

# Bsik Business Plan



Knowledge Project  
Food & Food Integrity

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# Food & Food Integrity

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# 1. Summary

## Background and problem analysis

Eleven "Expressions of Interest" for the ICES/KIS 3 investment incentive programme were submitted in September 2001. A common feature of the expressions was their focus on "food". The Expressions of Interest came about through ideas and plans from individual institutions and organisations in the knowledge sector. Formulation of "food & food integrity" as the thrust of policy for ICES/KIS 3 provided a good platform for launching a common and integral programme for this subject and for filling the identified gaps. The submitters of the "Food & Food Integrity" (V&VI) have seized the challenge to come up with answers to complex knowledge questions centred on food integrity. V&VI brings together a broad and unique combination of seven centres of knowledge excellence.

The key items identified in the current problems surrounding food integrity are:

- "integrity" is a dynamically, individually and situationally determined concept. Insufficient fundamental knowledge exists to make the concept workable for policy purposes or as a foothold for the business community;
- improving food integrity requires an approach that makes allowance for the features of the food system;
- the problem is of an interdisciplinary nature requiring co-operation between wide-ranging disciplines in a knowledge combination never before set up in this way.

## Objective and approach

The objective of the V&VI knowledge project is to develop fundamental and applied knowledge and instruments that help improve the integrity of food and to give food integrity a central position in the consumer choice process regarding their consumption and nutritional patterns. This objective has been broken down into three distinct sub goals. They are to:

1. Improve (and where necessary restore) consumer confidence in food, the credibility of food and consumer involvement in food as a product, food technology and the food production system;
2. Promote conscious and informed choices by consumers for healthy food;
3. Encourage responsible consumption without consumers having to make compromises.

The cornerstones of this approach are:

- projects in which fundamental knowledge is developed or increased in tandem with acquisition of knowledge that can be applied by groups of knowledge customers;
- development of knowledge throughout the cycle of fundamental research, development of a portfolio of technologies and concepts for raising the integrity of food all the way through to delivering Proof of Principle for new integrity concepts;
- activities for knowledge dissemination, for which purpose a set of defined deliverables has been produced.

## Innovative

V&VI differs from other research projects in this field because it:

- combines all areas of research relevant to "food integrity", taking into account the ambiguous nature of this concept, and integrates fundamental research based on consumers' actual behaviour;
- embraces the entire cycle of fundamental research from the different facets of food integrity all the way through to development and testing of new innovative concepts and intervention possibilities;
- examines the food integrity problem at system level and thus consciously invests in integrating beta and gamma sciences.

## **Benefits**

Some of the direct benefits of V&VI are:

- avoidance or reduction of damage caused by the explicit failure of monitoring food safety, resulting in contamination of food, epidemics, import restrictions and other direct economic damage;
- the health of the population is related in part to consumers' consumption patterns in the short term (contaminations, preparing food properly at home) and in the long term (the indirect costs alone of people being overweight amount to €1.5 billion per year in the Netherlands). Food-related diseases and disorders like obesity, undernutrition, allergies, and cardiovascular diseases cause great economic damage directly and indirectly and impair the quality of life of many people;
- reduction of damage arising from the great uncertainty that exists for companies regarding whether the food system will accept innovations. This stems on the one hand from the international legal regime that determines what is and is not permissible, and on the other from the flexibility for gearing the range of products in international markets optimally to what consumers want;
- in terms of innovation, "integrity" is a driver for a far more varied range of products with far greater differentiation at group and individual level. This creates considerable scope for new and existing companies to respond to this situation in national and international markets by means of a range of products and services that consumers experience as "integrity" for which they are prepared to pay a higher price because they recognise the added value for them as an individual (healthier, produced sustainably, more reliable information).

The V&VI knowledge project combines two fields of research in which the Netherlands is widely recognised as being a strong player (agricultural food and human health) in an answer driven way centred around an issue that unquestionably affects the everyday life and health of every person in the Netherlands: healthy, tasty and reliable eating and drinking. In the preparations for this plan, the participating parties have demonstrated how they can break down dividing lines between disciplines. Together with the complementary knowledge project "transitions to sustainable agriculture", V&VI provides a strong and high quality boost for the knowledge infrastructure and also for a sector that has always been one of the Netherlands trump cards in the international economy.

## **Facts, Names and Figures**

*Submitter:*

Innovation Network Rural Areas and Agricultural Systems (Innovatienetwerk Groene Ruimte en Agrocluster)

*Combination of research areas, researchers and knowledge institutions:*

<b>Field</b>	<b>Researchers</b>	<b>Knowledge institution</b>
Consumer Behaviour & Marketing	Prof. W.F. van Raaij Prof. J.C.M. van Trijp	University of Tilburg Wageningen University
Information Handling, Risk Perception, Consumer Trust	Prof. J. van der Pligt	University of Amsterdam
Food Design and Development of New Innovation Concepts	Prof. A.G.J. Voragen Dr. H.S.M. de Vries	Wageningen University Wageningen University / ATO
Health, Food Safety and Food Analysis	Prof. W.H. M. Saris Prof. R.J. Brummer Prof. C.A.M.J.J. van den Hondel	University of Maastricht University of Maastricht TNO Food
Food System Dynamics	Prof. R.E. Smits Dr. E.H.M. Moors Dr. A. Tukker	University of Utrecht University of Utrecht TNO STB

*Scientific Director of the Programme:*

Prof. J.C.M. van Trijp, Wageningen University

*Actively contributing organisations:*

Ahold	Heinz
Aviko	HZPC
CSM	KnowledgePlaza
Centraal Brouwerij Kantoor	Metaflex
DSM Food Specialties	Noord Oost Nederland b.v.
Dumeco	Numico
Easyfood	Plukon
FCDF	Smilde
Genetwister	Sonsbeek Software
Greenery	SVS Holland
Haust	Unilever
Heineken	Wessanen

*Project Preparation Steering Committee*

R.P.J. Bol (Ministry of Agriculture, Nature Management & Fisheries)  
 Prof. P. Folstar (National Genomics Organisation)  
 Dr. H.J. Huizing (Innovation Network)  
 K. de Jonge (Consumers' Association)  
 B.J. Krouwel (Rabobank Netherlands)  
 J.F. de Leeuw (Food and Non-food Authority)  
 Dr. B. Sangster (Unilever plc)  
 Prof. W.H.M. Saris (University of Maastricht)  
 Y.E.C. van der Sluys (Nutritional Centre)  
 Dr. N.J. Snoeij (TNO Food)  
 F.J.M. Tummers (VAI, Chairman)  
 Prof. A.G.J. Voragen (Wageningen University)  
 J. van der Veen (Horticultural Marketing Board)  
 Prof. L.C. Zachariasse (LEI)

*Budget for 2004-2007 period*

The V&VI project has a total budget of kEUR 41,650.

Budget for carrying out research programme and projects: kEUR 40,817.

Budget for transferring and disseminating knowledge and competences: keuro 833

*Contribution requested from ICES/KIS:*

A total ICES/KIS contribution is requested for the 2004-2008 period of: keuro 20,825.

## 2. Background

### 2.1. Confidence in our food

The Minister of Economic Affairs submitted a letter to the Lower House of Parliament in March 2002 about the progress of the third ICES/KIS 3 investment incentive programme. The letter contains a list of policy priorities that the government has set for the coming years for answering unsolved knowledge questions. "Food & Food Integrity" is one of the priorities.

The government has set down its policy on food and food integrity in policy documents entitled "food safety" (written jointly by the Ministry of Agriculture, Nature Management & Fisheries/Ministry of Health, Welfare & Sport), "position of the consumer" (Ministry of Economic Affairs), and the National Environmental Policy Plan NMP-4 (Ministry of Housing, Spatial Planning & the Environment). *The task that has been set is to tackle the growing mistrust among consumers regarding the safety of their food.* Companies bear a major responsibility in this regard towards customers/members of the public (by conducting business in a socially responsible way). This matter concerns not only food manufacturers but also other sectors of the economy (like the health care, hotel and catering, transport, logistics, ICT and advertising industries). Practice has shown that many members of the public are unable to cope with information streams about food." [quoted from a letter from the Ministry of Economic Affairs; passage in italics written by the authors of this plan].

"Tackling mistrust" summarises in powerful terms eleven proposals submitted in September 2001 as "Expressions of Interest" for the ICES/KIS 3 investment incentive programme. A common feature of them was their focus on "food". The Expressions of Interest came about through ideas and plans of individual institutions and organisations in the knowledge sector.

#### **Baseline for and approach to V&VI project**

The submitters of the Expressions of Interest jointly formulated the following baseline situation for and approach to the project (25th February 2002):

##### *Baseline:*

- consumer demand for healthy, safe, reliable and tasty food;
- need for sustainable and socially responsible production and distribution of foodstuffs.

*Approach:* develop a knowledge programme that *starts at the demand for knowledge* in such a way as to:

- create new, innovative knowledge combinations;
- provide a sharp picture of the utilisation of knowledge strengths and the new knowledge that needs to be developed (to fill in gaps in knowledge);
- combine beta and gamma knowledge in the programme.

The submitters of the Expressions of Interest had already concluded that each Expression directly answered one particular aspect, but did not address the "confidence" issue in its entirety. An analysis was subsequently conducted of the underlying wishes and ideals in the Expressions of Interest. This produced results that included:

- the business community would be provided with the knowledge, technology and people necessary to work on "safe" food in a faster, better and more innovative way;

- a consumer is largely a person who *is* understood and accepts modernisations. His assumed need for information could be met by means of information and knowledge banks, but how the consumer uses such information and knowledge "in his head" was not a research subject. Hardly any differentiation existed according to target groups (senior citizens, immigrants, people engaging in sports);
- the role of government appeared confined to participation in the exchange of information and knowledge with other parties in the food system and as a user of monitoring systems. Government also needed to remove some institutional barriers and amend legislation;
- the "old" distribution of roles between parties like the government, NVA (Netherlands Food Authority) and public information organisations had implicitly been maintained. The increasingly dominant role of European legislation continued to receive too little exposure;
- the Expressions of Interest gave hardly any explicit attention to knowledge usable for solving policy questions or modernising policy.

Formulation of "food & food integrity" as a policy priority provided a good platform for setting up a common and integral programme for this subject and for filling the identified gaps.

An extensive survey was conducted in the May-July 2002 period in preparation for the V&VI knowledge project. The survey asked a large and varied group consisting of authorities, companies, non-profit organisations, community organisations and independent experts what they considered to be the "ideal" situation concerning food safety/food integrity, how they defined "integrity" and which knowledge and research questions they would like to see answered, in each instance viewed from the perspective of their own organisation.

The ideal situations that came out of the survey were aggregated and fed back to the respondents. This enabled formulation of an ideal situation broadly accepted by all parties (refer to section 3.1). The interviews led to the compilation of a list of a few dozen knowledge and research questions relevant to the working of the food system. These questions were aggregated to approximately 30 generic knowledge and research questions. These questions formed the input for a process in which knowledge institutions were sought (within and outside the group of original submitters of Expressions of Interest) that collectively could answer this set of questions (refer to section 4.4.1). The list of questions served as a basis for drawing up the portfolio of projects for V&VI (Appendix A). Subsequent to the survey round, two workshops were organised with the business community at a later stage of the preparations and bilateral talks were held with individual knowledge customers. This approach enabled full compliance with the objective of setting up a knowledge project.

The V&VI knowledge product has taken on board the challenge to analyse and answer complex questions concerning the knowledge of food integrity. The project represents a broadly based and unique combination of seven knowledge institutions. Based on an analysis of the underlying knowledge questions, the project has opted for an approach that continually allows new knowledge combinations to be created in order to anticipate and address new knowledge questions. As will be demonstrated later in the problem analysis (refer to section 3.1) and the programming (refer to section 4.3), a process was initiated in the run-up to this knowledge project that allowed the knowledge institutions - despite their distinct disciplinary roots - jointly to make a problem analysis and set down a multi-disciplinary approach. This joint effort clearly demonstrates the significance of this project for strengthening the knowledge infrastructure.

## 2.2. Embedding in activities of the Consortium members

The implementation of the knowledge project is closely aligned to the activities of the consortium members. The principal participants are the government, knowledge institutions, companies and community organisations. The interests of these various stakeholders are:

- for the **government**, the knowledge project fits in with the totality of activities undertaken to strengthen the knowledge infrastructure by reinforcing new interaction between knowledge institutions and knowledge customers and stimulating multi-disciplinary research;
- for the **knowledge institutions** (universities, institutes of education), two essential activities of the project represent *their core business*, i.e. conducting scientific research and transferring knowledge by training students and post-graduates;
- for the **institutions of applied scientific research**, the core activity is brokering between fundamental research and developing applications;
- for **companies and other knowledge customers (non-profit or otherwise)**, participation in this project allows acquisition of pre-competitive knowledge, considerable leverage on their research and development investments and enlargement of their network in the knowledge infrastructure. This fits in with the regular R & D activities for developing knowledge and competences and widening networks and, in a wider context, all activities concerning reinforcement of their competitive position by investing collectively in confidence in food;
- for **community organisations**, the knowledge project creates a possibility for active input into discussions in such fields as food safety, consumer interests, health/environment, patients' interests, sustainability and animal welfare;
- the applicant is the ***Stichting InnovatieNetwerk Voeding en Voedselintegriteit*** (Foundation Innovation Network Food and Food Integrity). The Dutch government established this independent organisation in 2000 (to succeed the National Council for Agricultural Research) with a two-track remit: (1) making long-range forecasts and (2) initiating, stimulating and facilitating system innovations for agriculture, agricultural business and green space. Together with the other knowledge project that is submitted by the innovation network, i.e. "Transition to Sustainable Agriculture", this knowledge project will make an important and modernising contribution to stimulating and modernising agricultural business.

## 2.3. Strategic Context and Objectives

The strategic context of the V&VI knowledge project is defined by the relationship that exists between the goals, working method and benefits<sup>1</sup> of the project and the strategic interests and goals of the consortium participants. These can be summarised in general terms in the following way.

- for the **government**, the knowledge project fits in with the entirety of policy goals concerning economic competitive strength of the food sector, sustainability and health care. These goals are detailed in policy documents entitled "food safety" (Ministry of Agriculture, Nature Management & Fisheries), "position of the consumer" (Ministry of Economic Affairs) and NMP-4 (Ministry of Housing, Spatial Planning & the Environment) and, with regard to the dynamics of the knowledge infrastructure, in the policy document "economic structure outlook";
- for the **knowledge institutions** (especially universities), the knowledge project is important because of the integral approach built on disciplines that have not before co-operated and the strong emphasis on beta-gamma interaction. This makes the project a test case for entering into new question driven co-operation projects for

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<sup>1</sup> "Benefits" consist of fundamental and usable knowledge, instruments and innovation concepts and also the creation of networks and strengthening of the knowledge infrastructure.

the knowledge infrastructure. V&VI is closely aligned to the strategy and spearheads of the participating knowledge institutions. It additionally offers an exceptional opportunity to draw on these existing strengths to develop what internationally is a unique interdisciplinary platform in a field that will take on major social and economic significance in the industrialised world in the coming years;

- for **institutions of applied scientific research**, like TNO and ATO/DLO, the knowledge project will strengthen their positions on the interface between developing and applying knowledge in the field of agricultural food and health and supporting disciplines;
- for **companies and knowledge customers (non-profit or otherwise)**, there will be the availability of knowledge, methods and tried-and-tested instruments resulting from a question driven combination of fields of knowledge that would not have been created without investments in V&VI. Direct benefits include fewer unsuccessful market introductions, "correct" introduction of new products/technologies and the flexibility to gear a range of products optimally in national and international markets to what consumers want. In terms of innovation, "integrity" in its numerous manifestations is a driver for a far more varied range of products with far greater differentiation according to groups and individuals. There will be a range that consumers experience as "honest" for which they are prepared to pay a higher price because they recognise the added value (healthy, produced sustainably, tasty, it is what it claims to be). It is also important for companies to incur less direct and indirect damage (through destruction, lost income and import restrictions);
- for **community organisations**, the knowledge project is important because it provides a channel to provide input in discussions about integrity in its numerous manifestations and to inform their "grass roots" about this matter and obtain their active involvement;
- transcending the goals of the individual parties, there is a higher common interest at **system level**<sup>2</sup>. By ensuring the system responds more effectively (through prevention and monitoring) to actual or impending crises and risks there will be fewer disruptions (in the form of epidemics and contaminations) and, if they do occur, they will be easier to contain in terms of time and place. This will produce greater confidence among consumers in the system as a whole and a greater capability for the food system as a collective of different parties to achieve greater food integrity and to learn how they can together achieve optimum co-operation. In the run-up to this knowledge project (refer to section 2.1), a first step was taken towards integrating scientific disciplines and matching the knowledge questions from all kinds of different parties in the food system, a step that can now be attributed to the ICES/KIS 3 investment incentive programme.

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<sup>2</sup> "Food system" in this context is understood to be the totality of *parties* (consumers, processing industries, retailers, manufacturers, knowledge institutions, NGOs and anybody else involved professionally with "food"), *physical streams* (the entire chain: growing, raw materials, semi-manufactures, foodstuffs, residual streams), *institutions* (authorities, bodies, legislators, contracting parties, regulators), *transactions* occurring between the parties (purchase, co-operation, consultancy) and the *financial, knowledge and information streams* that accompany the transactions.

# 3. Problem definition, objective and key questions of the programme

## 3.1. Problem analysis

In the process that led to this business plan, the participants observed that several paradoxes have come about in recent years in the complex and global system in which food is produced and consumed:

- our food is safer than it has ever been in the history of man, yet the belief that food is unreliable has never received such prominent media exposure;
- modern test methods enable the measurement of increasingly lower concentrations of components in food, yet as this sensitivity increases, the relationship between tests, standards and policy is becoming increasingly strained;
- huge volumes of information are being gathered about consumer behaviour, yet consumers no longer stick to fixed conventional market segments and instead choose what and where they consume something depending on their mood and situation;
- news about new contaminations make the headlines rapidly, yet before consumers can look up what an abbreviation like MPA means, they are reassured that the "quantities are so small that they cannot pose a health risk";
- the portfolio of technologies for producing foodstuffs is greater and smarter than ever before, yet consumers and advertisers believe in a world in which food is prepared according to traditional methods by smiling chefs wearing white hats;
- there is a huge offering of "healthy products", yet the products are used hardly at all by the consumers that need them most;
- supplements and functional foods enable us to compose our diet exactly as we want it, yet we have hardly any idea about what is healthy for individual consumers and which claims can be substantiated;
- companies and authorities excel in providing information about food, yet consumers have most confidence in information provided by environmental organisations, or they ignore all information;
- there is ample food (last year 1,100,000,000 people worldwide were suffering from obesity, for the first time higher than the number of people suffering from a lack of food), yet in Dutch nursing homes between 30-40% of the old people are undernourished.

An initial result of the knowledge network being created for "food integrity" is the joint insight that "integrity" is not a stable and value-free concept and that it affects all disciplines involved in food integrity. The question of whether something exhibits "integrity" depends on the composition of what we eat, the way it was made, who made it and the set of values important to each individual consumer. Consumers weigh up not only long term and short-term considerations, they also have an intermingling of egotistical and altruistic considerations. "Confidence" in our food is derived from all of these factors, determined individually by our lifestyle, experience and fed by a wave of sometimes conflicting information from a variety of different sources.

What's more, "confidence" in food depends on the information mentioned above. It takes a long time to build up confidence, but confidence quickly evaporates when a crisis occurs. Conversely, consumers can become impervious to "bad news" and the next alarming report fails to make any impression whatsoever. For an indifferent consumer, almost anything qualifies as food with integrity; for critical and well-informed consumers, a wide range of matters like an absence of vitamins, additives, possibility of allergy or non-sustainable production methods can provide just as many reasons for not buying something. Amidst this multiplicity of paradoxes and views, nobody is able to define exactly what "honest food" is.

