumer preferences, acceptance and needs.
	To introduce scaleable and flexible food manufacturing techniques and their intelligent in-line control.	To identify bioactive food constituents from plant, animal and microbial sources, and beneficial microorganisms and their mechanisms of action.	
	Development of track and trace systems with improved information accessibility for the all the stakeholders in the chain	Develop effective models for consumer orientation in food innovation on the basis of consumer needs and preferences for product, process and packaging technologies, across different target groups	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)

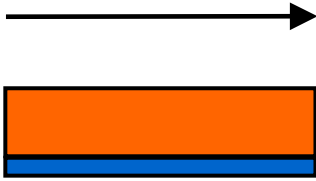





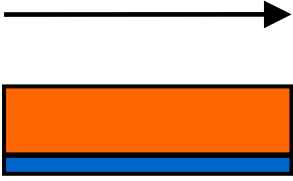






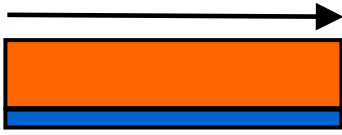





		Mapping of consumer needs, expectations, knowledge and attitude with regard to information on food and food production in a pan-European context	Design of transparency schemes that serve transparency needs of consumers
		Development of (culturally sensitive) effective communication strategies to consumers for innovation and new product technologies	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









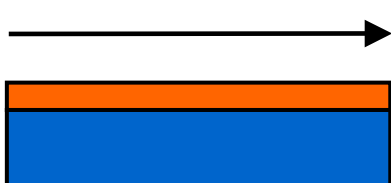



Evaluation of risks versus benefits¹²





Priority research challenge 1	Evaluation of risks versus benefits			
	Participants, contribution and timeline 	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 which the food matrices represents and to predict the effects on resistance and persistence.			
Deliverable	Knowledge about the ecological behaviour of priority food pathogens Scientific data using advances in 'omics' technologies describing the ecological behaviour of priority food pathogens & spoilage micro-organisms at different stages of the food chain will be of particular relevance to development of new technologies or increasing the efficiency of present technologies.			
Implementation				
Major research challenge 2	To enhance understanding of behaviour and virulence traits of food-borne pathogens and the mechanisms of emergence.			
Deliverable 1	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. Methodology for studying microbial behaviour in these model systems.			

¹² See pages 23 and 24 of this document for explanation of the symbols used.

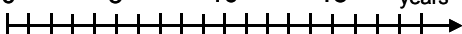




Implementation				
Major research challenge 3	To generate data on the dynamics of priority chemical hazards: structural changes, interaction effects, process-generated contaminants and migration from food-contact packaging and data on the levels occurring in specific product types.			
Deliverable 1	Knowledge on the dynamics of priority chemical hazards. Investigation of a) bioavailability and structural changes, interactions with other molecules / substrates, b) process-induced contaminants from inoffensive precursors (establishing a procedure for prioritization and 'top 10' setting; identifying mitigation strategies, 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 are (biotechnology, energy, [safe drinking] water management).			
Implementation				
Major research challenge 4	To describe and understand the effects of chemical hazards in humans.			

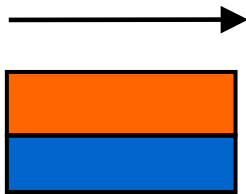






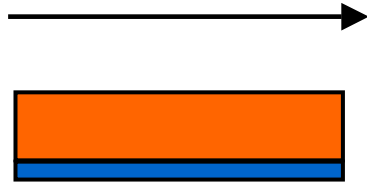




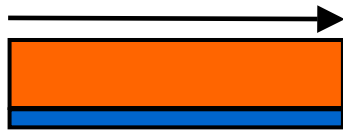












Deliverable	Data allowing effective hazard characterization for determining the risks of priority chemical hazards including risks at very low levels of exposure. This subject should receive high priority and a first preliminary list of priority chemicals must be established within 2-3 years and reviewed after 5 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 appropriate science based quantitative risk assessment tools and models (in vitro, in vivo, in silico), refinement of data required for food allergen risk assessment and tools to analyse such data.			
Deliverable	Tools, protocols, including user-friendly software and decision support systems for comparative risk analysis.			
Implementation		   		
Major research challenge 6	To develop and validate scientific approaches to carry out risk versus benefit evaluation along the food chain.			
Deliverable	Validated approaches to carry out risk and benefit evaluation along the food chain.			
Implementation		  		
Major research challenge 7	Risk-benefit balanced innovative, sustainable, and safe food packaging for implementation into integrated food chain concepts.			
Deliverable	New active packaging reducing food degradation and for controlled delivery of functional components. Research for production, use and disposal of eco-friendly packaging, and tailor-made packaging for perishable, diverse and complex foods. Novel intelligent packaging including the use of nanotechnology for monitoring food quality and safety during transport, storage and processing.			


















Implementation				
Major research challenge 8	To develop environmentally friendly sustainable food processes, such as better utilization of by products and innovations to avoid excessive packaging.			
Deliverable	Research in food technology enabling environmentally friendly and sustainable production with a special focus on better utilisation of by products. Developing systems with minimal use of non-renewable and non-biodegradable materials as well as developing systems with reduced use or more efficient use of water.			
Implementation				
Major research challenge 9	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				
Major research challenge 10	Development of track and trace systems with improved information accessibility for the all the stakeholders in the chain			
Deliverable	Track and trace systems with improved information accessibility for the all the stakeholders in the chain			















Implementation				
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System innovation methodologies in the food production chain

Priority research challenge 1	System innovation methodologies in the food production chain			
	Participants, contribution and timeline	Project type	Human resources	Funding amount
Major research challenge 1	<p>0 5 10 15 years</p> 			
Deliverable	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	Development of technologies for tracking and tracing and their integration into management systems.			
Deliverable	Validated technologies for tracking and tracing and their integration into management systems.			






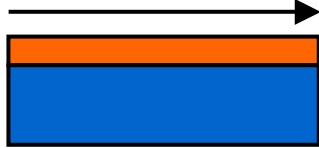











Implementation		   		
Major research challenge 3	Development of next generation predictive/probabilistic models for food microbial stability and safety and their translation into easy-to-use tools for the end-user.			
Deliverable	Predictive and probabilistic models for food microbial stability and safety.			
Implementation		 		
Major research challenge 4	To develop technologies for the reduction or the elimination of hazards at the level of primary production (including breeding) and during processing.			
Deliverable 1	Agronomical research for developing plants more resistant to toxigenic moulds and formation of mycotoxins 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.			
Implementation		   		







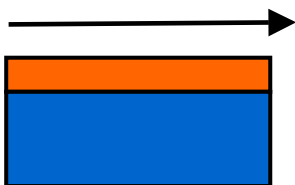






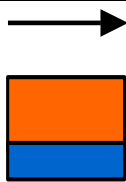





Major research challenge 5	To develop effective methodologies for tracking and tracing of microbes, contaminants and allergens along the food chain, to be incorporated into integrated management systems.			
Deliverable	Validated technologies for tracking and tracing and their integration into management systems			
Implementation		   		
Major research challenge 6	To understand relationships of food structures from molecular via nano to macro scale with respect to product and process design, and to develop new processing principles for improved consumer preference, acceptance and need (PAN) profiles.			
Deliverable	Development of quantitative methods to assess process-structure-property relationships to understand structure property functions and their relationships with formulation and processing. Process optimisation through combinations of new and conventional technologies to new and traditional foods. Sustainable food processing in synergy with new packaging technologies. Point of use processing systems for timely delivery of freshly produced personalised food.			
Implementation		    		
Major research challenge 7	To develop and apply novel processes for the implementation of the PAN profiles through innovative product functions.			
Deliverable	Consumer preferences, acceptance and needs (PAN) function driven sustainable food processing in synergy with new packaging technologies.			
Implementation		    		
Major research challenge 8	To identify bioactive food constituents from plant, animal and microbial sources, and beneficial micro-organisms and their mechanisms of action.			





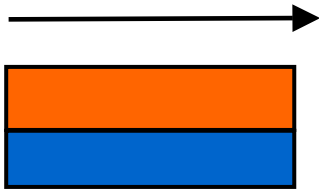



Deliverable	Development of in vitro assays and biomarkers to predict in vivo functionality of bioactive components leading to new product functions. Understanding of impact of food bio-actives and beneficial micro-organisms on human health and effect of food matrix formulation on the activity, delivery and transfer of bioactive compounds and beneficial micro-organisms.			
Implementation	 	  		
Major research challenge 9	Develop models for consumer orientation in food innovation on the basis of consumer needs and preferences for product, process and packaging technologies, across different target groups.			
Deliverable	Design of new methodologies for effective incorporation of consumer understanding into new product development. Design of new tailor-made, personalized foods targeted at individual consumers.			
Implementation	 	  		
Major research challenge 10	Development of (culturally sensitive) effective communication strategies to consumers for innovation and new product technologies			
Deliverable	Preparation of quantitative models how product, process and packaging affect consumer responses.			

Consumer studies

Priority research challenge 1	Consumer studies			
	Participants, contribution and timeline	Project type	Human resources	Funding amount

	0 5 10 15 years			
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 or physiological data.			
Deliverable	Harmonizing and elaborate existing national databases on food composition and consumption patterns, including ethnic and traditional foods.			
Implementation		 		
Major research challenge 2	Validated models and methods for effective public participation of and engagement with consumers on food safety governance.			
Deliverable	Development of 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 integrate consumer-orientation in new product development, and to understand consumer responses to new products, processes and packaging technologies across different target groups.			
Deliverable	Predictive and operational methodologies and toolboxes for PAN patterns. Research leading to assessment tools and diagnostics for PAN profile evaluation from consumer, nutrition and health science. Models for PAN patterns as a function of quality and well-being factors to produce a diversity of foods for specific consumer groups. PAN relationship to food manufacturing and packaging concepts.			
Implementation		 		
Major research challenge 4	To develop convenient, tailored personalised food products to meet the preferences of all consumers, as well as acceptance and needs.			

Deliverable	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 availability.			
Implementation		  		
Major research challenge 5	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 in how public perception of risk develops in interaction between consumers, media and stakeholders, followed by effective communication strategies.			
Implementation		   		
Major research challenge 6	Design of transparency schemes that serve transparency needs of consumers.			
Deliverable 1	Reference models for networks for tracking, tracing and food quality transparency for consumers Reference models for integrated and flexible networks for tracking, tracing and food quality transparency that serve different user groups and transparency needs, identify organizational, managerial, technological, and economic alternatives, outline flexible development paths and specify suitable information sources.			
Implementation		  		
Deliverable 2	Reference models for flexible multi-layer transparency networks for consumers 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.			

Implementation				
Major research challenge 7	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.			
Deliverable	Databases on food composition and consumption patterns including ethnic and traditional foods. Harmonizing and elaborating existing national databases on food composition and consumption patterns including ethnic and traditional foods.			
Implementation				

KEY THRUST 3: SUPPORTING SUSTAINABLE AND ETHICAL PRODUCTION

Scope

Considerations of sustainability will need to guide future developments in European food production and must be an integral part of all future developments. Today the European food production system demonstrates a number of unsustainable features which need to be addressed by research focusing on sustainability of food production systems both in the form of assessments of present systems, by developing knowledge on future possibilities and on methods and technologies for practical improvements.

The European food production system is facing major challenges to remain competitive taking into account changes in the sector's economic and non-economic environments, from changes in lifestyles and consumer needs, structural problems with many SMEs in the sector as well as the globalisation of the food markets. These challenges cannot be met by any individual enterprise but require concerted actions and coordination of initiatives. In addressing its challenges the sector needs to activate its potential for organisational innovations beyond process improvement and build on those potentially inherent in relational enterprise networks and their flexibility in responding to the twin demands of customers and consumers. Changes might focus on operational improvements or on strategic development perspectives where an important consideration is the need to integrate and balance the interests of all stakeholders in the food production system.

Key research challenges

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

Major problems

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

What needs to be done and why?

As the most sustainable option can be difficult to identify it is important to develop better tools for assessing sustainability of food chains (Priority Research Challenge 1, **Sustainability of European food systems**) and for using the knowledge of these to identify directions for the



future developments (Priority Research Challenge 2, **Solutions for sustainable food systems**). The influence of the actions of the various actors of the food chain should also be analysed in order to identify improvement potentials for technical and managerial solutions in each step in the chain. Special emphasis should be on the behaviour of the consumers and how to communicate with them about information on more sustainable options (Priority Research Challenge 3, **Food system efficiency and effectiveness**).

What progress needs to be made?

Better understanding of how to assess sustainability of various food chains and consumptions patterns will give directions for selecting the most desirable future developments. The identification of improved technical and managerial solutions to sustainable food chains will facilitate and speed up the introduction of more sustainable solutions in the food chains. The road to improved sustainable food chains will be supported by the improved understanding of how to communicate the information about more sustainable options with consumers.