This has led to the following conclusions:

- "confidence" is not objective, but is determined by the consumer dynamically, historically and individually. This is a broad range from objectively determinable characteristics (like "free of microbial contamination") to highly subjective ("tastes good") and normative ("produced sustainably") characteristics. This notion needs to be a central consideration in the overall setting of developing and applying knowledge;
- confidence in food is a problem/challenge approachable only at system level. Innovations and interventions affect each other. Untenable laws, quality marks, introduction of controversial technologies and the "incorrect" provision of information do not work one for one or can have a counter-productive effect on confidence. The source of information about food determines to a great extent the credibility of apparently "objective" information;
- "technology" is just as indispensable as knowledge from the gamma disciplines. There is a need to integrate the two. It is the quality of the portfolio of technological capabilities that determines how safe and healthy food can be; it is the quality of the deployed gamma knowledge that determines to what extent this produces confidence among consumers in what they eat. It is the way that all parties work together to design the food system that determines whether this confidence is generally felt to be sufficiently objective and stable.

This problem analysis would be incomplete without looking at the question of why it is precisely now that a broadly based investment in developing knowledge about food integrity is necessary. The sense of urgency for the Food & Food Integrity project stems from the explosive increase over the past two decades of technological capabilities, global streams of raw materials and end products, variation in eating habits and the scale of production processes. Other factors that play a role include the emergence of nutraceuticals increasing susceptibility to epidemics of animal diseases, the role of the mass media, the declining knowledge among consumers about their food, concerns about the accumulation of food components and the ever-growing role of international legislation covering food safety.

### **Shared ideal of Food Integrity**

An extensive survey was conducted among authorities, companies, non-profit organisations, community organisations and independent experts in order to draw up an "ideal picture" broadly endorsed by the aforementioned parties, i.e.:

- mechanisms, rules and relationships for jointly making and keeping the food system adaptive, flexible and economically powerful, and embedding it permanently in society;
- the numerous "natural" conflicts of interest between the parties must be recognised and respected. The parties have shared ambitions regarding the direction the food system must take, the opportunities that exist and the obstacles that must be overcome. The parties can work with multi-dimensional issues in which different types of values and interests must be weighed up against each other to pave the way for an optimum solution;
- knowledge and information about food, production and risks must be available in a shared and sufficiently objective form. Tools must be available for the joint exploration and assessment of the future outlook and scenarios and to jointly design implementation processes;
- the food system must utilise experience with system innovation and transitions elsewhere and must make its own knowledge, experience and insights accessible within and outside the food system;
- the food system must play a stimulating and inspirational role for the creation of new companies, promote growth and innovation of existing companies and primary producers, and must attract foreign companies and researchers. The Dutch food system must be regarded internationally as a frontrunner for its knowledge, organisation and tangible results.

The role distribution, methods, interventions and agreements once adequate to monitor and guarantee the integrity of our food are now reaching their limits. They are unable to keep pace with the consequences of continual autonomous technological and social developments. In this vision the recent crises were not unfortunate avoidable accidents but show what can go wrong if a working method decades-old must be used to ensure the integrity of food in a large scale, varied, fast evolving worldwide system, or to respond properly to actual or impending crises. As the food system becomes more intensive and larger, the impact of crises will increase as well.

Therefore, a turnaround is needed in the way society deals with integrity, uses new technologies, addresses risks and makes information accessible. It is obvious that none of the parties in the system can on its own improve integrity, and that actions by individual parties have an effect on each other. Better test methods and new process technologies influence policy and public opinion; the choice of raw materials by manufacturers has a knock-on effect in the health of the population (allergens), "guidance" by government agencies and non-government organisations changes consumer preferences and by consequence competition between companies; intelligent packaging gives consumers the possibility to determine for themselves the quality of their food and this may result in entirely different strategies for quality control.

Summarising, the most important points to emerge from the problem analysis are:

- "integrity" is a dynamically, individually and situationally determined concept still insufficiently understood for it to be workable for policy purposes or for providing pointers for the business community;
- improving the integrity of food ("removing mistrust") requires an approach that makes allowance for the characteristics of the food system;
- the issue is interdisciplinary and calls for co-operation between wide-ranging disciplines in a knowledge combination never before set up;

- the pressure of international and European developments within and outside the food system will become so great that continuing in the old way will lead to a continual series of incidents and crises with ever-greater consequences.

### **3.2. Objective and key questions**

The general objective of the V&VI knowledge project is to develop fundamental and applied knowledge and instruments that help to improve food integrity and to give food integrity a central place in the choices made by consumers regarding their consumption and nutritional patterns. This objective has been firmed up by defining three sub-goals:

- improve (and where necessary restore) consumer confidence in food, the credibility of food and consumer involvement in food as a product, food technology and the food production system;
- promote conscious and informed choices by consumers for healthy food;
- encourage responsible consumption without consumers having to make compromises.

It is important for the customers of this knowledge (consumers, companies, government agencies and NGOs) to know how the developed knowledge and tools can contribute to attainment of the general objective. It will be achieved through innovations and interventions covering the entire cycle ride from the fundamental understanding of the meaning of "integrity" and processing a portfolio of technologies for increasing food integrity (in its several meanings) all the way through to methods for analysing and explaining consumer expectations and perceptions and to delivering Proof of Principle of new integrity concepts.

### **3.3. Strategic Lines of the Knowledge Project**

Ahead of the matters discussed in sections 4 and 8 of this document, it is worth pointing out that the integral approach to "confidence in food" will be reflected in the structure of the programme. The submitters have concluded from the analysis mentioned in section 3.1 that an approach with an excessive focus on technology, which additionally involves the various actors insufficiently or is based only on thinking in old roles, will not produce the desired result. Therefore, the programme calls for integration between knowledge of technology, behavioural science and systems. This integration needs to exist both in the development of fundamental knowledge (refer to section 4) and in the way in which the knowledge is disseminated (refer to section 8).

Successful interventions for increasing confidence in food necessitates co-operation between numerous different disciplines, for example in the development of a new functional food claimed to have positive effects on fat metabolism:

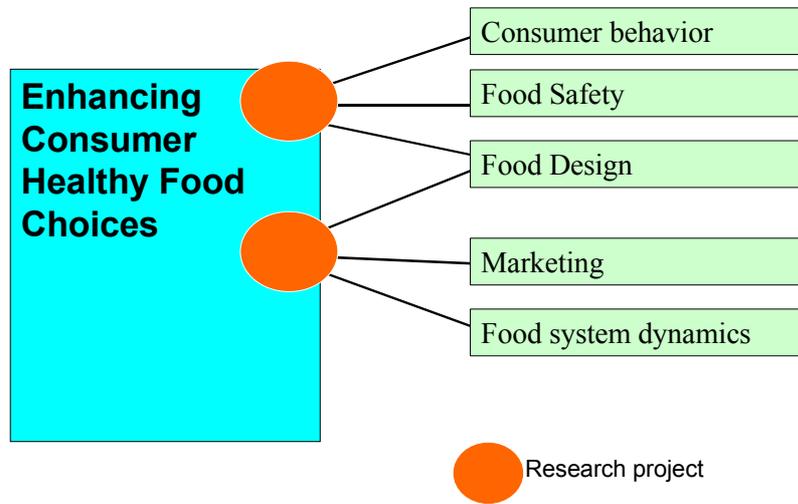
- how does the consumer perceive his health and the degree of influence he can exert upon it?
- how can specific target groups (like the "indifferent" group) be informed and involved?
- how can customised foodstuffs be designed and manufactured for such groups?
- how should the quality and safety of these foodstuffs be monitored?
- how can positive health effects be demonstrated?
- which obstacles at system level stand in the way of effective market introduction?

The development of applied and fundamental knowledge and associated products like tools, strategies and similar has been structured according to the three sub-goals mentioned in section 3.2. Each has three "focuses" that differ in the method of achievement of the goal. In line with the basic principles for this knowledge project, they have been formulated from the consumer's point of view:

- *motivation*: this yields the fundamental knowledge for successfully designing "interventions" that increase the motivation and willingness of consumers to choose healthy and responsible food and increase consumer confidence in food and food production (and the information about these matters);
- *ability*: knowledge of the way the ability of consumers is increased (in the sense of knowledge and skills) for making healthy and responsible choices regarding their food;
- *opportunity*: knowledge of the behavioural characteristics of consumers (determined objectively, normatively and situationally) and about the incentives and barriers capable of stimulating or impeding the choice of consumers for a healthy and responsible food.

Intentionally, these three sub-goals have not been demarcated according to disciplines because they require the use and combination of concepts and methods from several of the "conventional" scientific disciplines. For example, knowledge institutions and organisations involved in applied research can co-operate with each other on one of these three research subjects, establishing interdisciplinary and transdisciplinary collaboration while at the same time enlarging the knowledge base of their own scientific province. Section 4 provides more details on this matter. Figure 1 groups together the more than 30 planned projects defined in consultation with knowledge customers. This approach further overarches the dividing lines between existing disciplines. The result is a broadly based knowledge network in which the participating research groups do not work alone on their "own" projects, but always work together on the issues that knowledge customers (companies, government agencies) have identified as being relevant.

Figure 1 Example of Relation between Objective, Projects and Science Areas



# 4. Fundamental and applied research on food integrity

## 4.1. Introduction

The overall aim of the research program is to stimulate and realise public and corporate ambitions to enhance integrity in consumers' food choices. Integrity in this research program stands for an honest, fair (equitable) and sustainable approach to food production, food technology and food marketing taking consumers' frame of reference as well as satisfaction, health and well-being into account.

The program concerns those consumer behaviours that provide delayed rather than direct gratification (as in the case of taste, pleasure and convenience). It includes longer-term effects (e.g., health and safety), moral obligations (e.g., opposing child labour in the production of food), social/altruistic (e.g. third-world farmers' compensation) and environmental motivations (in relation to product and process technology). However, environmental sustainability from the point of view of sustainable primary agricultural production is not covered within this program. The latter may be achieved in synergy with the research program "Transition to sustainable agriculture".

The approach builds on the idea of socially responsible consumption of honest, fair, healthy, safe and sustainable food products with optimal intrinsic product quality. For this purpose the research program builds the tools, knowledge and infrastructure that stimulate consumers to behave in ways consistent with this orientation. It does so by combining pull (enhancing consumer motivation/willingness and ability) and push (providing the social, marketing, legislative and health/safety/sustainable technological options and opportunities for consumers) strategies.

The approach followed in this program is innovative as it:

- Combines all research areas that are relevant to the notion of 'food integrity' and integrates these research areas by focusing on the actual behaviour of consumers and actions and intervention routes to influence this behaviour.
- Covers the full cycle from fundamental understanding of consumer behaviour and perceptions to giving a proof of principle of new food integrity concepts including prototypes.
- Is based on the actual behaviour of consumers as a starting point and aims to develop the proof of principle for new types of innovation concepts and intervention routes to influence consumer behaviour.

## 4.2. Scope

The development and possibilities for using knowledge generated in V&VI (fundamental knowledge and also knowledge in the form of tools, methods, policy instruments and similar) fall into the following categories:

- activities: the entire chain of activities (but excluding primary production, except where product information is concerned) from processing, manufacture, packaging and distribution all the way through to the consumption of products and return streams;
- market: the concepts developed will be usable in all sales markets; projects will take place in the Dutch sales market;

- knowledge infrastructure: strengthening of the Dutch knowledge infrastructure, with the possibility of small-scale co-operation with foreign knowledge institutions;
- companies: participation in the knowledge project will be open primarily to Dutch companies, regardless of the industry in which they operate;
- sustainability will be interpreted broadly: not only in terms of health and safety, but also social, economic and ecological sustainability and thus including animal-welfare, environmental aspects and ethical aspects of producing, distributing and consuming food;
- fundamental knowledge will be developed in interaction with projects that try out and oversee the implementation of new concepts in order to deliver pre-competitive Proof of Principle;
- scale: the programme will embrace the population as a whole (focusing on public health, prevention), specific target groups and individual consumers (bespoke diets).

### 4.3. Principal research objectives

#### 4.3.1. Introduction

The research program focuses on three principal objectives that it aims to achieve through a combination of various “intervention routes” (e.g., product and process development, communication, delivery systems, new technology, legislation, chain organisation, etc.):

- Reinforcing and restoring consumer involvement, trust and confidence in food, food supply and food technology
- Enhancing consumers’ healthy food choices
- Socially responsible consumption without sacrifice (ensuring integer foods with minimal sacrifices on the part of the consumer)

In order to structure the research effort of the overall program, we organised research on the above principal objectives under three headings:

- *Motivation*: Research under this heading concerns the scientific knowledge base to successfully design interventions to increase people’s motivation and willingness to make healthy and responsible food choices, and foster trust in (information about) food and food supply. These interventions aim to change people’s perceptions, preferences and choices, or at least their motivation or willingness to do so. These changes should, of course, be supported by scientific knowledge. Unfortunately, motivation or willingness does not always lead to behavioural change and perseverance of newly acquired behaviour. It is a necessary but (often) insufficient condition.
- *Ability*: In order to foster behavioural change people should also have the ability (e.g., knowledge and skills) to make healthy, responsible food choices. Ability enhancing elements include the provision of information to generate adequate levels of knowledge, self-efficacy (i.e. the ability to translate motivation into action) and decision support systems to help various agents to make sound decisions and help to maintain or foster healthy and responsible food choices as well as public trust in the various agents.
- *Opportunity*: Situational and supply factors also determine human behaviour. Consumers should have access to responsible food at an affordable price. Under this heading we investigate a number of situational barriers as well as potential situational incentives that foster healthy and responsible food choices.

The following paragraphs describe the three principal research objectives in more detail following each of the aspects of motivation, ability and opportunity.

#### **4.3.2. Reinforcing and restoring consumer involvement, trust and confidence in food, food supply and food technology**

Today's food supply has received high levels of sensory quality, variety and convenience. Even though objectively most of these foods have reached high levels of integrity, the interesting and problematic paradox has occurred that these foods have generated substantial levels of consumer scepticism. This is partly due to increased consumer expectations of and motivation for even higher levels of safety healthiness and social responsibility. Partly it also comes from a certain degree of consumer alienation from food, food production, food technology and food marketing. Although objectively food is probably safer than ever before, food now meets higher consumer concern and distrust than ever before. The program develops the following lines of approach to reinforce and restore consumer involvement and/or trust and confidence with food and food supply:

Affecting consumers' motivation or willingness

- increasing consumer involvement with food, food supply and food technology
- developing consumer-evidence based communication strategies that foster (dimensions of) consumer trust and credibility in food, food technology and food supply
- understanding and managing emotions and sentiments that can enhance consumer trust and credibility
- increasing public acceptability of food innovation with uncertain risk-benefit distributions

Affecting consumers' ability to respond in line with motivation

- development of transparent chain information systems with interactive / personalised consumer interfaces, both in terms of prevention (e.g. hygiene) and curative behaviours
- developing proactive communication strategies for integrity in food chains
- developing communication strategies to adequately handle food scares
- transparent corporate and governmental strategies and effective institutional settings for crisis management and crisis PR
- corporate reputation management of food companies and institutions

Affecting consumer opportunity to behave in line with motivation

- creating improved quality/risk management systems in food chains
- building consumer responsive public consultation and certification approaches
- building consumer-relevant reward systems for food consumption marked by moral integrity
- building reward systems that enhance corporate social responsibility (self-regulation)
- building transparent tracking and tracing systems
- building consumer aligned self-regulation, liability and punishment systems

#### **4.3.3. Enhancing healthy food choices among consumers**

Public health is one of the most urgent public concerns of today's food consumption patterns both in terms of public health costs and corporate marketing opportunity. Although the number of nutritional issues in relation to public health is considerable, this program will put special emphasis on the emerging problem of obesity and related health problems in children and adolescents and the problem of malnutrition in a growing segment of population of the elderly. Increased awareness of the long term positive consequences of a healthy life style (including a healthy diet) will also be studied. The program develops the following lines of influence and effect/impact.

Affecting consumers' motivation and/or willingness

- enhancing and reinforcing consumer motivation to consume healthy food
- making health foods more motivationally relevant to consumers by increasing consumer awareness of the physical/physiological consequences of food intake
- strategies to increase long-term health perspective vis-à-vis urgent motivations as taste and convenience (i.e., merit and demerit goods)
- health claim formulations and formats that generate consumer appeal
- building reinforcers into health food design that provide immediate gratification
- making health foods personally relevant to individual consumers (i.e., individualised effect measurement, monitoring, and food intake advice (e.g., based on allergy status), personalised food products and supplements, etc.)
- selling strategies for health foods on a pleasure, taste, fun and/or convenience platform

Affecting consumers' ability to respond in line with motivation

- consumer education programs on health and healthiness to enhance consumer knowledge on the health consequences of food intake and skills to prepare food in a healthy way
- enhancing consumer's recognition of product healthiness (e.g., product labelling)
- consumer learning from feedback systems on the healthiness of food
- creating reliable and credible knowledge about the relation between food ingredients and health
- organising stakeholders and (new) intermediaries in health education (e.g., schools, journalists, radio/TV programs, media/program sponsorship, consumer organisations)
- consumer decision support systems for healthy choices, based on individualised monitoring and advice

Affecting consumer opportunity to behave in line with motivation

- creating research infra-structure to increase the availability of healthy food, both qualitatively and quantitatively, through rapid and large scale screening of ingredients
- ensuring the availability of healthy food with a minimal sacrifice on the part of the consumer in terms of convenience and taste
- enhancing the social value and acceptance of health foods and healthy consumption
- improving (self-)legislation and (self-)regulation with regard to health foods
- finding ways to make health foods more affordable (e.g., pricing)
- enhancing the availability of healthy foods in out of home consumption (e.g., on the go and in institutional cuisine)

#### **4.3.4. Socially responsible consumption without consumer sacrifice**

In actual food choice behaviour, consumers' integrity motivations compete and interact with the more urgent motivations of taste, pleasure and convenience that deliver immediate rather than delayed gratification. This is an important barrier to integer food consumption, not only in The Netherlands but also worldwide. The addition "without consumer sacrifice" implies that institutional improvements in the food chain and improvements in food technology may be made without direct consumer involvement, although these changes are being made from the perspective of consumer satisfaction, health and well-being. The research program develops the following lines of influence and effect:

#### Affecting consumers' motivation or willingness

- understanding consumer endorsement, appreciation and relative importance of aspects of socially responsible consumption
- strategies to enhance integrity motivations vis-à-vis more urgent motivations
- remedying the perception that taste, pleasure and convenience are incompatible with integrity-related motivations
- strategies to sell food integrity on emotional, intrinsic and social appeals
- strategies for communication, lifestyle and value-added positioning of integer foods in The Netherlands as well as worldwide

#### Affecting consumers' ability to respond in line with motivation

- developing clear (self-) legislation for corporate social responsibility (CSR). CSR includes fair (equitable) pricing for all stakeholders, adequate labour conditions and environmental impact of actions at international scale
- educating consumers on corporate social responsibility of companies and their produced food stuffs, and on socially responsible consumption
- effects of information of an independent agency ("third party") for food certification and information
- providing insight in socially responsible consumption, at home or out-of-home (including restaurants, hospitals, canteens, etc.)
- increasing our knowledge on the impact of processing technologies on appreciation of (high-quality) food transparent for companies
- forward and backward information provision and co-operation in food chains to enhance food integrity

#### Affecting consumer opportunity to behave in line with motivation

- ensuring availability and affordability (e.g., price) of integer foods without compromise on taste, pleasure and convenience, supported by the development of some generic proof of principles (either food components or full meals)
- Enhancing supply by delivering design schemes for integer foods based on intrinsic product quality and chain characteristics
- providing a portfolio of (mild) new processing technologies to enhance food integrity
- designing marketing strategies based on food integrity (including image building)
- delivering information systems that help companies (amongst others SMEs) assessing and predicting the integrity-related impact on intrinsic product quality
- enhancing availability of integer foods in out-of-home consumption (e.g. on the go and in institutional cuisine)
- developing demonstration facilities for preparation of integer foods that lead to interaction between suppliers and end-users (various target-groups e.g. including children)

## **4.4. Research programme**

### **4.4.1. Participants and fields of research**

The strengths of the Dutch knowledge infrastructure that will co-operate in the Food & Food Integrity project are shown in the table below (in some cases clustered around existing co-operation).

Cluster	Fields of research	Researchers	Knowledge institution
Consumer Behaviour & Marketing	Consumer behaviour and marketing	Prof. W.F. van Raaij Prof. J.C.M. van Trijp	UvT WUR
Information Handling, Risk Perception, Consumer Trust	The way people use information and assess risks and reliability of information	Prof. J. van der Pligt	UvA
Food Design and Development of New Innovation Concepts	Design of food and production processes and development of innovative concepts for food	Prof. A.G.J. Voragen Dr. H.S.M. de Vries	WUR WUR/ATO
Health, Food Safety and Food Analysis	Human health, human metabolism and the composition of food in relation to health aspects	Prof. W.H. M. Saris Prof. R.J. Brummer Prof. C.A.M.J.J. van den Hondel	UvM UvM TNO Food
Food System Dynamics	Behaviour of the food system and its actors at system level	Prof. R.E. Smits Dr. E.H.M. Moors Dr. A. Tukker	UU UU TNO STB

Sections 4.4.2 to 4.4.6 describe the contribution each of the above clusters will make to the programme and the relationship with the building up of knowledge in these areas of specialisation. Research projects that the participants (knowledge institutions and companies) develop interactively in close consultation with each other as the programme progresses will form the link between the clusters. The participants will cooperate under the management of the aforementioned scientific directors. Appendix A contains a list of initial project ideas ('Examples of projects') that will be fine-tuned, selected and fleshed out in consultation with the participating companies. The appendix defines each project's deliverables and scientific contributions in detail. Appendix B contains the qualifications of the researchers, their track records and their places within the knowledge infrastructure.

#### **4.4.2. Consumer behaviour and marketing**

Food is produced and distributed in order to supply consumers. The consumer is the ultimate goal of the food supply chain. But do we know consumers sufficiently well to know how they behave and what they want? Does consistency exist between the attitude, views and behaviour of consumers? Does "the" consumer actually exist? To what degree is the market fragmented? Knowledge-building in this discipline falls into seven groups. They are (a) interactive consumer participation in food developments, (b) consumer perception and confidence in food and nutrition, (c) consumer involvement in food and nutrition, (d) trade-offs and consumer dilemmas, (e) the individual consumer in terms of innovation in target group analysis and reach, (f) communication with the honest/moral side of the consumer, (g) fine-tuned research methodology for understanding consumers and (h) sensory characteristics related to nutrition and food integrity.

Relevant research questions will be formulated for these eight groups focused on consumers and food.

#### **A. Interactive consumer participation in food developments**

The goal will be to develop from a theoretical (gamma) basis tangible Proof of Principle concepts and strategies for effective and efficient forms of active consumer

participation through experimental research and, where possible, intervention studies. Relevant knowledge questions include:

1. How can active consumer participation in matters concerning food and food integrity best be designed and carried out? What is the underlying theoretical basis and evidence?
2. Which consumers are most likely to be keen to participate in new developments?
3. Which communication, motivation and innovation strategies exist for involving consumers more intensively and in larger numbers in new developments?
4. How can interaction be embedded effectively and efficiently ("falling forward through experimentation") in product innovation models (e.g. consumer interaction in new product development) and how can modern technology (e.g. virtual design) be used to good effect in this regard?

### **B. Consumer perception of and confidence in food and nutrition**

The goal will be to develop from a theoretical (gamma) basis tangible Proof of Principle concepts for providing information about and strengthening consumer confidence in food and nutrition. Relevant knowledge questions include:

1. Which categorisations and perceptions/misconceptions do consumers have about nutrition? How can these categorisations and perceptions/misconceptions be coupled to experience, expectations, degree of involvement, emotions and values?
2. Influencing behaviour by self-perception: to what degree and in what way do consumers rationalise their nutritional behaviour and adapt their perceptions to their behaviour (rationalisation, reduction of dissonance)?
3. How do consumers experience their "subjective" health? Where do they draw the line between "sick" and "healthy"? What role does nutrition play in this regard?
4. How do consumers view functional nutrition like cholesterol reducing margarine, and to what extent does this result in "self-medication"?

### **C. Consumer involvement in food and nutrition**

The goal will be to attain knowledge about the "involvement in nutrition" factor as a major determinant or co-variant in interpreting and explaining consumer behaviour. Relevant knowledge questions include:

1. Which differences exist between people with high and low degrees of involvement in terms of benefits and values concerning nutrition? What is the relative importance of easy obtainability, health, safety, convenience (prepared meals) and the status of foodstuffs?
2. People highly involved in products devote greater attention to nutrition and information about nutrition. Which differences exist between people with high and low degrees of involvement in terms of knowledge of food and nutrition, attitude, media usage, tendency to think about nutrition and nutritional behaviour?
3. Which socio-demographic features characterise people with high and low degrees of involvement, such as education, gender, age and ethnic origin (segmentation)?
4. What effect does involvement have on the way people absorb advertising and information messages (content of the message, like arguments versus marks, media and origin characteristics)?

### **D. Trade-offs and consumption dilemmas**

The goal will be to develop and test through the gamma sciences some specific hypotheses on how consumers deal with these considerations and dilemmas, translate them into firm recommendations for developing concepts for food and nutrition and then test the concepts and hypotheses among consumers. Knowledge questions include:

1. Which considerations and individual and social dilemmas play a role in consumers' choices of food and nutrition?
2. What are the contents of their motivations, what overlaps and irreconcilabilities exist between them and what is their relative importance?

3. What time perspective (time preference) do consumers have in relation to their choice of foodstuffs? Is there a weighing up of the short-term hedonistic motivation (impulse purchases) and a long-term health motivation?

#### **E. The individual consumer: innovation in target group analysis and reach**

The goal will be to develop and test through the alpha and gamma sciences innovative concepts for target group analysis ("segmentation") and supply of appropriate food and nutrition. This will not be undertaken using traditional stable bases (like social demographic variables) but lifestyle-situational and other transitory factors (interception instead of stable customer groups). Using segmentation theory, concepts will be developed (like food dispensers and vending machines) capable of meeting the transitory and changing needs for food and nutrition. Knowledge questions include:

1. Observation of individual nutritional behaviour at home and in other situations: preparation of meals; food and drink in the staff restaurant and while travelling. These observations will be compared with self-reports on behaviour;
2. Which lifestyle elements are related to nutrition? These may include values like materialism, egocentrism, sustainability, environmental awareness, health/physical condition/fitness. Others are behavioural matters like entertainment, recreation, shopping, hobbies and other ways of spending time.
3. Behavioural interventions regarding healthy food among specific groups like young members of ethnic minorities and young people from the lower social classes.

#### **F. Communication with the honest/moral side of the consumer**

The goal will be to develop suitable and validated communication strategies capable of stimulating consumer demand for honest foodstuffs.

1. What logos, quality marks and other distinctive characters appeal to consumers in order to communicate food integrity?
2. What claims appeal to consumers with regard to safety, health and sustainability?
3. Segmentation of consumers according to their media use, especially printed media, television and the Internet. Is media usage predominantly passive (delivery media) or active (active search behaviour using retrieval media)? Examples of segmentation variables are involvement, education and age.
4. Comparison and optimisation of media combinations (simultaneous and sequential) in terms of reach, contact frequency and effectiveness (changing knowledge, attitude and behaviour among the target group).

#### **G. Research methodology fine-tuned to obtain an understanding of consumers**

The goal will be to produce a toolbox of validated, innovative research methods capable of providing a more detailed and deeper insight into consumer behaviour regarding food and nutrition. Questions include:

1. What limitations does existing mainstream research methodology have as regards nutrition and food integrity?
2. Which methods from adjacent fields and research areas can potentially overcome these limitations?
3. What is the validity of existing and new research methods as regards nutrition and food integrity?
4. To what extent can learning without awareness beneficially supplement the conscious processes of learning and is this a way of identifying implicit barriers in the acceptance of healthy and honest food?

#### **H. Sensory characteristics related to nutrition and food integrity**

1. How can sensory characteristics of food be put into objective terms and what relationship exists from the consumer's point of view between taste and other values of food ("healthy food can't taste very good")?
2. How can sensory characteristics be optimised in relation to objective product quality and the way consumers experience such characteristics emotionally?

#### **4.4.3. Information handling, risk perception, consumer trust**

Obtaining an insight into the processes by means of which relevant actors - manufacturers, retailers, consumers, authorities, NGOs - process information about food integrity and safety is the central goal of developing knowledge in this field. As is the case with other subjects, the food production and consumption chain will be analysed from the perspective of the final link in the chain, i.e. the consumer. The objective is to identify the most important conditions for continuing or creating consumer confidence. The starting point for attainment of the objective is the necessity of optimising the organisation of the supply of information about nutrition and in particular the production method, composition and distribution of food. This must result in improvement of the traceability and transparency of information about relevant processes, while taking into account the competition sensitivity of the information and also the need for information that exists among consumers and other actors.

The first step is identification of the most relevant actors' need for information. Attention will then need to be devoted to the effects of the nature and amount of information on opinion forming and consumer behaviour. Regulatory bodies and retailers are obvious secondary target groups for which these matters can be determined. It is also relevant in this context to look at the subjective assessment by other actors of consumers' needs for information and the way they use the information. Results from this research must provide an answer to the question of how best to organise the supply of information about production, composition and distribution, and the extent to which a differentiation in information is possible and/or desirable for the various sectors.

The most important elements of information about food integrity and safety concern the benefits of a food product and the perception and acceptance of the risks that people associate with a food product. The benefits relate to such matters as taste, price, price/quality ratio, convenience and health effects. The potential risks are both short-term and long-term risks for health and the environment. The research will focus heavily on the role of communicating on risks and the role played in this respect by the perceived reliability of the source of information. Research into the communication of risks has increased steadily in recent years, partly as a result of the increased scientific knowledge of risks. This enlargement of knowledge stems from developments in risk analysis techniques and also increased epidemiological research into the effects of eating habits and lifestyle. Inadequate or incorrect information about risks can result in non-acceptance of risks and mistrust of the source of the risk information. Information from a source that is mistrusted - whether or not the mistrust is legitimate - will usually have little effect on established opinions and preferences. The perceived reliability of the source of information determines in large measure the credibility of claims about the positive health effects of food products.

The research will identify the role of the perception of the aforementioned benefits and risks in the establishment of attitudes and behaviour. The important role of the perception of risks in this field necessitates also devoting attention to the determinants of the acceptance of risks.

Experience in recent years has shown that inadequate communication about risks can significantly influence the acceptance of the risky activities and/or products concerned. This has already been demonstrated in research into technological risks. Substantial differences observed recently within the European Union in the acceptance of new technological developments in the food field can also be related to communication about risks and confidence (or a lack of it) in relevant actors. This project will seek to identify the perception and acceptance of relevant risks with the aim of producing pointers on how to communicate various types of risks. Consequently, pointers to the influence of the form, amount and content of information that should be useful in the

risks/benefits analyses underlying consumer behaviour occupy a central position in this field; the perceived reliability of the source of information plays an important role in this setting.

**A: Research into information handling**

This research will address how information about the benefits and risks of the production, composition and distribution of food is handled by various relevant actors (with an emphasis on consumers). The research will centre around recently introduced and expected technological developments (genetically-modified food, functional foods) and also devote attention to the subject of “biological food”.

**B: Accuracy of the lay person's perception of food related risks**

Research will be conducted into the influence of different forms of information (for example, numerical as opposed to verbal information about risks), into the influence of abstract information as opposed to concrete information about risks and into the influence of knowledge and experience.

**C: Determinants of acceptance of risks**

The focus in this part of the research will be on cognitive and more emotional, affective factors, but will also address moral/ethical aspects. Cognitive factors relate to the controllability of the risks, the voluntary exposure to risks and the nature and scale of the consequences. The likelihood of occurrence of the consequences generally plays a minor role. Emotional factors concern particularly the role played by fear and concern. Moral risks are those related to such matters as the potential negative consequences for the welfare of animals, the situation in the Third World and possible consequences for future generations. In short, this latter group of risks concerns the fairness of the risks/benefits ratio for different groups and/or generations. The research into the acceptance of risks will identify the place occupied by the aforementioned determinants in typical associative networks of consumers and will determine their relative impact on the acceptance of food related risks.

**D: Role of risk communication in the acceptance of risks**

This part of the research will look at short-term and long-term risks (environmental risks as well as health risks). Optimum and less than optimum aspects of the form, content and amount of risk information will be identified.

**E: Role of the source of information**

What role does the perceived reliability of the information source play in the interpretation of the information and how does the information affect opinions, preferences and behaviour? The project will also examine the question from the other direction, i.e. how does the form and content of risk information and its consistency over time influence the subjective assessment of the reliability of the information source.

**F: Informing about benefits**

The project will examine the communicative aspects mentioned at (D) and the role of perceived reliability mentioned at (E) for supplying information about benefits (for example, positive health effects) of food products.

This part of the project will produce manuals or protocols for providing risk information and for risk-related communication with consumers. A protocol will provide greater information about the form, scale, content and interaction of information and communication about the risks of food products and their expected impact on attitude, preference and behaviour.

**4.4.4. Food design and development of new innovation concepts**

The purpose of this part of the project is to design food with an effective intrinsic quality based on consumer behaviour and also the increasingly greater differentiation of preferences and requirements among members of the public. In particular, the goal will be to optimise the integrity attributes of a food basket that is becoming more varied all the time: the safety of the product and of flexible processes, the quality and health effects of the food basket and also the resulting environmental impact (refer to figure). Dilemmas have arisen regarding food consumption and production. They include:

1. *Lifestyle versus health.* What influence do changing food products and eating times have on the balance of healthy food components? For example, does a relationship exist between the consumption of convenience food and the sharp rise in the number of overweight people (more than 1.1 billion worldwide, including a substantial number of children)? Can "tasty" food still be produced without complications (from a product-process-technology point of view)?
2. *Lifestyle versus safety.* Do stakeholders repeatedly fall back on familiar and safe food preparation methods (which guarantee 100% safety throughout the food supply chain) in order to meet consumers' wishes? Exactly how safe are these methods (refer to the recent reports of acrylamide found in higher than usual concentrations in fried products)? Have these reports pushed into the background innovations in the field of mild (food-safe) preparation methods that better retain health promoting ingredients, flavourings and aromatic substances?
3. *Lifestyle versus sustainability.* Has the increasingly greater diversity of convenience products (available through retail or food service outlets) and eating times (within and outside the home) increased the burden on the environment (waste production at source, discarded products, packaging, efficiency or inefficiency in logistics and energy/water and consumption)? What degree of acceptance is achievable/expectable for products based on biological raw materials and on which product attributes does this depend (combinable or not combinable with convenience food or more generally used products)?

These three dilemmas raise some generic questions, like:

- how can consumer behaviour be translated into the design of food that has intrinsically healthy, safe, desired and sustainable attributes in order to achieve a better balance of control in the supply chain?
- which functions (efficiency, diversity, transparency, etc.) do new intelligent virtual and physical design methods have and what does the acceptance of new methods by consumers (particularly members of the public) depend upon?
- how can integrity be achieved technologically by means of innovative product, process and packaging technologies (e.g. by creating sustainability through new conservation techniques and packaging methods and through innovative nano micro-scale separation systems)?

To address the above dilemmas and questions, the project will develop a knowledge portfolio for designing food with an effective intrinsic quality. Effectiveness is determined by such factors as the perceived variation, taste and aroma, health value, safety (microbial, toxicity), sustainability (in this context in the sense of environmental impact throughout the food supply chain), ethical and cultural aspects (covered partly in it the Transition to Sustainable Agriculture knowledge project). The field of work for this subject comprises the translation of those factors into product attributes, i.e. a design tool. The project will further devote attention to the way these attributes can be materialised in the development of generic Proof of Principles (POPs, in terms of both product and process). Changing product attributes require new raw materials, the development of hygienic, low energy and water efficient processing capabilities and innovative packaging concepts, the development of knowledge of the retention of quality notably of composite food baskets in sales chains (including new ones) and valorisation of residual and adjacent streams.

The matters described above require new knowledge at the following interfaces:

- Consumer sciences (including perception - psychology - in conjunction with product and process knowledge (food technology, biochemistry) and supply chain management;
- Sensorics in conjunction with physics/biochemistry concerning the stability and functionality of the food matrix;
- Microbial safety in conjunction with product and process technology;
- Environmental science in conjunction with production processes (zero losses of thanks to a smart product design) and logistics.

Besides this cross-boundary knowledge, there is a need for new integrated knowledge and methodology in the field of complex systems (mathematics, informatics) and design (ICT).

#### **4.4.5. Health and Food Safety**

Nutrition is the most important exogenous factor that influence health. Leaving aside matters directly related to the safety of food, nutrition is mainly a question of the choice of food, often in conjunction with other lifestyle factors (like physical exercise) and the long-term health of the individual. Another consideration is individual sensitivity to health risks, especially chronic prosperity diseases and nutritional behaviour as part of a lifestyle pattern.

This field of knowledge is aimed at developing infrastructure and knowledge for identifying these positive and negative aspects of food within a given food pattern, both at the level of specific target groups (like senior citizens and children) and for individuals, and, using this knowledge and infrastructure, working towards the optimisation of food and nutrition while retaining values that consumers attach to their food.

Food safety will be another focus through the development and application of knowledge regarding the composition and production of foodstuffs, ensuring the absence of contaminants but the presence of required nutritional components. The absence of allergens can be examined or, conversely, indications of their presence. Together, these activities require good communication, co-ordination of research and the use and analysis of data from alpha and gamma research. All of this information will be put into a decision support system.

The project will build up knowledge in the following fields:

- an insight into the demand among consumers/members of the public for safe and healthy food;
- an insight into the demand existing in the industry for new concepts and technologies that help ensure safe, efficient and healthy production and distribution of food;
- the demand existing among the authorities and industry for objective information about risk assessments in the production chain, public health risk assessments and individual risk assessments by consumers/members of the public, and the translation of this knowledge into policy/action.

The matters summarised above will be achieved through research into:

- diagnostic and control methods throughout the production chain for microbiology, toxicology, food quality and raw materials quality for safe and healthy food;
- diagnostics and methods regarding attitudes, perception and behaviour of consumers/members of the public with regard to safe and healthy food;
- the coupling of alpha and gamma research into consumer knowledge to diagnostics for the safety and health of foodstuffs by means of a decision support system;
- strategies for recognisable packaging concepts and quality labels;
- strategies for food allergies;

- innovative screening techniques (e.g. high throughput screening) for new functional ingredients for foodstuffs;
- new approaches to individualised nutritional advice based on insights obtained from (nutri-)genomics.

#### 4.4.6. Food System Dynamics<sup>3</sup>

Developed innovation concepts must always be implemented within the entire food system. An inability to adopt what for consumers and companies are the dominant drivers will result in this "ideal design" of food being used only in niche markets. This part of the project will build up knowledge - from the macro and meso perspectives - about the institutional arrangements that authorities, companies and intermediaries can set up to bring about the broad application of innovations that will make food safe, healthy and sustainable, both factually and in the perception of the consumer. There will be recommendations for the following groups:

- *authorities*: instrument mixes that should be used (regulation, quality marks, provision of information; organisation of networks, incentive schemes, etc.);
- *intermediaries/interpreters*: a change in role, the need for new types of intermediaries, etc.;
- *companies*: strategic and organisational options for interventions in the food supply chain that contribute positively to the market for safe, healthy, sustainable and tasty food.

The core idea in the theoretical approach is that the return in social and economic terms of investing in developing knowledge will be determined to a very great extent by the way in which the produced knowledge is embedded in the economy and society. In relation to the objective of the project, the following research lines will be necessary:

- a. exploration/analysis of the food innovation system;
- b. governance and instruments: new roles for authorities and intermediaries;
- c. refocusing of supply chains: new opportunities for companies.

The relationship between the subjects is that the exploration/analysis will provide an insight into the present structure and development of the food innovation system. Given the objective of creating a system that provides safe, healthy, sustainable and tasty food, there will be pointers for the roles that the authorities/intermediaries (ii) and companies (iii) can play in this.

#### **A: Exploration/analysis of the food innovation system**

A model will be developed that provides an insight into the dynamics of innovation in the present (and future) food system and into its existing institutional arrangements. This part of the project will include empirical studies of innovation dynamics in a number of cases in which incremental or radical innovations have occurred in the food system (for example, slow->fast food; development of nutraceuticals, the Novel Protein Food project). An attempt will be made in an exploratory way to identify patterns in the food innovation process and the factors that specify the conditions under which these processes take place. There will also be an examination of desired normative requirements the system must meet in the future, and a back-casting process to find out via which development paths this goal could be reached.