Opportunities for the industry and other stakeholders

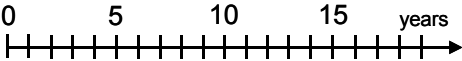








Improvements in sustainability have long-range benefits for the food industry in terms of reduced resource use, increased efficiency and better governance. Improvements of efficiency of the entire food chain will also benefit the other stakeholders in the chain, e.g. through improvements in network cooperation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

Priority research challenges



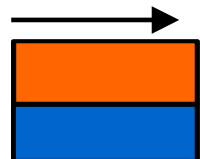




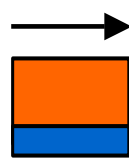



	Sustainability of European food systems	Solutions for sustainable food systems	Food system efficiency and effectiveness
Sustainability Food Production	Develop a methodology for describing the essential parameters.	Develop dynamic modelling tools to determine and demonstrate the sustainability frontiers.	Develop methods for value chain analysis of entire food chains.
	Identify relevant factors in the future affecting or improving sustainability.	Use scenarios to study “What if?” alternatives.	Develop viable approaches and innovations to produce resource friendly, improve utilisation of food raw materials and reduce waste.
	Identify and analyse the major environmental, social and economic pressures.	Identify and evaluate novel primary food production systems.	
	Analyse and monitor the sustainability of emerging lifestyle trends.	Understand how consumers behave and how responses differ between different consumer groups.	

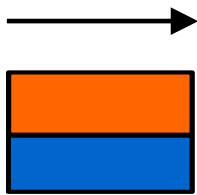







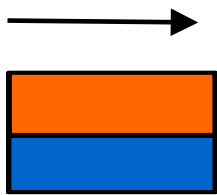





Managing the food chain	Determine opportunities for innovations and improvements in processes in production, logistics and management.	Design organisational network alternatives that combine efficiency and responsiveness to changing consumer demands for quality and diversity.	Design transparency schemes that serve transparency needs of food networks.
	Understand and utilise success factors for supporting food system dynamics in times of globalization and change.	Design and support knowledge communities for SME support.	Deliver suitable approaches for functional cooperation that fulfil needs and overcome integration barriers.
Ensuring that the healthy choice is the easy choice for the consumer	To develop better tools for communication with the consumer, including insights from semiotics and persuasive and interactive communication through different media.		
Developing quality food products	To provide improved PAN functions through the redesign and optimisation of food processing and packaging, in order to increase competitiveness and sustainability.		
	Risk-benefit balanced innovative, sustainable, and safe food packaging for implementation into integrated food chain products.		

Sustainability of European food systems



















Priority research challenge 1	Sustainability of European food systems¹³			
	Participants, contribution and timeline 	Project type	Human resources	Funding amount
Major research challenge 1	Develop a methodology for describing the essential parameters.			
Deliverable	System analysis of sustainability performed for a range of regional and sectoral food chains.			
Implementation	 	  	 	

¹³ See pages 23 and 24 of this document for explanation of the symbols used.

				
				
Description	<p>The varieties of European regional and sectoral food chains from the northern Europe to the southern Mediterranean countries require the developing and performing of system analysis. The different food production chains occurring in different countries with extremely different land and climatic background and different food culture, also in the way to prepare and cook foods, of course could lead to different outcomes in the identification of the sustainability hot spots. It is important, then, to understand the differences between the regional and sectoral food chain in different countries by involving the primary producers, both SME and big industry, throughout the setting up of pilot projects necessary to analyse 'pilot commodities' and 'pilot food chains'.</p>			
Major research challenge 2	<p>Identify relevant factors in the future affecting or improving sustainability.</p>			
Deliverable 1	<p>Development of scenarios of food production and supply chains based on existing general scenarios.</p>			
Implementation		 		
Description	<p>Scenarios on food production and supply systems must be based on existing scenarios for the development of the global society, including demographic, social, economic, trade and environmental developments. The consequences on these prospected developments in the scenarios must be translated to possible developments in the European food production and supply chains as well as issues on 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.</p>			
Deliverable 2	<p>Elaboration of scenarios for future food production systems illustrating the consequences of different development options.</p>			
Implementation				
Description	<p>Scenarios for future European food production and supply systems will be developed where factors affecting the sustainability of these developments will be assessed. A number of 'possible futures' will be employed for scenario building, including effects of global warming, of dramatic energy price increase, of 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</p>			

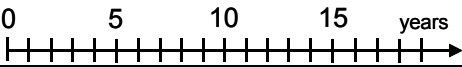
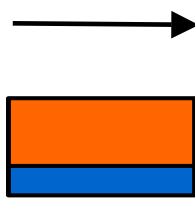



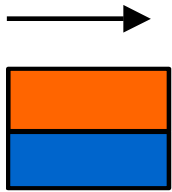



	sustainability will provide the basis for identifying improvement potentials and scenarios with improved sustainability included. This task should be performed in close collaboration with scenario-oriented activities within Food Chain Management Working Group.			
Major research challenge 3	Identify and analyse the major environmental, social and economic pressures.			
Deliverable	Establish a knowledge base to optimise existing primary food production systems 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 production systems (crop, livestock and fish). The indicators must be 'location specific' as they have to taking into account the widely differing environmental and socioeconomic conditions and their complex interactions that determine the design of the actual production system. Required adjustments towards sustainable practices require an interactive learning process with (groups of) farmers, researchers and other stakeholders, using both formal (quantifiable) and non-formal knowledge. This knowledge is used to design, test and disseminate appropriate farming systems in such an interactive mode.			
Major research challenge 4	Analyse and monitor the sustainability of emerging lifestyle trends.			
Deliverable	Analysis of the influence of lifestyle trends on sustainability of the food production system.			
Implementation		 	 	
Description	The direction of changes in consumer behaviour and food production depends on the adaptive capabilities of coupled human-ecological systems,			





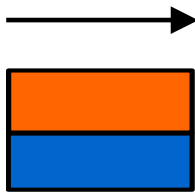







	<p>which primarily shape the behaviour of individuals. In turn, the adaptive capabilities at the system level are to a certain extent affected by the day-to-day choices of consumers who display similar and consistent preferences for a better quality of life. Environmentally, a diet with more meat exerts 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. There will be a strong link to the Food and Consumer Working Group.</p>			
Major research challenge 5	<p>Determine opportunities for innovations and improvements in processes in production, logistics and management.</p>			
Deliverable 1	<p>'Best practice' process organisation alternatives.</p>			
Implementation				
Description	<p>Specification of 'best practice' process organisation alternatives from production agriculture until food deliveries at the retail stage (through, e.g., the reduction of waste) that will allow the potential for further improvements to be identified.</p>			
Deliverable 2	<p>'Hot spots' in process organisations.</p>			
Implementation				
Description	<p>Specification of 'hot spots' in process organisations that will allow improvements in the delivery of food through appropriately focussed developments and innovations and the elimination of development and innovation barriers in processes and institutional environments.</p>			
Deliverable 3	<p>Priority 'landscape' for the initiation of activities.</p>			
Implementation				

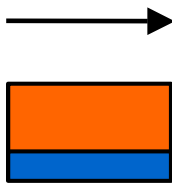




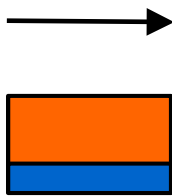





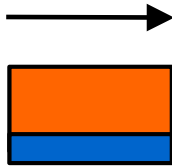




Description	Specification of a priority 'landscape' for the initiation of activities that reduce barriers and support process development, process innovation and institutional change.			
Major research challenge 6	Understand and utilise success factors for supporting food system dynamics in times of 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	Best practice reference models for value chain organisation and development.			
Implementation	 	 		
Description	Identification of 'best practice' reference models for value chain organisation and development linked to different performance views (including both economic and non-economic) and their development over time.			
Deliverable 3	Specification of 'performance maps'.			
Implementation	 	 		
Description	Specification of 'performance maps', based on 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 organizational development paths derived from 1) 'best practice' reference models as well as from 2) reference models determined through modelling research, and b) provide support for decisions on value chain developments.			

Solutions for sustainable food systems







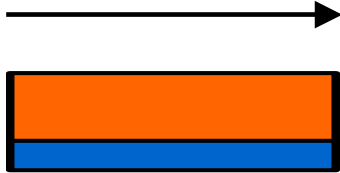





Priority research challenge 2	Solutions for sustainable food systems
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	Participants, contribution and timeline 	Project type	Human resources	Funding amount
Major research challenge 1	Develop dynamic modelling tools to determine and demonstrate the sustainability frontiers.			
Deliverable	Appropriate sustainable indicators developed.			
Implementation				
Description	The three pillars of sustainability require the identification, selection and development of sustainability indicators applied on food systems. Such work needs the application of different tools coming from both natural and socio-economic science. The creation of a tool box where environmental methodologies (LCA, IO-LCA) etc. leading to environmental indicators could share the information with economical and social analysis (LCC, TCA, SLCA etc.) is highly required in order to reach this goal. Both applied and basic are needed to assess the food systems in a life cycle perspective in a globalised food market context			
Major research challenge 2	Use scenarios to study “What if?” alternatives.			
Deliverable 1	Development of novel and alternative food production systems demonstrating sustainability benefits.			
Implementation				
Description	Novel and radically different food production method can present 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 goals of the ETP. The task is to assess the sustainability of novel food production systems built on these novel concepts in the form of scenarios for the future and to direct the development efforts towards sustainability benefits. Cooperation within the ETP is essential as is that with other ETPs, especially with the Plants for the Future, Aquaculture and Biofuel.			
Major research challenge 3	Identify and evaluate novel primary food production systems.			

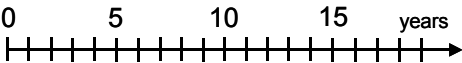
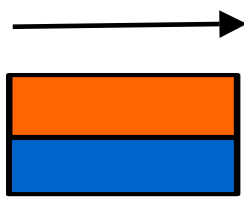



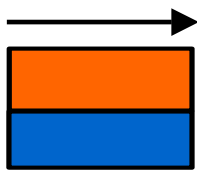



Deliverable	Identify novel primary food production systems and assess their sustainability.			
Implementation				
Description	Radically different food products and production systems can be developed based on innovative concepts and advanced biotechnologies. These may dramatically improve the use efficiency of natural resources. Emphasis should be on maximising the formation of desired products (full-product concept), on fully utilising any 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-ETPs.			
Major research challenge 4	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 increasing 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. Link to food and consumer group.			
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			

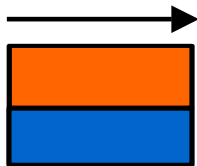



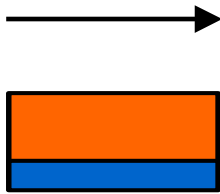



	<p>consumption is to focus on the opportunities offered by local food economies currently arising in metropolitan areas. Such urban food economies may relate restaurants, catering, schools and shops to local producers, with the concomitant advantage of creating a green 'buffer zone' around the city. 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. This will be linked to the Food and Consumer Working Group.</p>			
Major research challenge 5	<p>Design organizational network alternatives that combine efficiency and responsiveness to changing consumer demands for quality and diversity.</p>			
Deliverable 1	<p>Separable functions along the food chain.</p>			
Implementation		 		
Description	<p>Identification and analytical analysis of functions along the food value chain that could be separated for individual process optimization '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.</p>			
Deliverable 2	<p>'Best practice' experiences in the realisation of separable functions.</p>			
Implementation		  		
Description	<p>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 might limit the efficient integration of functions into value chains.</p>			
Deliverable 3	<p>Simulation and optimisation models that support flexible adjustments of global production and logistics networks.</p>			
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 in case of disruptions in production base, production ability or delivery and distribution networks.			
Major research challenge 6	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 organizational, 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 (for example, open network architecture).			

Food system efficiency and effectiveness

<p>Priority research challenge 3</p>	<p>Food system efficiency and effectiveness</p>			
	<p>Participants, contribution and timeline</p> 	<p>Project type</p>	<p>Human resources</p>	<p>Funding amount</p>
<p>Major research challenge 1</p>	<p>Develop methods for value chain analysis of entire food chains.</p>			
<p>Deliverable</p>	<p>Development and implementation of methods for value chain analysis of entire food chains explicitly incorporating sustainability assessment.</p>			
<p>Implementation</p>				
<p>Description</p>	<p>Current techniques to analyse the total food chain are primarily focusing on the end product quality and competitiveness. However, it is necessary to develop suitable methods for complex system analysis, which directly involve sustainability indicators for assessing the food chains as a whole, rather than the separate units. Integral approach should inherently encompass several interdisciplinary research fields (engineering, environmental, managerial, market and consumer-related aspects are all considered) 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.</p>			
<p>Major research challenge 2</p>	<p>Develop viable approaches and innovations to produce resource-friendly, improved utilisation of food raw materials and reduce waste.</p>			
<p>Deliverable 1</p>	<p>Developing more sustainable food processing, preservation, packaging and transportation operations.</p>			
<p>Implementation</p>				
<p>Description</p>	<p>The strategic goal is to strengthen the sustainability of the European food sector throughout the entire chain for processing, packaging, warehousing,</p>			

	<p>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 chain technologies, equipment and logistics should be developed for environmentally benign, energy-efficient and consumer-friendly manufacturing and handling of a large diversity 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.</p>			
<p>Deliverable 2</p>	<p>Improve utilisation of food raw materials and reduce waste throughout the food chain, including the development of systems for reprocessing to add value to food waste.</p>			
<p>Implementation</p>				
<p>Description</p>	<p>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.</p>			
<p>Major research challenge 3</p>	<p>Design transparency schemes that serve transparency needs of food networks.</p>			
<p>Deliverable 1</p>	<p>Reference models for networks for tracking, tracing and food quality transparency for networks.</p>			
<p>Implementation</p>				
<p>Description</p>	<p>Reference models for integrated and flexible networks for tracking, tracing</p>			

	and food quality transparency that serve different user groups and transparency needs, identify organizational, managerial, technological, and economic alternatives, outline flexible development paths and specify suitable information sources.			
Deliverable 2	Reference models for flexible multi-layer transparency networks for 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. Includes the 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 characterized by their 'transparency value' (benefit) for consumers and the costs of information generation.			
Major research challenge 4	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	<p>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 utilization, and organizational, 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).</p>			



PART 3.