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<sup>3</sup> This part of the research programme has a strong link with parts of the Bsik programme "The NIDO/KSI knowledge project toward a national knowledge and competence center, promoting the transition to a sustainable society". The mission of this programme is the development and transfer of pre-competitive knowledge and competencies, needed for initiation and further development of sustainable system innovations and transitions. In case both programmes are awarded, mutual co-operation shall be investigated.

The result will be an insight into the following matters for the three defined target groups (authorities, intermediaries, companies):

- "National System of Innovation" of the Dutch food system (physical streams, knowledge streams, financial streams, streams of "sets of requirements" (i.e. power over customers/suppliers, key actors in this setting, etc.);
- autonomous trends in changes to the existing institutional framework (nationally and internationally) and the influence on drivers within the food innovation system;
- other trends and normative goals that food supply chains must or should meet in due course (for example, safe, honest, sustainable, tasty, convenient food). Explicit attention will be paid to the difference in views and interpretations of problems concerning this subject among the relevant groups of actors (members of the public/consumers, the authorities, companies). Compare box 2;
- possible road maps and development paths for organisational/technical innovations by means of which these desired normative goals are achievable.

## **B: Governance and instruments: new roles for authorities and intermediaries**

### a) Authorities as providers of preconditions

Alongside the more process driven role of intermediaries in controlling innovation, the authorities will be able to take on Board a more "guiding" role, at least in fields in which the other actors afford the authorities sufficient legitimacy in this regard. The purpose of this part of the project will be to generate an insight into:

- optimum policy mixes for intervening in innovation processes in such a way as to achieve desired normative goals (sustainability, food safety, health, etc.). This may concern regulation, quality marks, standards or also innovation programmes and similar;
- translation of these policy mixes into recommendations for institutional arrangements capable of effectively and efficiently assuring achievement of the normative goal of the "ideal food system" (or at least ensuring that the direction of development (and not a fixed goal) moves along the right road from a normative point of view.

### b) Intermediaries as facilitators of innovation processes

Changes to the structure and content of the innovation system will have consequences for the objectives and the way different actors intervene in the innovation system. This applies to the type of intervention (policy concept), the distribution of intervention options among the actors (public-private, manufacturer-user, etc.) to the levels (for example, regional, national and international policy) and to the type of instruments available to the actors. Recent research has shown that developments in innovation systems lead to the emergence of "systemic instruments". These instruments are designed not so much for facilitating innovation within an organisation or between a knowledge institution and a company, but with a view to facilitating innovation processes within clusters and/or chains of companies, user organisations and knowledge institutions. Development of instruments of this kind is still in its infancy and requires further research. The research to be conducted in this project will focus on providing an insight into and answers to the following questions:

- how do these instruments promote learning and experimenting?
- do the instruments have a structural impact?
- to what extent are the instruments context-dependent?
- how can the instruments be evaluated effectively?

### c) Intermediaries in other roles

A specific role in the food innovation system can probably already be identified in the form of providing guidance to consumers. As a result of the changes in eating patterns and the introduction of new types of foodstuffs (including functional foods), the existing channels for providing guidance are beginning to exhibit gaps. The medical

sector sees the provision of guidance about functional foods insufficiently as health care and the traditional food information providers see it insufficiently as guidance on food. The system analysis and research conducted in the other parts of this project will probably lead to the conclusion that other gaps exist as well. This part of the project will generate an insight into:

- which other intermediaries are necessary in an efficiently functioning food innovation system;
- which roles and tasks these other intermediaries can fulfil.

### **C: Refocusing of supply chains: new opportunities for companies**

The exploration will reveal that the food innovation system will need to meet other requirements in the future from those that apply today. Trends like the ageing of the population, increased workplace mobility and growing pressure on the time available for preparing food will cause substantial changes in the designs of the chains of growing, preparing and consuming food. It seems almost inevitable that there will be an intensified demand for convenience food in the years ahead. People are increasingly eating out of the home. Within these reorganising chains, the requirements for safe, healthy, sustainable and tasty food will need to be fulfilled, whereas the autonomous development will probably run counter to this need in any event as regards the health aspect. This part of the project will seek to develop insights and toolboxes for:

- a) management tools, instruments and business concepts usable by companies in order to achieve the ideal of safe, healthy and tasty food; the development of co-design methods across the supply chain will play a central role in this regard;
- b) analysis of how use can be made of existing trends and changes and how other so far less obvious actors can be employed in this respect (like the hotel and catering industry, insurance organisations, etc.);
- c) practical tests and analyses in a number of model supply chains. This could include the development of such concepts as:
  - the healthy staff restaurant;
  - healthy and sustainable fast food;
  - sustainable and healthy lunches for schoolchildren;
  - tasty food for senior citizens no longer able or willing to do their own cooking.

The deliverables are:

- development of an analysis framework to identify institutional arrangements within the food innovation system;
- a set of recommendations for new modes of governance, instrument mixes and new business concepts for sustainably meeting the requirements of the future food innovation system, viewed from the institutional framework and also from the food supply chain and the companies involved;
- empirical studies into new supply chain arrangements in relation to the role of institutional arrangements in the food innovation system, focusing on each of the three aforementioned dimensions, i.e. safe, sustainable and healthy (using the analysis framework - deliverable 1 for example for the "healthy" dimension as regards the school canteen of the future).

## **4.5. Scientific methodology**

The knowledge project will utilise a wide range of research methods embracing:

- research into the dimensions of "integrity", target group analysis, segmentations;
- theoretical research into the "behaviour" of various actors in relation to different aspects of food integrity;

- theoretical research into the role of information (and types of information) in food integrity;
  - practical research into the behaviour, perception and motivation of actors;
  - development and testing of product design and innovation models, design tools and intervention/implementation strategies for food products;
  - development and testing of analyses and explanatory models at individual, chain and system level;
  - development and testing of strategies, methods, policy instruments, guidelines, etc., for interventions, information supply to and the active involvement of target groups of consumers and other actors;
  - empirical studies and practical observations;
  - scenarios, trend analyses and road maps;
  - development of innovation concepts and delivery of proof of principle.
- Appendix A states which method(s) will be used for each distinct project.

#### **4.6. Alternatives**

No alternative methods of developing knowledge were considered in this project. The knowledge project is built upon a wide spectrum of methods and, if necessary, additional methods can be applied.

#### **4.7. Specific requirements**

Given the objectives and strategy of this knowledge project (refer to sections 3.2 and 3.3) and the approach to scientific advance (refer to sections 4.3 and 4.4), two types of integration have been identified as specific requirements for the development of fundamental knowledge. They are integration of the entire cycle of knowledge development and integration of the fields of knowledge.

##### **4.7.1. Full cycle integration**

The research programme is characterised by a bias toward action and intervention. This means that (clusters of) projects are designed to cover the full sequence of:

- (1) fundamental understanding/modelling of an issue
- (2) market / behavioural analysis of the issue
- (3) identification of leverage point for action
- (4) fundamental understanding of the technological options
- (5) fundamental understanding of the infrastructural context
- (6) development of appropriate responses (both technologically and marketing wise)
- (7) development of appropriate legal and organisational context
- (8) proof of principle analysis to validate the proposed solution

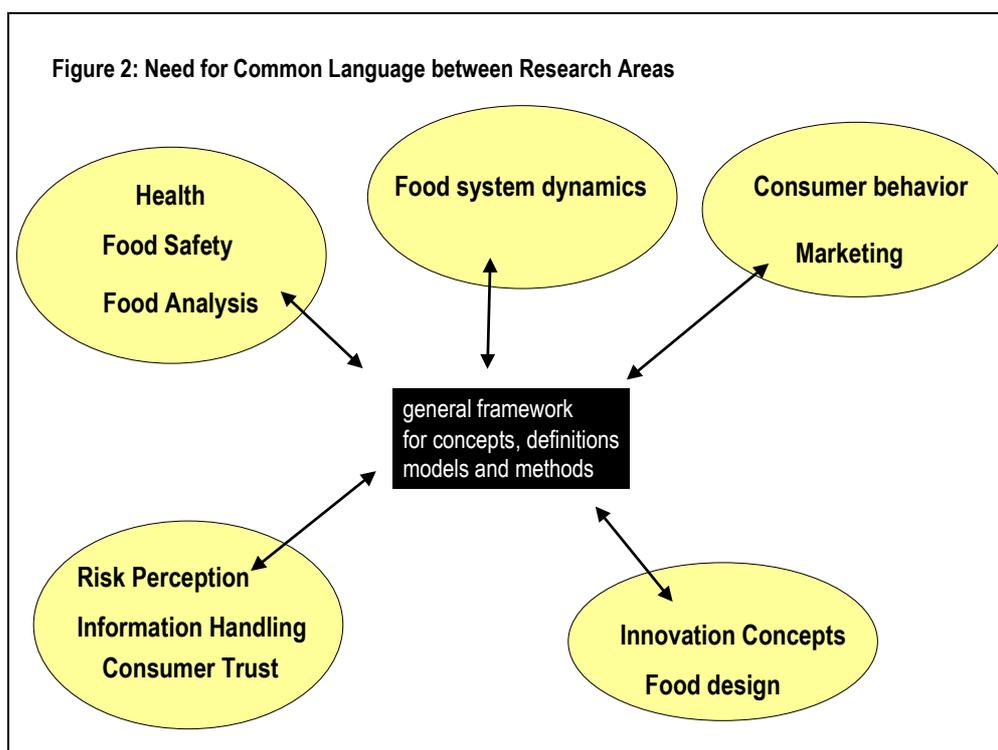
As a result the overall research programme consists of a great number of specific projects (Appendix A) which may be diverse in nature. These include:

- fundamental analysis of scientific principles underlying (aspects of) consumer choice behaviour, including communication effects and “segmentation”
- real life manifestations in (drivers and barriers of) consumer behaviour
- action research to translate consumer / market / technological insight into intervention
- fundamental research into new technological options
- socio-political and regulatory analysis of the infra structural context
- application oriented research into optimal delivery of food integrity

- “integrated” projects (e.g. for a total solution and/or a specific target group) that integrate the various steps in the delivery process and show proof of principle

#### 4.7.2. Integration of fields of knowledge

Another way of defining the integration of fields of knowledge is the task of building a "common language". With such a language, the different disciplines will jointly be able to use the required definitions, concepts, methods and models. A combination of disciplines this wide is unique and at the same time essential for the integration of the numerous facets of "food integrity". The common language is needed to achieve integration of the scientific areas. It will allow "integrity" to be translated into a number of dimensions (healthy, safe, produced sustainably, "honest" manufacturer, animal welfare, etc.), allowing the different food integrity requirements and wishes of all actors in the food system to be expressed in a single language.



#### 4.8. Alignment with European Research Programmes

V&VI fits into the 6<sup>th</sup> Framework Programme FP6 through its general objective, through each of its knowledge development goals and through its combination of methods and concepts *aimed at strengthening the scientific and technological base of agrifood industry and encourage its international competitiveness* [European Commission, 2002].

The V&VI research programmes fit directly and completely into the FP6 thematic priority *Food Quality and Safety* and fit partly into the FP6 thematic priority *Life Sciences*.

#### **4.9. Alignment with other international research programmes**

See Appendix B for details of the research activities of research groups that participate in V&VI.

# 5. Economic and social relevance

## 5.1. Significance of the project

The descriptions of the strategic context and objectives (refer to sections 2.2 and 3.1) highlighted the importance of tackling the food integrity issue integrally and at several levels. It needs to be emphasised that the necessity of adopting an approach like the one proposed in this knowledge project is increasing rapidly all the time. The explosive growth of technological capabilities for designing and producing food and the intensification of physical and information streams have created a widening gap in relation to the ability of consumers to understand whether or not they can still trust their food. The gap is also in evidence in the present way in which laws, inspections, supervision, guidance, quality marks and other methods are being used in the food system in an effort to maintain this confidence and handle actual or potential incidents and crises proactively and reactively. This gap will go on increasing in the coming years unless the entire issue is tackled at system level collectively by several different parties.

The fundamental gaps in knowledge can be found partly within the individual disciplines brought together in this knowledge project (ranging from process technology to system science, from consumer behaviour to analysis methods). Even more important, however, is the question of how these disciplines can produce new inter-related insights and be translated into a number of knowledge products immediately usable by the different actors (notably the authorities and companies). This approach is the only way that this knowledge project can develop new social concepts for food integrity, get all relevant parties involved and keep them motivated. Carrying out projects is essential in order to maintain the link between the development of knowledge and the everyday reality of the food system.

In line with the philosophy of ICES/KIS 3, an essential element of this knowledge project is that contacts must be established and relations cultivated within the knowledge infrastructures between knowledge institutions and knowledge customers. This will allow the various parties to discover in a practical setting how and with which parties food integrity questions can be defined and answered.

## 5.2. Challenges for the Food & Food Integrity programme

Given the problem analysis (refer to section 3.1), the objectives (3.2) and the adopted approach (refer to section 6), the main challenges for the Food & Food Integrity project will be:

- scientific challenge (also refer to section 4.7): the task of building a common language. With such a language, the different disciplines will jointly be able to use the required definitions, concepts, methods and models. A combination of disciplines this wide is unique and at the same time essential for the integration of the numerous facets of "food integrity". The common language is needed to achieve integration of the scientific areas. The second challenge is to embrace the entire cycle from the development of fundamental knowledge all the way through to delivering a proof of principle of new integrity concepts;
- social/economic challenge: the task of developing new concepts for food integrity (by integrating knowledge and consistently working from the point of view of the position, perceptions and actual behaviour of consumers) that will be successful at system level. In order to address this challenge effectively, the project has adopted

as its point of departure the collection of knowledge and research questions of the different types of knowledge customers (refer to section 2.1), will consistently regard the consumer as the pivotal point (motivation, ability, opportunity, refer to section 4.3 1) and define quality and social relevance as important criteria for programming the project (refer to section 7).

### 5.3. Legitimacy of Bsik contribution

The purpose of the ICES/KIS investment incentive programme is to bring about a fundamentally new approach that includes a change in the knowledge infrastructure. The main focus is co-operation and interaction between knowledge institutions and knowledge customers, creating high quality networks and developing knowledge that responds to long-term knowledge issues in society. This process cannot be driven by one of the parties, because for each party the risks are too great and the "distance" to other parties - for example with regard to creating new relations in the knowledge infrastructure such as between the beta and gamma sciences - is too great to justify investing in it. This absence of "spontaneous" network building is a well-known imperfection of innovation systems and for that reason provides justification for co-financing by government. The existing set of policy instruments lacks any other possibility for getting projects of this kind up and running. In terms of objectives and activities (creation of new networks in the knowledge infrastructure and real-life development of new social concepts centred on food integrity), the knowledge project addresses the central objectives of the ICES/KIS 3 investment incentive programme.

It was mentioned in section 3.1 that the objectives cannot be achieved solely by technological means. The relationship with and linkage to institutional changes and the major gaps in knowledge of how consumers actually deal with food integrity mean that within the standard term of four years insufficient results are likely to be achieved to meet in full the objectives of the knowledge project. This applies all the more because this knowledge project is the first time that integration is being pursued on this scale and with this level of ambition between several previously separate disciplines. Experience has shown that in such a situation it takes a lot of time to build up lasting relationships and a history of concrete co-operation in projects. These are the reasons for requesting exemption under article 9, paragraph 2 of the Order in Council.

### 5.4. Alternatives

Two alternatives are conceivable for carrying out this knowledge project:

- *alternative 1: leave it to market mechanisms.* Theoretically, the strengthening of the knowledge infrastructure necessary to bring about greater food integrity can be left to market mechanisms. However, it is highly unlikely that, without a joint effort in the ICES/KIS context, the market parties would jointly and pre-competitively invest in a programme like Food & Food Integrity. This fundamental step towards integrating knowledge would barely get off the ground in this alternative and would not be used at system level;
- *alternative 2: spontaneous co-operation in the knowledge infrastructure.* The knowledge infrastructure could also be strengthened through the "spontaneous" creation of links between knowledge institutions. However, the existing knowledge infrastructure is now too strongly organised into separate clusters. Experience shows that notably the integration of beta and gamma sciences takes place sluggishly and that, without a direction-setting demand from a real-life situation, the knowledge that is developed is of little value to knowledge customers. The

essential link between fundamental research and real life would in this instance be created far too slowly if at all.

## 5.5. Economic and social results

The benefits of knowledge generated in this project are:

- avoidance or reduction of damage caused by the explicit failure of the monitoring of food safety, resulting in food contamination, epidemics, import restrictions and other direct economic damage. The benefits include avoiding damage caused by incorrect or exaggerated reports about harmful components of food (which can lead to lost sales and damage to the image of individual companies or industries). The direct and indirect damage caused by calamities of this kind ranges from a few million euros to hundreds of millions of euros each time. Another hidden source of damage concerns the enormous uncertainty for companies about whether innovations will be accepted by the food system. This has to do on the one hand with the international legal framework that determines what is and is not permissible (and what a company may claim, for example as regards health effects), and also with the flexibility for gearing a range of products in international markets to what consumers want. More than 75% of new product introductions are unsuccessful. The challenge is to improve the "precision" of product launches in the market and thus raise the efficiency of marketing costs and the return achieved on R&D investments;
- in terms of innovation, "integrity" in its numerous manifestations is a driver for a far more varied and far more differentiated range of products at group and individual level. This creates scope for new and existing companies to respond by offering a range of products and services that consumers consider "honest" and for which they are prepared to pay a higher price because they recognise the added value (healthier, produced sustainably, more reliable information);
- the health of the population is related partly to consumers' consumption patterns, both in the short term (contaminations, preparing food sensibly at home) and in the long term. The long-term aspects concern food-related diseases and disorders like obesity, undernourishment, allergenicity and cardiovascular diseases. These cause great economic damage directly and indirectly, on one hand because of the impaired quality of life and discontinuation of economic and social activities of patients, and on the other because these disorders impose a relatively heavy burden on the health care budget because of their long-term nature and costs. The direct damage caused by obesity in the Netherlands (35% of adult males and females are overweight, including 10% classed as obese) was recently estimated at EUR 0.5 billion per year, while the indirect damage (particularly through absence from work) is three times as high as at EUR 1.5 billion. Even with a reduction of 5%, there will be a substantial economic and social saving (an effect that knocks on for a prolonged period because people are becoming overweight at an increasingly younger age);
- financial/economic analyses predict a growing international demand for the assurance of "quality" in the widest sense of the word in all links in production chains. The total added value of Dutch industry in this sector amounts to approximately EUR 33 billion per year. Roughly 75% of Dutch agricultural produce is exported, including 60% within the European Union. The total value of the output of the Dutch agricultural industry is estimated at approximately EUR 50 billion per year. Food that international consumers recognise and value as "honest" can give a strong quality boost to the combination of the Dutch primary sector and the agricultural industry. With an improvement of just 10% (through the wide application of innovation concepts concerning integrity), there will be a substantial improvement of the Netherlands' competitive position in this sector, as a result of increased exports or reduced imports of foreign products.

It should be re-emphasised that the added value of the Food & Food Integrity project lies in the joint approach mounted by several parties and that the envisaged effects can best be achieved by each individual party making a contribution from its own specific position:

- authorities: by means of policy and instrument mixes (regulation, quality marks, supply of information; organisation of networks, incentive schemes, etc.);
- intermediaries and interpreters: by initiating innovation, information exchange, facilitating innovations and system changes;
- companies: by means of new strategic and organisational options, implementation of innovation concepts for interventions and innovations in food and food production.

## **5.6. Sustainability and embedding**

In the period beyond 2007, a situation will be pursued in which:

- ICES/KIS grants are no longer necessary;
- the further development of knowledge concerning "food integrity" has been sufficiently embedded at the participating knowledge institutions;
- parties in the food system have experienced the value of fundamental research in this field and know their way within the knowledge infrastructure to bring about the further development of fundamental and applied knowledge;
- the joint performance of research projects has enabled the knowledge institutions to develop a broadly-based network in the field of food integrity and to know each other's strengths in that network.