Enabling Activities

INTRODUCTION

The first two parts of this IAP have indicated the main thrusts where there is the need for co-ordinated European-wide research; estimated the approximate scale of the resources needed, and suggested a mechanism for its support in terms 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.

The issues can be roughly divided into three actions, namely those:

- required to ensure that European industry is competitive,
- required to ensure the optimal use of the resources available, and
- addressing communication, training and education.

COMPETITIVENESS OF THE FOOD AND DRINK SECTOR

The 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 has focussed attention not only on R&D needs but on those issues that are necessary to address to drive the market forward rather than simply to encourage technology push. It has placed a challenge on the food and drink sector to define their lead markets and identify what other issues must be addressed to deliver a holistic approach to potential market success involving a concerted involvement by all of the actors influencing this market.

Lead Market Initiative

The ETP has responded to the Lead Market Initiative (LMI)¹⁴ by identifying Healthy Foods, addressed here within Key Thrust 1, as a sector where the greatest market growth opportunities lie and which reflects the increasing consumer desire for a healthy and varied diet. Analysis of the issues facing this sector will cover areas that, in addition to R&D issues, will require future action for market success. These actions are likely to have more general applicability to overall market success.

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 have not been possible to achieve within the currently funded ETP programme.

The European Commission recently announced that a *High Level Group* would be established to address issues related to the competitiveness of the agro-food industry and related challenges such as food safety, health and the environment. The ETP is in an unique

¹⁴ A Lead Market Initiative for Europe. COM, 2007, 860.

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.*

SME Task Force

The SME Task Force develops recommendations for measures and activities supporting the improvement of the competitiveness of food industry SMEs through enhancing their innovation capacity and increasing their involvement into innovation. These measures and activities will be implemented across the ETP Food for Life through its individual Working Groups especially Communication, Training and Technology Transfer and the National Technology Platforms. The main activities include:

- finalising the recommendations for the report on “Measures for enhancing the innovation activities of SMES in the food industry” to be available in the summer of 2008,
- developing an inventory of innovation funding schemes applicable for SMEs in collaboration with the National Technology Platforms (in 2008) to be maintained and regularly updated,
- exploiting cooperation opportunities with the European clustering initiatives on innovation and competitiveness, and
- developing additional recommendations for ensuring efficient project management, innovation financing, commercialisation and networking supporting services for implementation of innovation projects by food industry SMEs.

A summary of “Measures for enhancing the innovation activities of SMEs in the food industry”:

- actions for enhancing innovation of SMEs shall be segmented according to the innovation behaviour of the companies,
- priority shall be given to the capacity building of SMEs through training and practical demonstrations and transfer of knowledge. Trainings shall not be limited to technical subjects, but should include techniques for managing innovation, commercialisation of outputs of R + D projects, business skills, innovation financing and techniques for improving market access shall be equally included,
- mediators and researchers shall also be trained on technology transfer, business supporting, project management and knowledge management techniques,
- a sound balance shall be maintained between the diffusion and enhancing of the practical use of existing knowledge and the generation of new research results,
- the potential of national food technology platforms for improving the access to SMES at national level shall be exploited; this will include establishing and monitoring national food industry technology transfer centres,
- predictable and reliable financial support shall be ensured for SMEs at all stages of the innovation process at EU, regional and national level. Within funding schemes targeted for enhancing the innovation of SMEs priority shall be given to the innovation aspects as compared to research excellence,
- innovation supporting activities for SMES shall include services for project management, business development innovation financing and commercialisation of R&D results, through a combination of collective assistance and personal coaching.

EFFECTIVE USE OF AVAILABLE RESOURCES

This ETP's Implementation Action Plan 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 the Member States. A series of European strategic research programmes should link national research activities and ensure resources are effectively co-ordinated and targeted. At the present time some 94% of funding for scientific research comes from national funds whilst the remainder is from support from the Framework Programme.

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

- multiple sources of funding internationally (DG Research, DG Enterprise & Industry). 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 the key societal issues where food and health have major impacts, in terms of production and distribution and consumption, environmental impact and communication with society.
- multiple sources of funding nationally. 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.

At this stage the problems of effectively co-ordinating national resources to address key issues are complex and slow. 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 promote integration so as 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.

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 co-ordination of national research at a European level - ERA-NETs. In the food sector there is already an ERA-NET SAFEFoodERA, which addresses the co-ordination of food safety research and which has shown that there is a very considerable duplication of effort in certain areas of food safety across Member States. It has initiated two joint calls for proposals so far on several topics in food microbiology and food toxicology research. Funding was made available by a selection of the Member States participating in this ERA-NET.

SAFEFoodERA's funding will come to an end shortly. The ETP has requested that the Commission considers a request for further funding of this important initiative. In addition, 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 a means of coordinating nationally-funded research. The ETP Mirror Group acts as a conduit for endorsing these views and strengthening the case for action. They would have an even greater impact if the European Commission were to



consider providing matched funding for any ERA-NET activity that resulted in a successful call for proposals from a multinational consortium.

National Food Platforms

A significant outcome of the extensive consultations undertaken in advance of publishing the ETP's SRA has been the initiation of national food platforms in 30 countries including Russia, Ukraine, Serbia and Israel¹⁵. The National Food Platforms 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 national language. They have an important task in dissemination, information, training, technology transfer and fostering innovation. Additional value has been obtained by networking these national platforms so that common issues can be identified and regional opportunities addressed. The structures and activities of the national food platforms will vary according to the importance of the national food industries and the extent to which stakeholders are already in contact with one another.

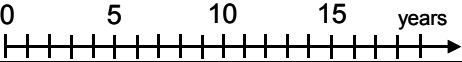
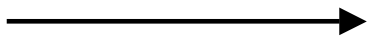












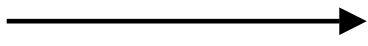








They are also the significant means in collecting national feedback to ETP proposals, position papers. Their collaboration and networking activity, which has already been established can significantly contribute to the exchange of experience to collection of best practices and in ensuring that a joint, coherent research programme on food is realised in each country and this programme is harmonised with the programs of other European countries.

The main task is to strengthen and develop further the networking activities of the national food platforms and exploiting the potential in their collaboration.
























Their activities cover the following main priorities:













- Maintaining and extending the collaboration of National Food Platforms for sharing experiences to assist the formation of new national platforms and to improve the operation of the existing ones for fostering innovation,
- Provision of input to the identification of the priorities of national and regional R+D and innovation programmes and provision of national feedback to ETP proposals, position papers through establishing and maintaining regular national dialogue between the food industry, the research community and other stakeholders,
- Development of best practices and guidelines for enhancing technology transfer – including tools, procedures and business development and project management supporting services – adjusted to the specific regional/national industry culture and business environment with emphasis to SMEs,
- 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, services.

¹⁵ Contact details can be found at www.etp.ciaa.eu.

National food platforms¹⁶				
	Participants, contribution and timeline	Project type	Human resources	Funding amount
	0 5 10 15 years 			
Priority activity 1	Maintaining and extending the collaboration of National Food Platforms for sharing experiences to assist the formation of new national platforms and to improve the operation of the existing ones for fostering innovation.			
Deliverable 1	Regular European and regional meetings/conferences to exchange views and experiences.			
Implementation				
Deliverable 2	Developing and updating communication tools for promoting the national food platforms and to disseminate success stories.			
Implementation				
Deliverable 3	Developing and maintaining best practice guides to operate national food platforms.			
Implementation		 		
Priority activity 2	Provision of input to the identification of the priorities of national and regional R&D and innovation programmes and provision of national feedback to ETP proposals, position papers through establishing and maintaining regular 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/conferences at national level for maintaining the dialogue of stakeholders.			
Implementation				

¹⁶ See pages 23 and 24 of this document for explanation of the symbols used.

Deliverable 3	Developing and revising national R+D strategies and their implementation plans.			
Implementation				
Priority activity 3	Development of best practices and guidelines for enhancing technology transfer – including tools, procedures and business development and project management supporting services – adjusted to the specific regional/national industry culture and business environment with emphasis to SMEs.			
Deliverable 1	Elaboration of best practices and guidelines for efficient technology transfer activities.			
Implementation		  		
Deliverable 2	National and European surveys and studies for developing methods and models for elimination of barriers of food industry innovation with specific focus to SMEs.			
Implementation		   		
Deliverable 3	Elaboration of recommendations and establishment of business planning/development and project management supporting services to innovation projects.			
Implementation		  		
Priority activity 4	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, services.			
Deliverable 1	Elaboration of organisational solutions like national / regional technology transfer centres for collecting research needs of the industry, the available expertise at international and national level and matching them and operating them.			

Implementation				
Deliverable 2	Provision of skilled staff in technology transfer and innovation management supporting services to technology transfer centres.			
Implementation				
Deliverable 3	Establishing and operation of networks, panels, clusters for shared cost and joint R&D and innovation projects.			
Implementation				

Mirror Group

Mirror Groups, bringing together national and other funding bodies from across Europe, are a necessary stage in

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

Food-Pharma Task Force

During the development of the 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 workshop¹⁷, attended by 110 people, was jointly organised with the Alimentary Pharmabiotic Centre, Cork, and the Irish National Food Platform. 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.

¹⁷ The Workshop presentations and the Book of Proceedings are now available to download from the ETP website, <http://etp.ciaa.be>.

International links

Many of the key issues described in the ETP's SRA and 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 that being proposed by 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.

In 2008, the work programme of the People pillar of FP7 included an 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.

Joint Technology Initiative

Joint Technology Initiatives, JTIs¹⁸, 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 choice has to be made by the key opinion makers and representatives of the food industry to develop a JTI in the area of Food and Nutrition. There are roughly two scenarios that can 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. An inventory of public-private partnerships will be made in 2008 by a Task Force set up by the ETP Board.

¹⁸ See <http://cordis.europa.eu/fp7/jtis>.

COMMUNICATION, TRAINING AND EDUCATION

Communication, Training and Technology Transfer are three distinct but deeply interweaved areas of one fundamental dimension, i.e. the maintenance of a high profile of the European Food Industry to the benefit of both this industry as well as the society it delivers to.

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 well-financed and effective regional centres of technology transfer..

Communication

The communication dimension in the ETP requires a coherent programme of initiatives over time. An effective communication strategy must build 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, an independent credibility for all stakeholders. The communicative dimension can be structured according to the following scheme (see scheme below). The logic of the scheme is a relational one, i.e. one that establishes links among different aspects of the communicative challenge.

	Activities directed towards:			
	the public	companies	researchers	consumers
Consumer - oriented initiatives	Communication of the corporate identity of the ETP programme and philosophy (2007-2015)	Continuous communication flow from and to consumers via associations and other sources (2008-ongoing).	Continuous communication flow from and to consumers via associations and other sources (2008-ongoing).	
Company-oriented initiatives		Development and implementation of communication management systems for the use of national Food-SME networks (2009-2011)		Continuous communication flow from and to consumers via associations and other sources (2008-ongoing).
Researcher-oriented initiatives	Improving communication through revision of the academic value traditions in food science (2007-2015).	Providing food company relevant content in the form of focused and updated information to food companies (2007-ongoing)		Continuous communication flow from and to consumers via associations and other sources (2008-ongoing).

Consumer-oriented communication initiatives

These actions will be functional at securing a steady and continuous relationship with the consumers via the 'umbrella role' of the consumers association. It is also aimed at assuring an important societal dialogue with governmental and non governmental bodies with a direct or indirect agenda on the food issue.

This comprises two lines of communication:

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

Objective

To guarantee a continuous communication flow from and to consumers via associations and other sources.

Approach

- The national food platforms will ensure that contributions from consumer organisations consistently are integrated in national initiatives involving food companies, food researchers or both.
- Meetings and conferences with emphasis on local issues will be organised in each member state.
- Both types of initiatives will be aimed at explaining issues of major concern for the end consumer to the companies and researchers.
- Specification of communication areas (food safety & health, consumer preferences, etc.)
- Specification of communication channels (mass media, group communication, ICT design, etc.)

Company-oriented communication initiatives

The dialogue with the companies of the European food industry has to be improved to motivate food companies exploiting research and innovation results. The provision of reliable information and use of new and appropriate communication technologies including direct contact on the national level will establish the ETP and the national platforms as 'partners of trust'.