# 6. Approach, working method and execution

## 6.1. Overview of sub-projects and activities

The activities that will be carried out in V&VI fall into the following categories:

- development of fundamental knowledge (refer to section 4);
- KEP projects (refer to section 7.3);
- GP projects (refer to section 7.3);
- knowledge dissemination (refer to section 8.2);
- delivery of proof of principle of innovation concepts;
- development of methods and tools;
- collaboration projects with other knowledge projects;
- activities undertaken by the operational organisation (refer to section 7.3).

## 6.2. Phasing

Late 2003:

Development of fundamental knowledge

KEP projects

GP projects

Knowledge dissemination

Innovation concepts

Methods and tools

Collaboration

Operational organisation



# 7. Co-operation between parties

## 7.1. Parties behind the project

### 7.1.1. Composition

As mentioned in section 2.2, the parties behind the Food & Food Integrity programme and universities, companies, authorities and community organisations. The table below lists participants and their financial involvement in the programme.

<b>Research institutes</b>	<b>Contact person</b>	<b>Financial involvement</b>
WUR	Voragen	as knowledge institution
UvA	Van der Pligt	as knowledge institution
KUB	Van Raay	as knowledge institution
UU	Smits	as knowledge institution
University of Maastricht	Saris	as knowledge institution
TNO-Food	Van den Hondel	as knowledge institution
TNO-STB	Tukker	as knowledge institution
<b>Business community</b>		
Unilever	Maat	financier
Heineken	Haitink	under preparation
Nutreco	Den Hartog	under preparation
Horticultural Marketing Board	Van der Veen	under preparation
Ahold	Schmid	under consideration
Coberco	Buck	under preparation
CSM	Olieman	under preparation
Haust	Timmer	under preparation
Numico	De Jong	under preparation
Coca Cola		under preparation
Campina	Van Hooijdonk	under consideration
Sara Lee	Six	under preparation
Greenery	Constandse	under preparation
ZLTO	Van Oosten	under preparation
<b>Community organisations</b>		
Consumers' Association	Cohen	none
<b>Authorities</b>		
Ministry of Agriculture, Nature Management & Fisheries	De Jonge	via ICES/KIS
Ministry of Health, Welfare & Sport	De Wit	via ICES/KIS

Status at 15th January 2003

### 7.1.2. Positions and roles

The parties in the Food & Food Integrity project will each perform their own particular functions ensuing from their natural roles:

- the knowledge institutions will provide the knowledge basis from which the research projects will be set up within Food & Food Integrity. They will provide the capacity needed for research (infrastructure, facilities and people) and will be responsible for the quality of knowledge development;
- companies will determine in part the content of the research and will make a financial contribution to it;

- community organisations will conduct a constant critical examination of the significance of the research to movements in society and the developments they represent;
- the authorities are one of the biggest customers for knowledge and in that sense will play a large role in determining the research agenda. Through ICES/KIS, the authorities are the biggest financers of the programme.

### **7.1.3. Openness and flexibility**

The way the roles and functions of the parties are organised will enable a high degree of openness and flexibility. This will be reflected by:

- the Food & Food Integrity programme will be completely open to new participants;
- by not setting the content of the Food & Food Integrity programme in concrete for four years, it will be possible to start at any time new projects that are aligned to the prevailing state-of-the-art and based on the latest demand among companies and authorities;
- the mechanism of checks & balances in the structure of the project portfolio will enable immediate intervention if projects no longer satisfy criteria of scientific quality and/or socio-economic relevance.

## **7.2. Administrative environment and control of the programme**

### **7.2.1. Basic principles**

Although the Food & Food Integrity programme does not form part of the System Innovations field, it unquestionably has a bearing on system innovation because of the nature of innovation in the knowledge infrastructure and the need to approach the food integrity problem at system level:

- the programme will be fleshed out as it progresses and is thus of a highly non-linear nature;
- new links will be created between the knowledge institutions and between the knowledge institutions and companies as a result of the co-operation that exists between knowledge institutions and companies at programme level and in individual projects;
- the focus on co-operation between beta and gamma disciplines will produce entirely new research lines and insights.

Carrying out programmes of this kind requires an organisation that plays an active role in creating, stimulating and monitoring the conditions under which and environment in which the programme can be successful. Such an organisation provides the expertise with which and the institutional setting within which it will be possible to meet the conditions for success. These conditions are determined by the:

1. Organisation and management of the core processes;
2. Capabilities of the Director of the programme;
3. Environment within which the Director operates;
4. Support available to the Director;
5. Monitoring of the programme.

### **7.2.2. Embedding of the project**

*InnovatieNetwerk Groene Ruimte en Agrocluster* (“Innovation Network”) is an organisation that has the culture and competences to fulfil the conditions in a way that creates a great probability of success, possesses the expertise necessary to initiate, stimulate and facilitate programmes like Food & Food Integrity and itself operates in

this field of work. The Food & Food Integrity programme will be embedded in this network in a way such that:

- intensive interaction exists between the regular work of the Innovation Network and the Food & Food Integrity programme, resulting in both benefiting to the fullest extent from each other's expertise, networks and activities and inspiring each other in such matters as finding new roads to the goal of the programme, or new or supporting activities of the Innovation Network. In terms of the "conditions for success", the Innovation Network will provide the environment and support for the Food & Food Integrity programme;
- the financial flows of the Food & Food Integrity programme in relation to ICES/KIS will be clearly separated from the regular work of the Innovation Network in terms of spending and control;
- the operational structure of Food & Food Integrity will be absolutely transparent and unambiguous with regard to responsibility for the programme.

### **7.2.3. Administrative and personnel matters**

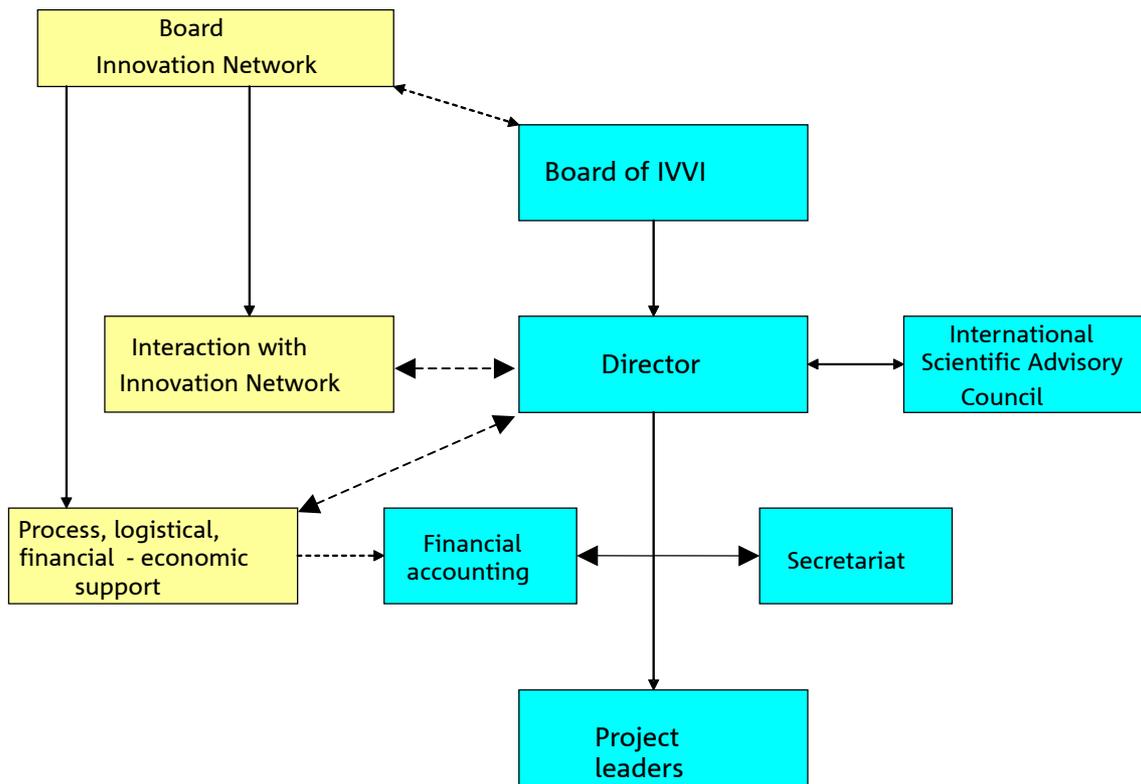
The Governing Board of the Innovation Network will establish a Foundation to carry out the Food & Food Integrity programme. The Foundation will be called "Innovation Network for Food & Food Integrity" IVVI. The Governing Board of the Innovation Network will appoint the Board of the Foundation, which will consist of representatives of the knowledge institutions, companies, community organisations, Ministry of Agriculture, Nature Management & Fisheries and the Ministry of Health, Welfare and Sport. The chairman of the Board will be chosen from members of the Governing Board of the Innovation Network.

IVVI and by consequence performance of the Food & Food Integrity project will be accommodated at the premises of the Innovation Network. This will ensure that the programme can be carried out in an intellectual and spiritual environment (i.e. culture) necessary to maintain the optimum course in ever-changing circumstances and find the right projects and partners necessary to achieve the defined goal.

Primary responsibility for carrying out the programme will rest with the programme Director who will be put on the payroll of the IVVI Foundation. The Director will be accountable to the Board of the Foundation. The Director will maintain close contacts with the Innovation Network and will receive support from it. The Innovation Network will also provide the logistical and financial administrative support necessary to set up and carry out projects properly and to transfer the results of the projects (refer to section 8). Regular co-ordination meetings will take place between the Director of Food & Food Integrity and the Director of the Innovation Network.

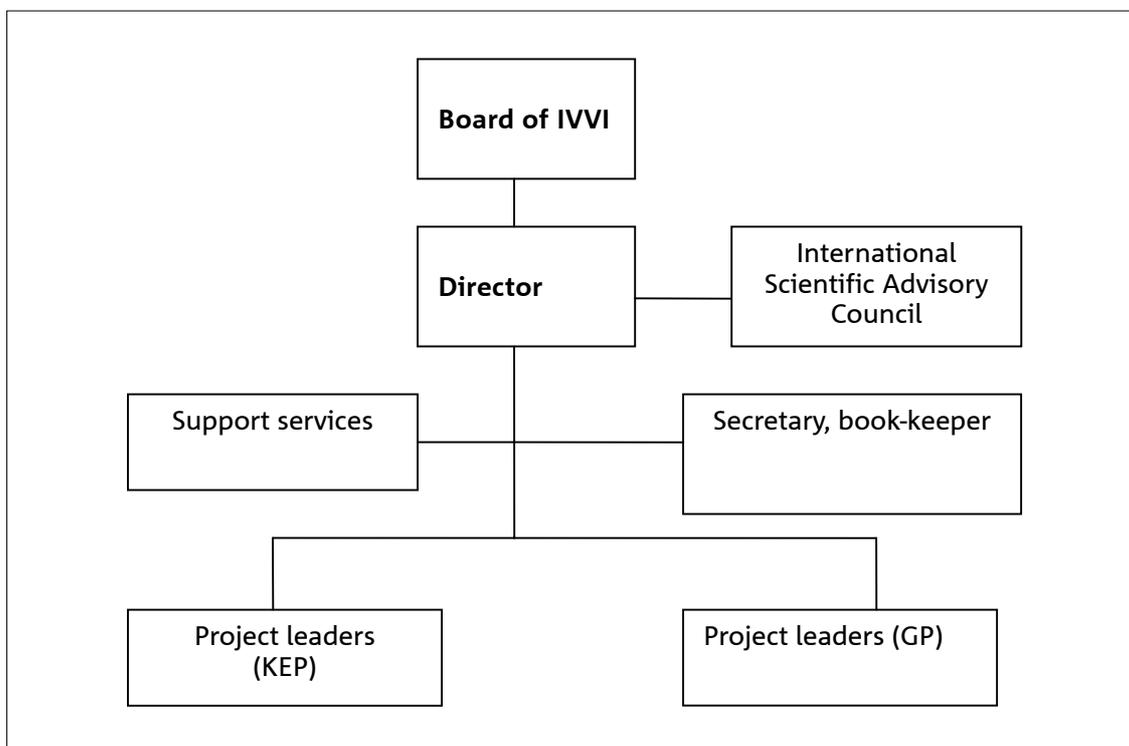
To the extent that personnel must be recruited, employees will be placed on the payroll of the IVVI Foundation (on a temporary posting basis), or pools of personnel will be created of employees of the Innovation Network or other organisations like COKON.

The figure below is a diagrammatic representation of the envisaged structure.



### 7.3. Structure of the operational organisation

The right-hand part of the figure on the previous page shows the main outlines of the operational organisation for Food & Food Integrity. A slightly more detailed picture is provided below



The highest body responsible for Food & Food Integrity will be the Board of the IVVI Foundation. The Board will act as the ambassador of the knowledge project, set down the strategic frameworks on the recommendation of management, monitor progress (financial and project work) at arm's length and keep a watch on the functioning of the Director. In the event of major changes of course, the Board of Food & Food Integrity will consult with the Board of the Innovation Network to ensure uninterrupted optimum synergy between the other activities of the Innovation Network and Food & Food Integrity.

The Director will be the pivotal person in the organisation. He will be the operational anchorman and will give the programme national and international authority. He will design the research programme, hold ultimate responsibility for the scientific results and will be actively involved from the outset in drawing up and working out the research agenda. He will consult with the project leaders on new proposals and on the progress and quality of research. He will structure the organisation, make checks & balances and monitor them. The Director will be responsible for building and retaining support among participating companies, community organisations and authorities. He will ensure the existence of a sufficient and stable financing basis. The Director will report to the Governing Board of the IVVI Foundation. He will be assisted by a secretary and an employee for financial and administrative matters.

In order to monitor the scientific relevance of the research in an international context, the Director will be assisted by an International Scientific Advisory Council consisting of top people recognised internationally in the field of food & food integrity.

The Food & Food Integrity programme will be supported by a number of people who provide the support services necessary for the efficient and effective progress of the programme, in accordance with the requirements of ICES/KIS and of the parties participating in the programme. These people will temporarily be put on the payroll of the IVVI Foundation or will be drawn from pools of personnel of the Innovation Network or other organisations.

The Director will hold ultimate responsibility for the quality of the results and will ensure cohesion between the different parts of the Food & Food Integrity project and the transfer of knowledge internally and externally.

### **Two types of projects**

The Food & Food Integrity programme will have two types of projects. They will be small exploratory projects (KEP) and large projects (GP) of a more traditional nature. Features of the two types of projects are:

#### *KEP*

- small in size (not more than EUR 100,000 per year per project);
- beta and gamma sciences;
- truly innovative research;
- pre-competitive (requirement of ICES/KIS);
- reinforcement for KIS;
- projects companies would never take up on their own;
- new combination of knowledge institutions;
- projects contribute to achievement of programme objectives and principles;
- participation of companies based on a membership model (refer to section 7.3.1).

#### *GP*

- large in size (in excess of EUR 500,000 for a total project);
- beta and gamma sciences;
- pre-competitive;
- projects required by consortiums of companies and research institutes;
- projects contribute to its achievement of programme objectives and principles;
- participation of companies based on a guarantee (refer to section 7.3 2).

The two sections below explain how the two types of projects will be controlled and organised.

### **7.3.1. Control of content and costs of KEP**

KEP will have the structure of an association. The following rules will be applied for participation in KEP:

- companies may participate in return for an annual membership fee;
- each member will pay an annual amount (EUR 50,000 for full members, EUR 25,000 for associate members) in return for which he will receive a number of votes (50 for full members, 25 for associate members);
- each member will be able to cast all of his votes at a vote;
- in the event of prioritising of projects within KEP, each member will be able to divide his votes over various projects. In principle, the projects that receive most votes are the ones that will be carried out. The Director will hold authority (for example, in the interests of ensuring a balance or cohesion in the portfolio) to deviate from the priority determined in a vote;
- all members will be entitled to use all results of all projects.

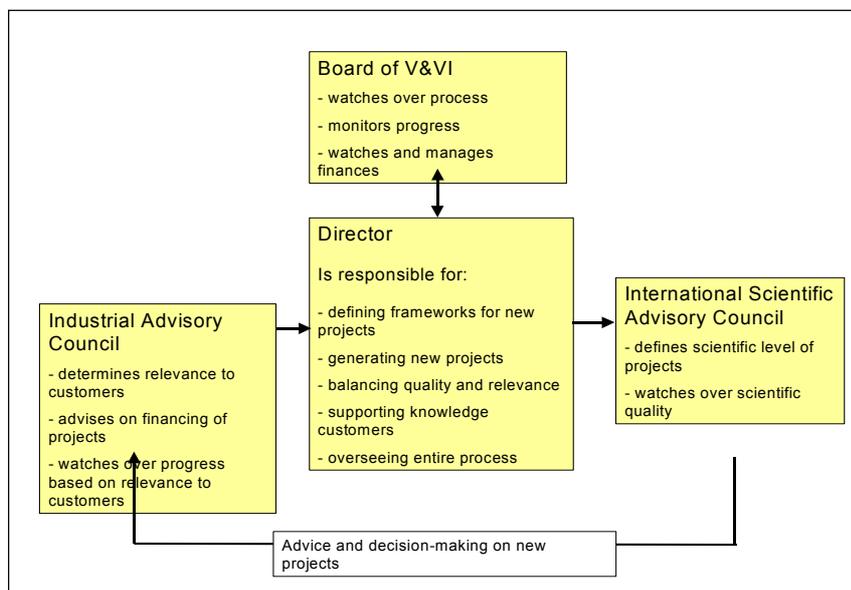
This structuring will make it possible to:

1. Update the research agenda for a KEP continually to assure a high level of scientific quality and the relevance of the research to companies;
2. Achieve a research value for companies that is a multiple of their own contribution to the KEP;
3. Build up support among companies and researchers by means of which, after a run-in phase, KEP can achieve a stable basis for ongoing financing;
4. Keep KEP open, i.e. accessible to parties who are only able or willing to join later on;
5. Keep separate the ownership and use of knowledge produced by KEP;
6. Have and maintain a transparent system right from the start for the allocation, accounting and settlement of costs.

Details of each of these items are given below.

*re 1: Management of the research agenda*

The figure below shows how the research agenda for KEP will be established and the parties that will hold distinct responsibilities within the agenda.



The scientific quality of KEP can best be monitored by the independent International Scientific Advisory Council, while the relevance of the research can best be determined by the customers of the knowledge. The project leaders and also members of the council will be able to put forward proposals. Companies contributing to KEP will have a seat on the Industrial Advisory Council.

This method of managing the research agenda draws its strength from the circumstance that the Director must always satisfy two parties, namely the researchers who want to conduct challenging research and the users who want to use the results of that research for their in-house developments. If the Director does his work properly, the researchers will always deliver top-quality research results and the companies will always provide funding.

*re 2 and 3: Multiplication factor*

KEP will be financed by a number of parties. Each party will pay a relatively small annual amount in return for knowledge from all of the projects. The totality of funds received for the programme (contributions from the companies, the ICES/KIS contributions and the contributions from knowledge institutions) will be allocated according to the process described earlier. Ultimately, the Industrial Advisory Council will decide which of the proposed projects, examined according to their scientific merits, will receive money. The council will prioritise projects according to the perceived relevance of the results. Projects will be prioritised at council meetings held

every six months that will also look at the progress of projects in progress. It is desirable for more new project requests than can be met to be put forward. It is also necessary to prioritise projects in such a way that:

- every approved project features on the wish-list of at least two companies;
- each company has at least two of its preferred projects carried out and the total costs of these two (or more) projects are higher than the contribution paid by the company;
- an approved project delivers added value in relation to the results of the total KEP.

This method of setting priorities will ensure that companies have a direct interest in the quality and efficiency with which a project is carried out. The more efficiently a project is carried out, the more money will be available for other projects and the higher will be the factor by which the contribution of the companies can be multiplied. When companies join KEP by paying a contribution, they will be signing up for a portfolio of projects rather than for individual projects. It is the task of the Director to generate or commission a projects portfolio such that the members of the Industrial Advisory Council recognise that their contributions will be earned back many times over in the form of knowledge that is relevant to them.