It is vitally important that all participating companies gain clearly identifiable advantages from a newly conceived networking. Information is one of the key benefits of a network. Therefore a successful communication system requires initiatives to be taken at company level. These initiatives should be mostly addressed at reinforcing existing networks by expanding and qualifying them, building on the existing best practices.

The relevant lines of communication are:

1. From companies to other companies: Exchange of information about common challenges, opportunities and experiences.
2. From companies to consumers: Establishment of independent communication where companies can explain and discuss with consumer organisations the situation for their enterprises, in particular 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. In this respect existing best practices like the EUFIC initiative represent an example to duplicate and reinforce.

3. From companies to researchers: Facilitation of 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.

Objectives

- To develop and implement a communication management system,
- To provide food company-relevant information to food companies,
- To minimise informative barriers to innovation, especially related to SMEs,
- To promote information exchange among companies,
- To promote adoption of 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 kinds.

Approach

- Establishment of national contact partners in each European country under the auspices of the national platforms,
- Realising a new ICT system for company networking on national and international level,
- Improved interaction and information transfer with the companies,
- Inclusion of other stakeholders (funding bodies, innovation suppliers, consumer organisations, research groups),
- Development of a national platform action plan basis for lobbying, tailored newsletters, consultations with associations, extension programmes, etc.,
- Setting up interesting and essential formats in order to channel useable content for food companies (quality of service providers, brokerage initiatives, etc.),
- Establish 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 transnational service providers.

Researcher-oriented communication initiatives

Researchers need to be motivated that next to the generation of new knowledge valorisation will contribute to the prosperity and well being of society.

The relevant lines of communication are:

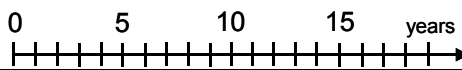








1. From researchers to other researchers: Extend the academic value tradition of generating new knowledge with valorisation as a key distinguishing factor of scientific achievement.
2. From researchers to consumers: Establishment of independent communication where researchers can explain and discuss with consumer organisations the situation for their work, in particular 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: Establishment of independent communication lines where researchers can explain and discuss with company organisations the situation for their work with the aim to identify 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 traditions in food science.

Approach

- Allocation of national research funds to institutions and projects in the food science area based on scientific and technological excellence and valorisation potential.
- Establishment of 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).
- Establishment of benchmarking facilities where end users (consumers and companies) can rank the quality of the service they received from research institutions.

Communication¹⁹				
	Participants, contribution and timeline	Project type	Human resources	Funding amount
				
Priority activity 1	Consumer oriented communication initiatives.			
Deliverable 1	Communication of the corporate identity of the ETP Food for Life programme and philosophy.			
Implementation				
Deliverable 2	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.			

¹⁹ See pages 23 and 24 of this document for explanation of the symbols used.

Implementation				
Deliverable 2	Providing food company-relevant information in the form of focussed and updated information.			
Implementation				
Priority activity 3	Researcher oriented communication initiatives			
Deliverable 1	Improving communication by revision of funding allocation principles.			
Implementation				

Training

Training is a key component for the extension of knowledge as well as the transformation of knowledge into competitiveness. The overall strategic goal is to increase the competitiveness of the European food industry through an excellent and skilled workforce. For this the general objective has one clear target: closing the present ‘innovation gap’ between research and its application as well as to close the gap between research and specific food industry designed training formats. The way to face this challenge is a two-fold approach defined in the priority areas:

- 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 architecture of existing and emerging training resources for the implementation of concerted training activities.

Objective	Activities directed towards:	
	trainers	companies
Improving the quality and accessibility of training	Establishment of a European network facilitator diploma for Techno-Science Mediators (2009-2015)	Establishing, updating and improving training facilities for the food industry in more than 30 European countries (2015-2020)



Objectives

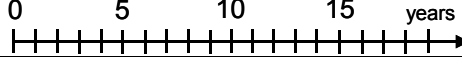
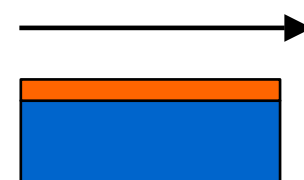



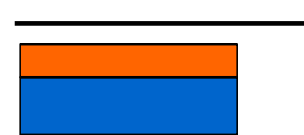



- To establish a European network facilitator diploma for Techno-Science Mediators.
- To establish, update and improve training facilities for the food industry in more than 30 European countries.

A clear common position about the skills of Techno-Science Mediators (TSMs) has to be achieved. TSMs should become an important resource for the innovation system of the European food industry. It is therefore necessary to establish a well grounded mutually recognised system of certification of the skills of these people. Existing bottom up initiatives taken at sub-sectoral level or in specific countries and regions must be supported by transnational 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 has become established across all European educational institutions that can meet the standards for accreditation by the European Foundation for Advanced Food Training and Technology Transfer (EFAFTTT), it will provide a number of fully skilled professionals, who will apply their skills on the level of the diverse national countries. However, at present not all countries already possess a sufficient training infrastructure to fully exploit the potentials of the food companies, so at this stage the role of the EFAFTTT will change from setting standards into a more involved coordination role to support national training activities to maximise their benefit for the industry. It is highly recommendable that each country refer to existing best practices in the field of food technology and food supply chain as those represented by integrated learning initiatives like for instance the HAS den Bosch (the Netherlands) methodology and others. The ETP recommends that these models for engaging the production and research sectors should be analysed and its potential applicability to other countries considered

Approach

- Set up a feasible design for EFAFTTT as a supra national institution to act as a Standards Approval Board for the European network facilitator diploma for Techno-Science Mediators,
- Define its task and activity program to allow the industry to define its needs for better coordination of the existing training capacity,
- Define standards and procedures for the accreditation of the European network facilitator diploma for Techno-Science Mediators, including integration with national curricula,
- Set up a feasible procedure aiming at the establishment of the diploma as a mutually recognised training agreement taken at European level (European certification at technical schools and early educational training/university/postgraduate level),
- Work on existing best practices to develop a suitable skill based profile of these newly created professional mediators based on the outcome from benchmark facilities of existing institutions and analysis of company scorings,
- Define and sustain the adoption of national operative training and technology transfer programme inspired by the EFAFTTT guidelines and training providers benchmarking,
- Maximise the utilisation of specialised training facilities through transnational collaboration.