#### *re 4: Openness of the programme*

All researchers capable of making a unique contribution to performance of the research agenda will be able to participate in the research and every industry willing to pay the annual contribution will be able to participate in the programme.

#### *re 5: Ownership and use of the results*

Given the foregoing, the results of the research will obviously be in the public domain. However, some of the results may be of such importance that it is necessary to protect them, with a view to generating revenues from their commercial exploitation. If such a situation occurs, the rules that will apply will be those laid down in the agreement between the companies and the IVVI Foundation with regard to KEP. These rules will naturally fall within the constraints defined by ICES/KIS.

#### *re 6: Financial management*

The Board of the Foundation will hold ultimate responsibility for the financial management of the KEP. Sound financial management requires that all projects to be undertaken must be authorised beforehand by the Board. Proper financial management will be assured through the following mechanism:

- researchers will report on the progress of projects and use of resources for them at the half-yearly meetings of the Industrial Advisory Council. Based on this information, the council will decide whether to continue, stop or adjust the projects;
- the researchers must keep a record of the progress of the projects and the time and resources spent on them. The Director will make it mandatory for individual researchers to record each week how many hours they have spent on their project and the other costs that they have incurred. The overview of spending that can be produced in this way (by a financial book-keeper) will form the basis for the half-yearly report to the Industrial Advisory Council and also serve as input for other reports (like reports to ICES/KIS);
- the half-yearly reviews conducted by the Industrial Advisory Council will allow the companies to maintain a good overview of the progress of the projects and spending on them. As the efficiency of performance of every individual project in the portfolio is one of the factors that determines the number of fundable projects, they will keep a watch not only on the projects of importance to themselves, but also on the way other projects are being carried out.

Matching content and costs at project level will generate primary data enabling control to be exercised over the projects (and by consequence the KEP part of the programme). With non-linear programmes like Food & Food Integrity, this kind of micro control and

monitoring is essential in order to know where the programme stands, the course that is being pursued and how the course can be altered in the event of changing external circumstances.

### **7.3.2. Control of content and costs of GP**

GP is a set of projects created in consultation between two or more knowledge institutions with two or more companies. Essentially, this means that the following rules will be applied for participation in GP:

- companies will be able to participate in formulating the content of projects based on an annual guarantee of EUR 100,000;
- companies that reach agreement with the knowledge institutions about the content of a project will collectively pay at least 25% of the total project costs;
- 10% of the costs of a major project will be deposited in favour of KEP (5% in the case of projects in excess of EUR 1 million). The project leader of the major project will have the right to vote in the Industrial Advisory Council;
- a project on which companies and knowledge institutions have reached agreement will be submitted to an International Scientific Advisory Council that will give an impartial opinion on the merits of the research. Partly on the basis of that opinion, the Director will decide whether to place the project before the Board for approval;
- all parties within the Food & Food Integrity programme will be entitled to use the results of all projects.

This approach will make it possible to:

1. Formulate and start-up major new projects continuously;
2. Achieve a research value for companies within the projects that is a multiple of their own contribution to the research;
3. Keep Food & Food Integrity open, i.e. accessible to parties who are unable or unwilling to join until later on;
4. Separate the ownership and use of knowledge obtained through GP;
5. Create intensive interaction between KEP and GP;
6. Have and maintain a transparent system right from the outset for the allocation, accounting and settlement of costs.

Details of each of the above items are provided below.

#### *re 1: Formulation of new projects*

Companies and knowledge institutions can take the initiative to formulate new projects. The research project must fit within the frameworks set out for the programme, like those defined by the Governing Board of the Foundation. The Director will monitor quality, among other things by enlisting the services of the International Scientific Advisory Council, and will keep a watch on synergy with other projects.

#### *re 2: Multiplication factor*

A basic principle is that companies will bear at least 25% of the costs, the knowledge institutions another 25% and ICES/KIS the remaining 50%. The multiplication factor for the companies will then be a factor of four compared with their own contribution.

#### *re 3: Openness of Food & Food Integrity programme*

Any company that wants to join the programme later on to take part in a new project can do so by providing a guarantee of EUR 100,000 per year. Participation in a project already under way will be possible provided that agreement is reached with the participants.

#### *re 4: Ownership of knowledge*

Ownership will be arranged in exactly the same way as for KEP.

#### *re 5: Obligatory payment into KEP*

A natural basis exists for synergy between KEP and GP because they will pursue the same programme objectives. This synergy will be achieved because the project leader of a major project will be a member of the Industrial Advisory Council and thus have a direct overview of developments within KEP. Moreover, he will be able to cast his votes for projects of importance to the major project. Additionally, KEP can function as a breeding ground for GP, while GP can be a source of explorative questions that can be addressed within KEP.

#### *re 6: Financial management*

As with KEP, content and cost will be matched at project level. The comments made in the section on KEP regarding generation of primary data for control and monitoring of projects also apply to GP. The same goes for the recording of progress and the time and resources spent on projects. The Governing Board of the Foundation will organise half-yearly reviews at which the project leader will report to the Board and to participating companies on the progress of the projects and the spending of resources on them. Half-yearly reviews will allow the companies to maintain an overview of the progress of the project and the spending of resources. Based on the reviews, supplemented by an opinion from the International Scientific Advisory Council about the scientific quality of delivered results, the Governing Board will decide whether to continue, adjust or stop a project.

### **7.4. Structure and content of co-operation**

The Food & Food Integrity programme has been structured in a way that allows an increase in the number of parties while the programme is in progress. Indeed, such an increase is a precondition for the success of the programme. At the same time, however, it is certain that one or more parties will withdraw during the course of the programme. Therefore, the form of co-operation has been designed to make it as attractive as possible for parties to participate (among other things through a high multiplication factor for their own money) to ensure that the withdrawal of parties will not disrupt the programme (such as membership of KEP). In practical terms, the co-operation is aimed at achieving the objective of the Food & Food Integrity programme. This will be one of the factors in the choice of the participants.

### **7.5. Availability of researchers**

The ambition of the Food & Food Integrity programme is to be a platform for setting the pace in translating "food integrity" into a number of dimensions (healthy, safe, sustainably produced, "honest" manufacturer, animal welfare, etc.) in such a way that the various food integrity requirements and wishes of all actors in the food system can be expressed and carried out in a common language. This requires participation of a sufficiently large number of good scientific researchers and intensive interaction between them and people from the field. The research leaders involved in this knowledge project do not anticipate any problems in recruiting researchers of the right calibre.

### **7.6. IPR agreements**

All knowledge generated within the Food & Food Integrity programme will be the property of the IVVI Foundation. Similarly, all patents resulting from inventions

conceived or used in practice for the first time as part of the research conducted for Food & Food Integrity will be the property of the Foundation. Arrangements regarding who will pay the costs of applying for and maintaining the patents and how parties will obtain licences - whether or not exclusive or free of royalties - will be set down in the agreement that parties conclude with the Foundation for participation in the programme. These arrangements will be compatible with the conditions that ICES/KIS has laid down in this respect.



# 8. Transfer and dissemination of knowledge

## 8.1. Disseminating and transferring knowledge

Knowledge will be transferred in the Food & Food Integrity programme to users such as authorities, companies and community organisations. This transfer will occur partly through and during projects, partly via deliverables resulting from the knowledge project and partly in the form of a general transfer of knowledge and information from organisations that do not directly take part in the projects but are stakeholders with an interest or a possible interest in them.

## 8.2. Knowledge dissemination activities

The start-up of Food & Food Integrity will put in motion numerous projects that will be created and carried out between knowledge institutions and companies and other organisations. Besides disseminating knowledge directly to project participants (refer to section 8.3), the results of the programme must be distributed wider and further. This will be done through the following activities:

- an electronic newsletter to keep parties in the food system and other target groups abreast of the latest developments, plans and results of the knowledge project;
- a website that will provide information about Food & Food Integrity, projects and project participants and results to the participants and also to Dutch and foreign companies with an interest in the Food & Food Integrity programme;
- using the media to highlight for consumers the importance to the community at large of Food & Food Integrity and to make known the objectives and results of the programme;
- a joint project in 2005 for publication of a "Tasty, healthy and honest cookery book" that contains recipes, background information, real-life experiences and "guidance" in an attractive way;
- the Food & Food Integrity programme will organise theme meetings about certain subjects, among other things to inform specific target groups (like new companies and hospitality establishments) or to allow an exchange of implementation experience between companies;
- information networks will be developed (refer to 4.4 5) that focus on food production, food safety, consumer behaviour, eating habits, nutritional status and health.

These activities will be carried out primarily by or under the direction of the supporting organisation within the Innovation Network (refer to section 7).

## 8.3. Progression to applications

The deliverables obtained during the scientific research or projects will be the launching pad for conveying knowledge to applications. The most important deliverables of the programme for knowledge customers are:

- intervention strategies that enhance integrity in consumers' food consumption through the processes identified under (1). Examples would include communication strategies to reinforce and restore trust, definition of more optimal health claims, etc.);
- proof-of-principle projects showing that and how these intervention strategies work to enhance integrity in consumers' actual food choice behaviour (e.g. show that the communication strategies to enhance trust work in real life situations);
- new product and process technologies that contribute to enhancing integrity in consumers' food choice behaviour (e.g. mild conservation techniques, innovative screening techniques for new functional ingredients);
- proof of principle that and how these technological options enhance integrity in consumers' food choice behaviour (e.g. show that mild conservation techniques stimulate integrity in food consumption in real life situations);
- new delivery systems for products and communication that strengthen involvement, trust, confidence and integrity in food consumption behaviour (e.g. personalised information on food system parameters);
- proof of principle that and how these delivery systems enhance integrity in food consumption in real life;
- analyses and models of the food system characteristics that enhance or hinder integrity in consumers' food consumption (e.g. chain arrangements, regulatory constellations etc.);
- intervention strategies aimed at optimising the system characteristics to enhance integrity in consumers' food consumption (e.g. how should legislation for health claims ideally be organised?);
- proof of principle that and how these optimised systems enhance integrity in consumers' food choice behaviour.

There will be an examination while the knowledge project is in progress of when and how fundamental knowledge, concepts, models and research methods can be used in mainstream university education (via the participating knowledge institutions and researchers) in the form of separate parts of curricula or integrated in other forms of education and of the possibilities that exist for widening this scope to include colleges of higher vocational education.

#### **8.4. Alternatives**

The Knowledge Project uses a wide range of methods actively to transfer knowledge and competences (refer to section 8.2). The methods range from newsletters and publications to different types of workshops, meetings and training sessions. According to present insights, no further alternatives are required for the dissemination of knowledge.

#### **8.5. Indicators**

The principal indicators of the progress and scale of knowledge transfer activities are:

- number of developed or used innovation concepts;
- number of curricula (at universities/colleges of higher education) that include food integrity; number of university/college students that come into contact with food integrity, number of work-experience placements and studies;
- number of meetings, symposiums and similar organised by the Food & Food Integrity programme;

- number of "appearances" by participants in the Food & Food Integrity programme at meetings and symposiums organised by other parties;
- number of published food & food integrity articles in media accessible to the target groups;
- number of visitors and requests for information on the Food & Food Integrity website .



# 9. Financing

## 9.1. Project budget

The table below shows the costs of the programme per annum and per category. Over time, the yearly budget is expected to increase as it is anticipated that the contribution of companies shall increase during the execution of the programme.

**Table 9. Budget over the project period in KEURO**

	year 1	year 2	year 3	year 4	
wage costs of direct personnel	3.518	5.198	5.828	6.233	<b>20.777</b>
surcharge for general costs	1.172	1.732	1.942	2.077	<b>6.923</b>
costs of machinery and equipment	952	1.400	1.568	1.680	<b>5.600</b>
costs of materials and inputs consumed	170	250	280	300	<b>1.000</b>
costs for dissemination and IPR	119	175	196	210	<b>700</b>
<b>subtotals</b>	5.931	8.755	9.814	10.500	
<b>total</b>					<b>35.000</b>
increased with VAT (19%)					6.650
<b>Grand total</b>					<b>41.650</b>

## 9.2. Accumulation of grants

Apart from amounts discounted in the first cash flow for universities, there will be no accumulation of grants.

## 9.3. Alternatives

Wherever possible, other sources of financing will be sought to co-finance programmes built around knowledge combinations. The sources may include NWO (Netherlands Organisation for Scientific Research) or other grants schemes. ICES/KIS is currently the only possible source of financing the typically innovative knowledge development within the combination of system, behavioural and technological knowledge development.

It is foreseen though, that a significant additional contribution to this programme shall also be delivered by budgets from the European Union, because of a good fit of the subjects described in this Business Plan with those described in the starting EU Framework 6 (see appendix C). The knowledge infrastructure of The Netherlands was always successful with a significant contribution to European programmes, not the least with research topics on food and related subjects.

#### **9.4. Indicators**

The indicators for measuring and monitoring progress and results will be set down in detail at the start of the knowledge project. In the year plans that Arrachne draws up annually, these indicators will be used to set and later evaluate targets. There are four groups of indicators:

- indicators of the scientific progress and quality and quantity of results (articles published in "A" journals, theses, number of postgraduates, conferences, etc.);
- indicators of the performance of projects (number of started KEP and GP projects, size, number of participants);
- indicators of the development and application of innovation concepts, methods and tools;
- indicators of success in financial management (expenditure compared with budget; commitments entered into; payments and funds still available; size of contributions from third parties (matching); percentage of management overhead; budget ratios between KEP projects, GP projects and the dissemination of knowledge;
- indicators of knowledge management (refer to section 8.5).

# Appendix A: Project portfolio of initial project ideas

As described in the main text, the actual project portfolio of the knowledge project “Food and Food Integrity” will get shaped in very close interaction and collaboration between the participants. The Centres of knowledge have shaped a first portfolio of initial project ideas in this area. These should explicitly be seen as example projects, to reflect what can be done. In discussions between the participating Centres of knowledge and participating companies, the overall portfolio and individual projects will be refined, reshaped, defined and redefined in a continuous process.

The portfolio of example projects is structured along the three principal research objectives (see main text):

1. reinforcing and restoring consumer involvement, trust and confidence in food, food supply and food technology
2. enhancing healthy food choices among consumers
3. socially responsible consumption without consumer sacrifice

The different Centres of knowledge work together in the projects under the supervision of the scientific directors residing in these Centres of knowledge and in close interaction and collaboration with the participating companies.

For each project is indicated what the objective and research questions are, what the scientific background and research tools are and which deliverables and costs are involved. The level of innovativeness of the project is also indicated, in relation to (a) the status quo in the research field, and (b) the existing strengths of the Centres of knowledge involved.

## Index of example projects

1. *Reinforcing and restoring consumer involvement, trust and confidence in food, food supply and food technology*
  - 1.1. Perceived risks of GM foods
  - 1.2. Source and message characteristics affecting consumer trust
  - 1.3. Communication about food hazards
  - 1.4. Consumer involvement for optimal chain management
    - 1.4.1. Improved understanding of consumer requirements and trade offs
    - 1.4.2. Methods to ensure consumer involvement
    - 1.4.3. Blue print for coordinated arrangements
    - 1.4.4. Model and prototype system for global chain performance
    - 1.4.5. Prototype system for transparency in tracking and tracing systems
  - 1.5. System analysis and strategic foresight Dutch food cluster
2. *Enhancing healthy food choices among consumers*
  - 2.1. Development of high-throughput test systems to identify new food ingredients in relation to health
  - 2.2. An individualised healthy nutrition advice
  - 2.3. Consumer orientation in functional food design
  - 2.4. Consumer effective health claim formulation
  - 2.5. Healthy snacks that kids can't resist
  - 2.6. Appealing health foods for on-the-go
  - 2.7. Post prandial wellness
  - 2.8. Obesity, food intake and exercise

## 2.9. Food behaviour and health of adolescents

3. *Socially responsible consumption without consumer sacrifice*
  - 3.1. Good sustainable practice standards for the food industry
  - 3.2. The (D)Innershop
  - 3.3. Design tool for fresh snacks for young consumers
  - 3.4. Social and technological aspects of food stuffs that counteract allergy
  - 3.5. Attractive and healthy food based on vegetable and fruit
  - 3.6. Healthy food via micro structuring of foods
  - 3.7. Ingredients for healthy foods using novel sustainable separation methods
  - 3.8. Consumption, trade and processing of sustainable convenience foods
  - 3.9. A monitor for consumer sentiment to food
  - 3.10. Innovation templates for (health) foods
  - 3.11. How intrinsic and extrinsic motivations combine in food choice behaviour
  - 3.12. Data chat too for consumers to ensure product keepability
  - 3.13. Differentiation of integer foods on intrinsic product quality
  - 3.14. Utilising post-harvest handling for optimising health aspects and quality of fresh products
  - 3.15. Selection and further development of (mild) preservation techniques

**Project Name:** Perceived risks of GM-food  
**Principal contact(s):** Prof. J. van der Pligt  
**Contributing parties:** Universities of Amsterdam, Tilburg and Wageningen

**Project Description**

This project focuses on the key factors that determine the perceived risks and, more importantly, the acceptability of the perceived risks associated with GM-food. First we assess the impact of a series of risk characteristics on the acceptability of the risks associated with GM-food. These include characteristics such as the nature of the possible consequences, newness of the risks, perceived controllability of the possible outcomes. Both cognitive and emotional factors will be investigated in a series of small scale experiments. These will be combined with physiological and neurological measures. This research will also address some generic issues of risk acceptability that apply to food related risks in general. Key questions are:

- How accurate do people assess GM-food related risks?
- What are the prime cognitive and emotional determinants of the acceptability of these risks?
- What are the neuropsychological correlates of the judged (un)acceptability of risks?
- What are the implications of the above findings for risk communication?

Confirmation of the core findings will be assessed in a survey of a representative sample of the Dutch population.

**Scientific Background**

The project is embedded in a standing research tradition on public perception and acceptability of technological risks. Added elements are the small scale experiments employing a variety of cognitive, physiological and neuropsychological responses that should enable a more profound insight in the determinants of risk acceptability. Recent advances in research on emotions and on the interplay between affect and cognition as well as recent advances in cognitive neuroscience provide new opportunities to help understand the prime determinants of the perception and acceptability of risks.

**Research Tools**

Small scale, lab based experiments with measurement techniques developed in social psychology, psychophysiology, and neuropsychology. These include fMRI scans. GSR/EMG measures as well as EEG/ERP measures. Cognitive measures include a variety of cognitive responses. Additional research will rely on survey techniques.

**Deliverables**

- Improved understanding of the cognitive, affective and neuropsychological basis of risk acceptability.
- Knowledge about which characteristics make risks less acceptable.
- Set of methods to improve the acceptability of risks.
- Communication strategies for food-related risks

**Estimated Costs (4 years)**

- Personnel: K€ 320 (2Ph.D's, supervision + supporting staff).
- Overhead: K€ 80
- Material costs: K€ 100
- Use of equipment: K€ 80
- Knowledge transfer: K€ 20
- **Total costs: K€ 600**

**New in the project in terms of furthering the research field**

Recent developments in neuropsychology as well as recent developments in research on affective processes and research on the interaction between cognition and affect provide the opportunity to substantially improve our understanding of the determinants of the perception and the acceptability of risks. The existing literature tends to emphasize cognitive responses to risk and, hence, provides only limited insight in the processes that determine the perception and acceptability of risks. The present approach is part of one of the fastest growing research areas in psychology: social cognitive neuroscience. Brain-imaging techniques should help to decipher how neural pathways control attitudes, emotions, and behaviour.

**New for the institutions that participate in this project**

In the recent national research assessment exercise carried out by the VSNU the research group (Social Psychology Unit at the University of Amsterdam) of the principal investigator obtained the highest possible score (2 out of 61 programs in psychology) obtained this score. The group is firmly embedded in experimental research on social cognition and emotion. The research group consists of 10 senior staff, 3 postdoctoral fellows and 12 Ph.D.'s. The group participates in a number of NWO-research programs on issues such as social perception, decision-making and the regulation of emotions. It also participates in the NWO-program on food safety and sustainability as well as in EC-research programs. Staff is represented in a wide variety of international journals on social psychology, decision-making and health psychology. Staff is also active as assessors for national science foundations in the Netherlands, UK, US and Australia. Over the past 10 years approximately 25 Ph.D.'s obtained their degree in the Social Psychology Program. These dissertations addressed both basic and more applied issues. The prime importance of the present research for both the research group in social psychology as well as the Psychology Research Institute as a whole is that it allows us to further develop the new and exciting field of social cognitive neuroscience. For that reason we recently employed a neuroscientist. The research will also be part of the recently founded Cognitive Science Centre Amsterdam.