Training				
	Participants, contribution and timeline	Project type	Human resources	Funding amount
	0 5 10 15 years 			
Deliverable 1	Establishment of the European Foundation for Advanced Food Training and Technology Transfer.			
Implementation				
Deliverable 2	Establishment of training facilities for the food industry in more than 30 European countries.			
Implementation				

Technology Transfer

Technology Transfer at its simplest is the conversion of existing knowledge into an appropriate format so that it can be used by the industry to develop new products, processing and services. Because there is a clear 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.

In analogy with the previous topics, the scheme below summarizes these points of attention. Firstly by intensifying the effort of the companies to act as innovation driven units being part of a collective network of innovators and secondly, by making the technology transfer resources a network shaped by a customer oriented philosophy, i.e. stimulating technology transfer providers to arrange their expertise, human capital and organizational structure as those of real service providers.

Objective	Activities directed towards:	
	company involvement	technology transfer providers
Improving the quality and accessibility of training	Techno-Science Mediator Networking Initiative (2015-ongoing)	Elaboration of recommendations for successful technology transfer at European and national level (2007-ongoing)



Objectives

- To develop the Techno-Science Mediator Networking Initiative.
- To elaborate on recommendations for successful technology transfer at European and national level.

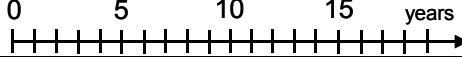
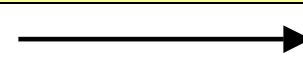





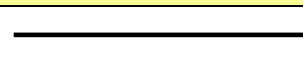





Techno-Science Mediators (TSMs), who have achieved the qualifications of the pan-European diploma will provide a key resource to actively promote technology transfer in direct contact to food companies on national levels, and will thus be a crucial tool for improved technology transfer activities. A foreseen two level networking approach of the TSMs is the key concept of improved technology transfer.

It is obvious, that no universal formula for successful technology transfer exists. All aspects of the TechTrans environment and specificities have to be taken into account. As a number of transfer activities have been carried out so far, the ETP wants to learn from their history, their strengths and weaknesses. ETP Food for Life will carry out an investigation on success 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 elaborate recommendations for how to implement this information by providers of know how, researchers, training institutions etc. in the area of the European food industry. These recommendations are the basis for the Techno-Science Mediator network and will have a crucial impact on the success of the ETP.

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,
- 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,
- Evaluation and ongoing monitoring of TSM basic programmes using established benchmarking facilities,
- Evaluation of potential enlargement of networks to exchange information on international and national level,
- Analysis of barriers for industrial exploitation of innovation,
- Analysis of the characteristics distinguishing best and worst practice and case studies for establishing new formats for enhanced support of innovation in the food SMEs,
- Evaluation of the effectiveness of SME partnership programmes and standardisation of activities to support them,
- Developing a specially dedicated project funding scheme (e.g. in the ERA-NET or others) 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.

It is clear, that all the mentioned intentions will be carried out side by side with a close exchange of information and results. This shall also lead to the development of coherent results and a complementing approach from the EFAFTTT to the TSM networks.

Technology Transfer				
	Participants, contribution and timeline	Project type	Human resources	Funding amount
	0 5 10 15 years 			
Deliverable 1	Techno-Science Mediator networking initiative.			
Implementation	 	 		
Deliverable 2	Elaboration of recommendations.			
Implementation	 	 		

CONCLUSIONS

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 co-ordinated, multi-disciplinary projects on a greater scale than exists at present.*

This IAP has assessed the resources and mechanisms that are needed to meet its objectives. It estimates that some 1.5 billion € are required to ensure their priorities are successfully achieved over a ten year period. 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.

In summary, the ETP recommends that:

- an analysis be undertaken of those national research programmes that have successfully engaged with industry and the reasons for their effectiveness and to propose a set of actions that reflect best practice. These should assist other Member States to obtain corresponding benefits following their adoption and implementation.
- the European Commission examines the need for further funding of the ERA-NET (SAFEFOODERA) and consider support for the establishment of two more ERA-NETs on *Food and Health*, and *Sustainable Food Production/Food Chain Management*.
- Policies are put in place that encourage the integration of national research resources; to encourage more research organisations to work closely with the industrial sector in all aspects of innovation, and to highlight best practices and encourage their adoption.
- A clear strategy be developed to communicate the concept of risk-benefit to consumers and to critically evaluate the benefits of highlighting very low level risks. The underpinning research must given the highest priority.
- Specific actions that are needed to meet the priority research needs that have been defined in this IAP.

Future of ETP Food for Life

It is planned that the ETP will continue to work across a broad range of relevant activities to ensure that the ERA is a reality for the food sector as well as the public at large, through its extensive and broad stakeholder network. It 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 made by the European Commission.

The aim continues that the ETP, with its approach to co-operation and consultation, will be the focal point for all activities related to promoting innovation in the food and drink sector in the future. There is a strong desire on the part of the industry to ensure this is so and the ETP Board will be giving serious attention to how the work of the ETP Food for Life should continue in the future.



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Glossary

A&I	Active and Intelligent (packaging)
AFT	Advanced Foundation for Food Training
CAP	Common Agriculture Policy
CEI	Central European Initiative
CFP	Common Fishery Policy
CIAA	Confederation of the Food and Drink Industries of the EU
DALY	Disability-Adjusted Life Year
ECRIN	European Clinical Research Infrastructure Network
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 Technology
EPIC	European Prospective Investigation of Cancer
ERA	European Research Area
ESF	European Science Foundation
ETP	European Technology Platform
EuChemMS	European Association of Chemical and Molecular Sciences
EU	European Union
FCM	Food Chain Management
FP	Framework Programme
IAP	Implementation Action Plan
IT	Information Technology
KBBE	Knowledge-Based Bio-Economies
KIC	Knowledge and Innovation Community
LCA	Life Cycle Assessment
NCP	National Contact Point
PAN	Preference, Acceptance and Needs
R&D	Research & Development
RFID	Radio Frequency Identification
RSSF	Risk Sharing Finance Facility
SME	Small and Medium-sized Enterprise
SRA	Strategic Research Agenda
SSRA	Stakeholders Strategic Research Agenda
TSM	Techno-Science Mediator
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.
Biological material:	any natural material that originated from living organisms containing carbon and being capable of decay.
Biotechnology:	technologies for cultivating, modifying or deriving products from living organisms.
Commodity food:	agricultural products of value and of uniform quality, produced in large quantities by many different producers e.g. wheat, milk, beef,



	coffee. The price of commodity foods is determined on the basis of an active market.
Commodity food chain:	interaction of all participants responsible for production, processing, refining, trading and consuming of an (agricultural) product.
Non-food:	biological (raw) materials used for applications others than food.
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.
Regional food chain:	interaction of all participants responsible for production, processing, refining, trading and consuming of an (agricultural) product, whole process is limited to a region.
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.