**Project Name:** Source and message characteristics affecting consumer trust  
**Principal contact(s):** Prof. WF van Raaij, Prof. J. van der Pligt  
**Contributing parties:** Universities of Tilburg and Amsterdam

**Project Description**

Trust or to be more precisely the lack of trust is one of the major factors hindering effective communication about the risks and benefits of food products. In this project we assess source as well as message characteristics that affect trust and, hence, interpretation of the information provided in the message and yielding in the propagated direction.

**Scientific Background**

The program is embedded in two separate literatures: social psychological research on the antecedents and consequences of trust, and a long tradition in the consumer sciences and marketing literature on consumer trust. In a series of experiments we will address the causal mechanisms that determine trust as well as the consequences of lack of trust for message comprehension, biased processing, acceptance and yielding to the message. Characteristics that will be investigated concern the context and format of the information provided, consistency over time and a number of source characteristics (commercial, non-profit, third-party, and governmental sources) to be selected in the bases of existing research findings.

**Research Tools**

This project combines laboratory based experiments with one or more large-scale surveys. The former will be used to assess the impact of the various causal mechanisms. The latter will provide descriptive information about the perceived trustfulness of various agents in the food industry, NGO's, science and governmental agents for the population at large. In the surveys the lab results can be tested to hold in a less controlled environment.

**Deliverables**

- improved understanding of the mechanisms determining trust of messages and sources.
- manual providing guidelines to foster public trust in both the industry and governmental agents.

**Estimated Costs (4 years)**

- Personnel: K€ 320
- Overhead: K€ 80
- Material costs: K€ 100
- Use of equipment: K€ 20
- Knowledge transfer: K€ 20
- **Total costs: K€ 540**

**New in the project in terms of furthering the research field**

The combination of insight from consumer sciences and economics psychology with the social psychological literature is a strong point of the present proposal. Unfortunately the prevailing research on the issue of trust tends to be exclusively based on one of the two traditions described above. In our opinion a combined approach would further enhance our knowledge about this important antecedent of consumer's judgment and decision-making. New developments in economic psychology on risk aversion and the use of heuristics (simplified decision rules) will help to understand how consumers use causal reasoning and interpret messages on food products and whether and how these messages contribute to creating trust in food.

**New for the institutions that participate in this project**

The research group at Tilburg University substantially increased its international stature in the area of economic psychology due to the arrival of the principal investigator of this project (Van Raaij). Economic Psychology is a unique area in psychology, only present at the University of Tilburg. It has a long and international tradition of research on consumer behaviour and marketing communication (advertising). In the recent national research assessment exercise the research group of the principal co-investigator (Social Psychology Unit at the University of Amsterdam) obtained the highest possible score (2

out of 61 programs in psychology obtained this score). The group is firmly embedded in experimental research on social cognition and emotion. The Amsterdam group is represented in a wide variety of international journals on social psychology, decision-making and health psychology. The major strength of the proposal is that it combines the economic psychology unit at the University of Tilburg with knowledge gained in the area of cognitive social psychology.

**Project Name:** Risk Communication about food hazards  
**Principal contact(s):** Prof. J. van der Pligt, Prof. L. Frewer  
**Contributing parties:** Universities of Amsterdam and Wageningen, TNO

**Project Description**

Risk communicating is of essential importance in the context of food related hazards. Over the years we have seen both successful and less successful attempts to communicate effectively during and after technological disasters. In some instances the major hazard concerned the communication strategy and not the hazard itself. In this project we address these issues with the aim to help develop communication strategies that prevent public unrest as well as guide the reactions of policy makers. Research questions are:

- What is the impact of source and content characteristics of risk communication efforts after food scares and/or technological accidents?
- What are the prime determinants of risk amplification in the context of food scares?
- How can risk amplification and public unrest be mitigated or prevented?
- How to apply contingent crisis response strategies?

**Scientific Background**

The background concerns the risk communication literature dealing with technological hazards. This literature goes back to the 1980s of the previous century in which a series of studies focused on risk communication practices in the case of nuclear or chemical disasters. More recent literature addressed a variety of health related hazards including both small and large-scale risks. These literatures will be applied to food related hazards.

**Research Tools**

The project consists of an extended literature search to assess the effectiveness of different communication strategies in the context of technological hazards. A shortlist of essential ingredients and strategies will be compiled and tested in small-scale studies. Small scale studies rely on a variety of cognitive response measures as well as assessments of affective/emotional states. These empirical tests focus on both specific ingredients and more general strategies.

**Deliverables**

- Manual describing various crisis communication strategies and their effectiveness in the context of food hazards/food scares.
- Improved insight in essential ingredients for effective risk communication.
- Identification of triggers and barriers of public amplification of perceived risks of food scares.
- Contingent application of crisis response strategies.

**Estimated Costs (4 years)**

- Personnel: K€ 180
- Overhead: K€ 45
- Material costs: K€ 90
- Use of equipment: K€ 15
- Knowledge transfer: K€ 20
- **Total costs: K€ 350**

**New in the project in terms of furthering the research field**

The existing literature on risk communication is largely descriptive and lacks thorough empirical tests of the effectiveness of communication strategies. The present project aims to combine insights from a variety of fields dealing with risk communication. These include psychology, consumer sciences, medical sciences, and policy oriented disciplines. Basic insights will then be tested empirically in small-scale experiments. This combination is novel and should help to improve our insight in how people react to food hazards / food scares and help to identify triggers and barriers of public amplification of food-related risks.

**New for the institutions that participate in this project**

In the recent national research assessment exercise carries out by the VSNU the research

group (Social Psychology Unit at the University of Amsterdam) of the principal investigator obtained the highest possible score (2 out of 61 programs in psychology) obtained this score. The group is firmly embedded in experimental research on social cognition and emotion. The research group consists of 10 senior staff, 3 postdoctoral fellows and 12 Ph.D.'s. The group participates in a number of NWO-research programs on issues such as social perception, decision-making and the regulation of emotions. It also participates in the NWO-program on food safety and sustainability as well as in EC-research programs. Staff is represented in a wide variety of international journals on social psychology, decision-making and health psychology. Staff is also active as assessors for national science foundations in the Netherlands, UK, US and Australia. Over the past 10 years approximately 25 Ph.D.'s obtained their degree in the Social Psychology Program. These dissertations addressed both basic and more applied issues. The prime importance of the present research for the research group in social psychology is that it allows us to further develop the general research area on risk communication to combine it with more experimental research traditions. To this end we will intensify our relationships with Carnegie Mellon University (B. Fischhoff), and Sussex University (P. Sparks) both research groups have a long standing track record of research on risk communication.

**Project Name:** Consumer Involvement for Optimal Chain Management  
**Principal contact(s):** Prof. CAMJJ van den Hondel, Dr. A. Tukker  
**Contributing parties:** TNO Nutrition, TNO-STB, ATO

**Project Description**

The overall goal of this project is to ensure confidence of consumers in safe and high quality food production systems through early involvement and transparency of chain management solutions throughout the food production chain, from industry and authorities. Our aim is to develop tools/ procedures to:

- Ensure early involvement of consumers in new chain management solutions
- Ensure early involvement of consumers/ citizens in new food safety policies
- Optimise transparency of food safety systems with full coverage and co-ordination throughout the food production chain
- Optimise transparency and information exchange on product safety and quality throughout the food production chain between partners and consumers.

This project will focus on identifying key factors that determine acceptability of and confidence in chain management solutions from industry and authorities, and to develop methods/ procedures to ensure that the ‘voice of the consumer’ is incorporated. It is emphasised that the ‘voice of the consumer’ will be incorporated as part of the complete range of stakeholders. In order to identify solution acceptable to all stakeholders it is essential that all stakeholders be heard. However, there exist gaps between the perception, requirements and trade-offs of all the different stakeholders. The aim of this project is to develop methods that allow all stakeholders to mutually understand each other and to jointly develop solutions (concepts) to actually ensure safe and high quality products via chain management solutions within industry and authorities.

Four sub-projects are described as examples within this framework.

1. Consumer Involvement in Safe and High-Quality Food via optimal Chain Management
2. Interactive Policy Making with consumers/ citizens
3. Food Safety Systems: Full coverage and co-ordination of the food production chain
4. CHOPS: Chain Optimisation System
5. CONTRACT; Consumer Oriented Transparency of Tracking and Tracing Systems

**Overall Deliverables**

- Improved understanding of consumer requirements and trade-offs concerning added value and confidence in chain management solutions (e.g. Tracking & Tracing)
- Methods to ensure consumer involvement and mutual understanding with experts in the decision process for industry and governance
- Bleu-print for co-ordinated arrangements for enhancing food safety
- Model and prototype system for optimising global chain performance
- Prototype system for Consumer Oriented Transparency of Tracking &Tracing systems.

**Estimated Costs**

Subproject 1: 480 k€  
 Subproject 2: 350 k€  
 Subproject 3: 400 k€  
 Subproject 4: 325 k€  
 Subproject 5: 400 k€

**Project Name:** Consumer Involvement in Safe and High-quality food via optimal chain management  
**Principal Contact(s):** Prof. CAMJJ Van den Hondel, Prof. J. van der Pligt  
**Contributing parties:** TNO Nutrition, University of Amsterdam, ATO

**Project Description**

This project will focus on identifying key factors that determine acceptability of, and confidence in chain management solutions for consumers, and developing methods/ procedures to ensure that the ‘voice of the consumer’ is incorporated. It is emphasised that the ‘voice of the consumer’ will be incorporated as part of the complete range of stakeholders. Day-to-day practice has shown that there is an information vacuum between consumers and experts; they speak a different language and make different trade-offs. The aim of this project is to develop methods that allow consumers and experts (professional experts on post-harvest optimisation of food production with respect to safety, quality, sustainability and economics) to ‘meet’, to mutually understand each other and to jointly develop solutions (concepts) to actually ensure safe and high quality products via chain management solutions.

Our aim is to develop tools to:

- identify key factors that determine the added value of new chain management solutions
- identify key factors that determine confidence in new chain management solutions
- efficiently involve consumers and other stakeholders in the decision-process

**Scientific Background**

The project is embedded in a standing research tradition on public perception and acceptability of technological risks. Furthermore this project builds on knowledge regarding consumer participation/ involvement in discussions concerning public policy and product/ concept development.

**Research Tools**

The following questions will be investigated sequentially

- What are key factors that determine the added value of new chain management solutions and how can they be identified?
- What are key factors that determine confidence in new chain management solutions and how can they be identified?
- In what way can consumers and other stakeholders effectively and efficiently be involved in the decision-process towards new chain management solutions?
- In what way can transparency support confidence in chain management solutions?

Survey techniques, mail survey techniques, observation techniques, trade-off techniques, participation techniques (focus groups, brainstorming, public hearings) will be used to identify key factors of acceptability and trust. New chain management solutions will be developed in concept and these will be tested among a small group of consumers and experts/ stakeholders.

**Deliverables**

- Improved understanding of consumer requirements and trade-offs concerning the added value of new chain management solutions
- Improved understanding of consumer requirements and trade-offs concerning the confidence in new chain management solutions
- Methods to improve consumer involvement in the decision process with other stakeholders

**Estimated Costs**

Personnel: 300 k€  
 Overhead: 75 k€  
 Material cost: 50 k€  
 Use of Equipment: 25k€  
 Knowledge transfer: 30k€  
**Total costs 480 k€**

**What is new in the project in terms of furthering the research field**

Transposition of knowledge on public level to consumer and industry level with clear distinction on origin of risks: production system, product technologies and production processes.

New methods to explicit trade-offs made by consumers between altruistic and egoistic on short, medium and long term.

Methods to involve all stakeholders including consumers in policy making by industry and governance.

**What is new for the institutions that participate in this project**

Chain Management solutions are mainly based on scientific technological (e.g. microbiology, epidemiology, toxicology) motivations. New solutions are needed that integrate motivations of all relevant stakeholders. This study will allow TNO to make a step forward in integrating new quality & safety systems taking the voice of the customer/ consumer into account.

**Project name:** Interactive policy making with consumers / citizens  
**Principal contact(s):** Dr. A Tukker, Dr. HSM de Vries  
**Contributing parties:** TNO-STB, ATO

**Project Description**

In the food system there is a number of subjects where there exists clearly a gap between perception between authorities / industry and the consumer/ citizens on the other hand. Examples of such gaps include the approach to solve discussions and problems like:

- Setting societal boundary conditions for innovations ( in the food sector; how to deal with Genetically modified organisms, the use of radiation for food sterilisation, and to lesser extent the use of certain conserving agents)
- Food safety policy and food safety perception

Research has shown, also for the food sector in specific, that the root of such ‘divides’ between authorities/ industry and citizens / consumers, often is rather technocratic of problem solving approach on the former and the lack of effective involvement in policy making of the latter group. The consequence is what often is perceived as ‘irrational’ or at least not predictable behaviour of citizens by industry and authorities of consumers and citizens in tense policy subjects related to food, and apply it on a number of important cases (e.g. the examples given above).

This project has a clear relation with the ‘Governance’ research line in the ICES-KIS III program proposal on System Innovation.

**Scientific Background**

This research builds upon the following bodies of knowledge:

- Participatory policy making
- New modes of governance

New is the practical application on an industrial cluster and using knowledge for practical approaches to stimulate innovation.

**Research Tools**

See the bodies of knowledge above. An important tool to be used will be the so-called ‘Policy-laboratory’ available at the University of Utrecht. Also, the knowledge within the partnership on interactive policy making between TNO, RUU, MIT/ Cambridge, Rotterdam University and some other major players will be made available.

**Deliverables**

- Gives for industry, authorities and intermediary parties insight in:
- Practical translation of the generic lessons on interactive policy making to the specific situation of the food sector
- Solution of a number of tenses ‘stalemate’ or ‘slippery’ discussions like the one on GMOs and radiation of food.
- Or , if solutions are not reached, insight in what drives societal resistance- and hence what the opportunities of new technologies are
- Potential models of governance in food sector that will reduce the risk on ‘amplification’, ‘irrationality’ , etc.

**Estimated Costs**

Personnel: 300k€  
 Overhead: .75 k€  
 Material cost: 25. k€  
 Use of Equipment: 25...k€  
 Knowledge transfer: 25k€  
  
**Total Costs: 450 k€**

**What is new in the project in terms of furthering the research field**

Despite all insights from social scientists and policy scientists the question how to solve 'dialogues of the deaf' like the ones on GMO's, food safety, etc. appears still a difficult one. An important reason is without doubt that in policy making many basic insights of these knowledge fields (e.g. framing, multiple rationalities, the limited usefulness of traditional 'hard science') are often not applied and this project is in part an answer to that problem. However, the project also wants to explore new roads to solve such 'wicked' policy problems by applying new concepts of interactive policy making, use of the RUU's 'policy laboratory', concepts like 'joint fact finding' etc., and evaluating the success of these concepts in practical solutions of the discussion.

**What is new for the institutions that participate in this project**

Both TNO and RUU have a great interest in novel forms of policy making and the use of science in policy making. As indicated, TNO and RUU set up an international expertise network in this field. This project fits very well in the existing project portfolio of TNO and RUU and will bring their excellence in this field further.

**Project Name:** Co-ordinated arrangements for food safety  
**Principal contact(s):** Dr. A Tukker, Prof. CAMJJ van den Hondel, Dr. HSM de Vries  
**Contributing parties:** TNO-STB, ATO, TNO Nutrition

**Project Description**

In a recent major research program of TNO into food and food integrity (with emphasis on safety and sustainability) it appeared that there is a great lack of co-ordinated (national, but also at EU level) between authorities who play a role in ensuring safety (and sustainability) of food. In practice this may lead either to insufficient safety (and sustainability) requirements on different parts in the food production chain or extreme requirements ‘just to be on the safe side’. Especially the latter may lead to situations that it is practically impossible to meet all requirements.

There is a clear need for a more integrated institutional system directed at monitoring and enforcing food integrity (safety and sustainability). Taking into account the ongoing globalisation, complexity and innovations in production, storage and distribution of food (from ingredients to end products) and new chain arrangements due to new stages of chain interruption.

This project aims at developing a

- procedure to identify gaps and redundancy in existing food safety and sustainability assurance systems;
- develop scenarios as to identify gaps and redundancies in future production, storage, distribution and chain arrangements;
- a blueprint for a new, flexible and dynamic (inter) national system directed at monitoring and enforcing food integrity (safety and sustainability).

**Scientific Background**

The project builds on practical knowledge of the organisation of food chains in relation to the incentive structures in this chain (see project on system analysis), and practical knowledge of legislative infrastructures, etc. Given this knowledge, and knowledge on practical control possibilities, new designs for co-ordinated legislative and other control structures will be proposed.

**Research Tools**

See Scientific background above.

**Deliverables**

The deliverable is a blueprint for co-ordinated arrangements for enhancing food safety. The added value for industry and authorities is:

- enhanced trust with the consumer/citizen;
- Less bureaucracy and hig

**Estimated Costs**

Personnel: 300k€  
 Overhead: 75 k€  
 Material cost: 25 k€  
 Use of Equipment: 25 k€  
 Knowledge transfer: 25 k€

Total Costs: **450 k€**

**What is new in the project in terms of furthering the research field:**

This research builds upon the following bodies of knowledge:

- System analysis
- Foresight, scenario development, back-casting
- Governance

New is the practical application on this particular industrial cluster and using this knowledge for practical approaches to stimulate innovation. Particularly the question how to ‘organise’ and align incentive structures in such a way that processes on the longer term are directed on the longer term into a direction that is desired from a normative point of view is a relatively new phenomenon with which relatively little experience is available.

**What is new for the institutions that participate in this project:**

Main driver for recent and ongoing efforts in developing quality & safety systems for food production chains have been early identification of food-borne hazards in order to reduce social and economic consequences of individual companies or production chains. This project will allow the institutions to make a step forward in designing quality & safety systems for industry including required incentives and infrastructure from governance to comply.

**Project name:** CHOPS; CHain Optimisation System  
**Principal contact(s):** Dr. HSM de Vries, Prof. CAMJJ van den Hondel  
**Contributing parties:** ATO, TNO Nutrition

**Project Description**

Product quality is optimally served when all chain elements perform in line with product quality. Current quality oriented Tracking & Tracing (T&T) objectives optimise decisions of individual actors in the chain. Optimal decisions for individual actors are often far from optimal for the total chain performance. By linking chain information with decision support, chains can be controlled towards an overall optimum. In order to do so, upstream information and downstream planning has to be linked, and chain elements have to conform to the global chain interest. On the other hand, chain results have to be shared among chain elements on a fair basis.

Aim of this project is to optimise chain performance by global optimisation.

**Scientific Background**

Recent development in tracking and tracing have focussed on chain information (traditional T&T) and local decision optimisation (e.g. logistics and quality oriented applications of T&T) By extending the scope towards global chain optimisation, exchange of chain information becomes crucial.

**Research Tools**

Aladdin: a tool to simulate logistic chains  
 FoodPrint: goal-oriented method for analysing and designing T&T systems

**Deliverables**

- A model for describing chain processes, chain decisions and their optimisation in terms of FoodPrint
- A concept for practical application, including chain information collection and evaluation
- A prototype system for chain optimisation using upstream information on product history and downstream information on demand

**Estimated Costs**

Personnel:	240 k€
Overhead:	45 k€
Material cost:	... k€
Use of Equipment:	15 k€
Knowledge transfer:	25 k€
<b>Total Costs:</b>	<b>325 k€</b>

**What is new in the project in terms of furthering the research field**

Main drivers for recent and ongoing efforts in developing tracking & tracing systems for food production chains have been identifying and exchange of relevant information to all professional stakeholders. The application of this information in optimising the control of the entire chain has not yet been attended.

**What is new for the institutions that participate in this project:**

This project will allow the institutions to make a step forward in design of Tracking & Tracing systems that will provide sound information for balanced decision making on costs & benefits concerning the food production chain.

**Project Name:** CONTRACT ; Consumer Oriented Transparency of Tracking & Tracing Systems  
**Principal contact(s):** Dr. HSM de Vries, Prof. CAMJJ van den Hondel  
**Contributing parties:** ATO, TNO Nutrition

<p><b>Project Description</b></p> <p>Tracking &amp; Tracing systems are mainly designed to allow professional partners within the food production chain to exchange information on product origin and growth &amp; production system and the like. Although consumers in general have limited interest in tracking &amp; tracing information, the information available in these systems might be of great importance with regard to the transparency of chain management solutions in general and to food scares in particular.</p> <p>This project focuses on transparency of the food production chain by making tracking &amp; tracing information available to consumers. When making information available it must be relevant, understandable, meaningful and easy to access by consumers. In order to make the information available a common language of experts and consumers must be developed for specific Tracking &amp; Tracing systems. Furthermore, the right channel(s) for consumers to access the information must be identified/ designed.</p> <p>The aim of this project is to develop:</p> <ul style="list-style-type: none"> <li>• Methodology to develop a common language for a specific tracking &amp; tracing system</li> <li>• Methodology to identify and design information channels for information exchange</li> </ul>													
<p><b>Scientific Background</b></p> <p>CONTRACT deploys the following fields of research:</p> <ul style="list-style-type: none"> <li>• Tracking &amp; Tracing Systems</li> <li>• Consumer Research</li> <li>• Internet-based communication</li> <li>• Logistics &amp; chain / network economics</li> </ul>													
<p><b>Research Tools</b></p> <ul style="list-style-type: none"> <li>• Foodprint, goal oriented method for analysing and designing tracking &amp; tracing systems</li> <li>• Consumer research, both qualitative and quantitative, to assess added value from consumer point of view</li> <li>• Consumer en b-t-b research to develop a common language on tracking and tracing systems</li> <li>• ICT and Communication Science to identify and design information channels/ sites</li> </ul>													
<p><b>Deliverables</b></p> <ul style="list-style-type: none"> <li>• Improved understanding of added value of T&amp;T systems to consumers</li> <li>• Prototype T&amp;T common language</li> <li>• Prototype system for Consumer Oriented Transparency of T&amp;T systems.</li> </ul>	<p><b>Estimated Costs</b></p> <table> <tr> <td>Personnel:</td> <td>290 k€</td> </tr> <tr> <td>Overhead:</td> <td>50 k€</td> </tr> <tr> <td>Material cost:</td> <td>... k€</td> </tr> <tr> <td>Use of Equipment:</td> <td>25 k€</td> </tr> <tr> <td>Knowledge transfer:</td> <td>35 k€</td> </tr> <tr> <td><b>Total Costs</b></td> <td><b>400 k€</b></td> </tr> </table>	Personnel:	290 k€	Overhead:	50 k€	Material cost:	... k€	Use of Equipment:	25 k€	Knowledge transfer:	35 k€	<b>Total Costs</b>	<b>400 k€</b>
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**What is new in the project in terms of furthering the research field**

Main drivers for recent and ongoing efforts in developing tracking & tracing systems for food production chains have been limited to professional stakeholders. In experimental settings consumers have been overloaded with information, and consumers have been invited to produce information for the chain. However, the provided information is hardly appreciated by consumers, and the motivation to actively provide information is low. In this project the aim is to design dedicated information channels to exchange information with consumers in a way that offers consumers the information they need, and to obtain in a flexible manner information from consumers that is relevant for improving chain transparency.

**What is new for the institutions that participate in this project**

This project will allow the institutions to make a step forward in design of Tracking & Tracing systems by making information available and transparent to consumers and vice versa integrate information derived from consumers into the systems.

**Project Name:** System analysis and strategic foresight Dutch Food Cluster  
**Principal contact(s):** Dr. Arnold Tukker, Prof. Ruud Smits  
**Contribution parties:** TNO-STB, University of Utrecht

**Project Description**

This project analyses the innovation dynamics in the current and future Dutch Food Cluster (including international developments relevant for this cluster). This research gives insight in:

- Ongoing dynamics in the cluster (social, economic, and environmental trends)
- Opportunities for innovations (by individual companies and within clusters of companies/food chains)
- Opportunities for effective institutional changes that support these innovations

Most of the other projects in the portfolio aim at realising practical innovations that will support integrity in consumer's food choice. Time and again it appears that normatively desired innovations (such as realising food integrity) will only be put into practice under the following condition: the players in the value chain, including the final consumer, must all feel an incentive to and feel benefits from change. A 'system analysis' is in fact an analysis of the main player groups in the food sector, how they are related, and what incentives they experience (methodologies: NIS, Porter, cluster approaches etc.).

Furthermore, a foresight and/or a scenario study with a time horizon of 5-10 years is part of this study. This will give insights in the ongoing socio-economic dynamics in the sector and at the consumer side. All this gives at meso-level insight which type of innovations will actually be promoted given the structure and dynamics in the system, and which innovations are likely to be blocked. In many specific projects in this Food programme, the same analysis has to be done at the level of a specific innovation. This project provides the methodology for this analysis, and the generic picture at meso-level as a background. In that sense, this project is a generic 'service module' for all other projects in the portfolio. However, the project also gives important information for companies in the Dutch food sector for their strategy development. Finally, it makes also clear what kind of desired innovations will not be realised without changes of the incentive system, indicated the needs for (self)governance measures. The project will be the linking pin with another ICES-KIS III programme, the one on System Innovation.

**Scientific Background**

This research builds upon the following bodies of knowledge:

- Innovation science (concepts like National Systems of Innovation, Porters Diamond, Cluster studies)
- Foresight, scenario development, backcasting
- Governance

New is the practical application on an industrial cluster and using this knowledge for practical approaches to stimulate innovation.

**Research Tools**

See above. The system analysis will be performed based on well-known approaches like NIS, Porter's diamond, and foresight methods (Delphi, scenario analysis).

**Deliverables**

Gives for industry, authorities, and intermediary parties insight in:

- a) National system of innovation of the Dutch Food Cluster
- b) Autonomous trends/developments
- c) Challenges/goals that have to be met by the Dutch food cluster in, say, 2010 (with an outlook onto 2020);

**Estimated Costs**

Personnel: 400k€  
 Professor, 0,5 day/wk, 2 yr. (40 days)  
 Senior researchers, 2 day/wk, 2 yr (160 days)  
 Researchers, 3 day/wk, 2 yr (240 days)

Overhead: .100 k€  
 Material cost: 33. k€  
 Use of Equipment: 33...k€

d) Possible roadmaps and development routes for organisational and technical innovations for meeting these normative goals.	Knowledge transfer: 33k€ Total Costs: <b>600 k€</b>
<p><b>New in the project in terms of furthering the research field</b> This research builds upon the following bodies of knowledge:</p> <ul style="list-style-type: none"> <li>• Innovation science (concepts like National Systems of Innovation, Porters Diamond, Cluster studies)</li> <li>• Foresight, scenario development, backcasting</li> <li>• Governance</li> </ul> <p>New is the practical application on this particular industrial cluster and using this knowledge for practical approaches to stimulate innovation. Particularly the question how to ‘steer’ innovation processes on the longer term into a direction that is desired from a normative point of view is a relatively new phenomenon with which relatively little experience is available.</p>	
<p><b>New for the institutions that participate in this project</b> See above. The participating institutions will expand their expertise and excellence in these fields. This project fits in the general interest and ambition of TNO-STB to contribute to transition management programmes and to link the theoretical insights on innovation processes with realising and experimenting with innovations in practice. For the RUU, it fits with its ambition to confirm its leading position in innovation studies and related governance models. The participating institutions have the following credentials:</p> <ul style="list-style-type: none"> <li>• Execution of some 30 cluster studies</li> <li>• A few dozen of scientific publications in the field of foresight and governance</li> <li>• Memberships of various editorial advisory boards and review committees in this field</li> </ul>	

**Project name:** Development of high-throughput test systems to identify new food ingredients in relation to health  
**Principal contact(s):** Prof. Dr. W.H.M. Saris, Prof.dr. AGJ Voragen  
**Contributing parties:** Universities of Maastricht and Wageningen

**Problem Description**

Raw materials for food production contain enormous amounts of specific components. So far the food industry has not developed a system to test these food components on functionality in relation to human health. For the development of a second generation of functional foods a systematic screening of potential food components is essential to identify the most suitable ingredients in relation to enhancing specific physiological functions or to reduce health risks.

**Aim of the project**

Development of a high-throughput biological test system to identify new food ingredients in relation to health. As a demonstration project, proteins will be selected as ingredient input and cellular cytokine production as biological function.

**Scientific background**

With the increasing aging of the population and consequent health care costs the consumer demands for specific functional health foods or healthier foods in general will rise. So far the identification of potential health enhancing food ingredients is a “by chance” process. No systematic search systems as developed by the pharmaceutical industry have been developed. Application of this knowledge in the food industry could accelerate the development of a second generation of functional foods. The project will be focussed on the health problem of chronic inflammation as is observed in several chronic diseases like CVD, obesity, diabetes and several common chronic intestinal and pulmonary disorders.

**Research tool**

The project will build on state of the art knowledge in innovative process technology used in the pharmaceutical industry for drug discovery. Besides the development of sets of food ingredients by using advanced analytical industrial procedures, special attention should be given to the development of specific human cell-line systems for high throughput screening on specific cellular biological functions and follow-up procedures for human clinical testing for proof of concept.

The project combines research on the development of methods and procedures to select, fractionate and storage of food ingredient components (AIO<sub>1</sub> PostDoc<sub>1</sub>). Development of cell line methods to test the concept of modulation of the inflammatory process by cytokines (AIO<sub>2/3</sub> PostDoc<sub>2</sub>) and the application of candidate components in human experimental studies as proof of concept (AIO<sub>3/4</sub>).

**Deliverables**

- Generation of sets of food ingredients for high though-put screening.
- Test systems for screening functionality of food components.
- Procedures for “proof of concept” studies in functionality in humans.

**Costs**

Personnel	5 AIO's	
	2 Post-doc	2300K €
Overhead		575K €
Material		1000K €
Others		200K €
Total		4075K €

**What is new in the project in terms of furthering the research field**

The approach as described in this proposal has been shown its benefit in the field of pharmacology. Similar to drugs, functional food components influence human metabolic processes and may positively intervene in the (patho)physiology of common health disorders. In contrast to the available knowledge and technology in pharmaceutical industry with regard to systematic evaluation of pharmacological substances, the available know-how and financial power with regard to evaluation of functional food ingredients in the food industry is very much restricted and scattered. However, in some nutritional area's (such as phytosterols) a systematic approach has been very successful.

**What is new for the institutions that participate in this project**

The institutions have a well-known past performance with regard to studying the effect of functional food ingredients in the field of lipid metabolism, obesity, chronic inflammation and physical and mental performance. However, the systematic approach as described in this proposal has not been applied yet. This requires not only enlargement of existing research lines but also bridging towards new technology and knowledge not yet available in the institutions.

**Project Name:** An individualised healthy nutrition advice  
**Principal contact(s):** Prof. WHM Saris, Prof. R-JM Brummer, Prof. JCM van Trijp  
**Contributing parties:** Universities of Maastricht and Wageningen

**Project Description**

It is well known that there exists an important variation among individuals with regard to developing nutrition-related health disorders as well as their response to nutritional intervention. This project aims to identify valid genetic biomarkers of relevant nutrition-related health disorders and to identify the relevant inter-individual variation in response to important nutrients with regard to these health disorders.

This type of information is of pivotal importance to inform individuals more appropriately in relation to nutritional guidelines and the individual response to a specific disease risk. In order to integrate the different technologies to come with a personal advice, the project will be limited to the disorders related to under- and overweight and the variation in energy efficiency in relation to macronutrients. This project will benefit from the WCFS initiative on Nutrigenomics focussing on the Metabolic Syndrome disorder at the level of techniques, concepts and results. Aspects of individual consumer expectancies and needs are crucial for this new approach to become effective in an individualised healthy nutrition advice.

**Scientific Background**

With the publication of the provisional Human Genome Chart in 2000, completely new opportunities appear to become reality. The well known large variability in physiological functions such as energy efficiency and food intake regulation is based on the genetic variability in response to nutrients. In the coming 5 years all relevant genes and genetic variants (SNP's) will become available in the public domain. Therefore it is realistic to expect that in 5 to 10 years SNP profiles will be available in relation to the relevant nutrition-related disorders. Large scale minimally-invasive test systems are needed to achieve public health benefit. It is of importance to start now with the integration of the results obtained by different disciplines at the level of technology and science. In addition, consumer expectations and needs must become clear and used as template for the design of the tests to characterise individual response.

**Research Tools**

Transcriptomics, proteomics, metabolomics, bioinformatics, techniques on energy and substrate metabolism and consumer sciences. The project combines human experimental work on underweight (AIO<sub>1</sub>) and overweight (AIO<sub>2</sub>), designing and application of dedicated gene chips (AIO<sub>3</sub>), proteomics/metabolomics (AIO<sub>4</sub>) and consumer science (AIO<sub>5</sub>).

**Deliverables**

- Large scale minimal invasive biomarker test to characterise individual susceptibility to weight unbalance
- Large scale minimal invasive biomarker tests to characterise the individual response to nutritional intervention.
- Strategies for implementation of new biomarkers to advice the consumer on personal optimal diet for long-term health.
- Procedure for the development of sets of biomarkers and procedures for other health disorders.

**Estimated Costs**

5 AIO	
1 postdoc	
2 technicians	2356 K€
overhead	589 K€
material	750 K€
others	200 K€
<b>Total</b>	<b>3895 K€</b>

**What is new in the project in terms of furthering the research field**

The enormous increase in knowledge and technology with regard to the field of genomics has not yet been satisfactorily transferred and translated to the field of nutrition and health. The existing knowledge about individual response to nutritional intervention is very much scattered and a broad and systematic approach is needed to fulfil the aims of the project. Furthermore, a systematic approach to select relevant biomarkers of the selected health disorders is needed and not yet available. This process should have a dynamic character to enable a continuous process of increased knowledge on this topic. Although the project is focussed on specific nutrition-related health disorders, the deliverables of the project may be of major importance to adjacent fields of medicine and public health.

**What is new for the institutions that participate in this project**

Although the institutions participating in this project both have broad knowledge and technology in the field of nutrigenomics and the health disorders involved, this know-how has not yet been applied in a systematic approach towards the research question described here. The project needs collaboration with biomedical technology centres and selected industrial partners. The studies with regard to consumer needs and expectations should be seen in a European perspective.

**Project Name:** Consumer oriented functional food design  
**Principal investigator:** Prof. JCM van Trijp, Prof. W.H.M. Saris  
**Contributing parties:** Universities of Wageningen and Maastricht, TNO Nutrition, ATO

**Project Description**

Functional foods offer the opportunity to substantially add to healthy eating patterns of consumers, by either reducing negative components in the food or adding positive features. So far, functional foods constitute only a small proportion of the total food basket. In that sense, they have not fulfilled their full potential. Consumer demand has lagged behind to public policy and commercial ambition levels. Enhancing the consumer orientation in functional food design could add to the success of future functional foods.

Aim of this project is to develop tools to:

- Identify consumer perception of health and the role of food consumption therein (e.g. vis-à-vis other lifestyle factors).
- Understanding consumer decision processes for functional food choice, vis-à-vis regular foods, medicinal solutions and lifestyle changes, including triggers and barriers for functional food consumption
- Understand how consumers evaluate healthiness of food products, both from product features and product communication, and how this understanding can be used for more accurate healthiness perceptions
- Derive implications for the design of functional food concepts

**Scientific Background**

Functional foods carry specific associations to both foods and medicine. Hence they are difficult for consumers to get to grips with. Also, although health and longevity are very central life values to most people, health is not a very central choice motivation in the life of healthy people (driven primarily by the pleasure and convenience dimensions of food). Situational factors can bring health as a choice motive very much to the forefront (at the expense of pleasure and convenience). This project will use goal theory (Austin and Vancouver, 1996) to understand consumer consideration on how the desire for a healthy life translates into their purchasing and consumption behaviour for functional foods. The project will apply and extend informational and inferential belief formation processes from attitude theory (Fishbein and Ajzen, 1975) to understand design implications for new functional foods. Individual differences will explicitly be taken into account.

**Research Tools**

- Literature review on determinants of functional food choice
- Model development of drivers and determinants of functional food acceptance
- Research guidance on how to translate into the design of new functional food concepts
- Qualitative and quantitative consumer research to understand consumer acceptance and to validate the model

**Deliverables**

- A model for the functional food evaluation and choice process.
- Methodology for translation into functional food design
- Research methodology for early warning on functional food concept potential

**Estimated Costs (4 years)**

- Personnel:	200 K€
- Overhead:	50 K€
- Material cost	100 K€
- Use of equipment	50 K€
- Knowledge transfer	20 K€
- <b>Total costs</b>	<b>420 K€</b>

**New in the project in terms of furthering the research field**

Functional foods are a new category to the consumer, relating both to food and medical choice behaviours. So far, the approach has been largely technology push for new opportunities and findings in the life sciences. This project takes consumer motivations for health as the starting point to understand the decisions and trade-offs consumers make regarding health behaviours and functional food choices in particular.

**New for the institutions that participate in this project**

The project intimately brings together marketing and consumer behaviour experts with scientists in the area of nutrition and life sciences. This close connection should add substantially to the true understanding of what consumers want and expect from functional food concepts. Hence it should build market realism into the life science and life science realism into the marketing approaches.

**Project Name:** Consumer effective health claim formulation  
**Principal contact(s):** Prof. J.C.M. van Trijp, Prof. J. van der Pligt  
**Contributing parties:** Wageningen UR, Universities of Amsterdam and Maastricht

**Project Description**

Conveying the health benefits of foods to consumers depends on the communication, both through subtle intrinsic product cues and through extrinsic cues such as health claims accompanying the product. Health claims can be defined on various contents (e.g. health vs. disease) and formats (e.g. positive vs. negative, long vs. short). Consumer effective health claims can add motivation to consumers and reduce barriers to healthy food consumption. Currently, little is known about what is more or less appealing to what consumer under what situations (e.g. Lee and Aaker, 2002). As a consequence the consumer perspective on function food claim definition has largely been ignored and claims have been “pushed” primarily from a regulatory and scientific perspective.

Key questions that will be addressed:

- How do consumers evaluate health claims currently in the market?
- How should health claims be defined to maximise consumer (and public health) impact?
- How can the voice of the consumer be integrated in existing claim formulation and substantiation processes?

**Scientific Background**

Existing research on consumer effectiveness of health claims has largely been generic (“eat healthy, avoid HIV) rather than product specific (e.g. Rothman & Salovey, 1997) and based on prevention rather than promotion motives (e.g. Lee & Aaker, 2002). Also, these research efforts have yielded inconsistent results due to differences in framing object (e.g. Levin et al., 1998). Within goal framing, only recently have authors begun to address health claims in terms of both the action (“if you do” versus “if you don’t”) and the consequence (“gain”, “forego gain”, “lose” and “avoid loss”), based on regulatory focus theory (e.g. Higgins, 1997; Aaker and Lee, 2001). There is reason to believe that consumer consistently differ in their preference for health claim content and format based on regulatory focus (e.g. Aaker and Lee, 2001), involvement and personality factors (e.g. Rothman and Salovey, 1997).

Building from this current state of knowledge, the present project add a consumer angle and a food product angle to validate and extent these findings in the health food area.

**Research Tools**

- Literature review of claim effectiveness
- Model development of consumers’ health claim evaluation process
- Categorisation of potential claim definitions
- Qualitative consumer research to understand consumer evaluation process
- Quantitative consumer research to test and refine health claims for optimal consumer responsiveness

**Deliverables**

- Consumer drivers of claim effectiveness
- Insight into consumer appeal of (categories of) health claims in the market
- A consumer-based classification scheme for health claim definition
- Do’s and don’t of health claims from a consumer point of view

**Estimated Costs (4 years)**

- Personnel: 320 K€
- Overhead 80 K€
- Material cost 100 K€
- Use of equipment 80 K€
- Knowledge transfer 20 K€
- **Total costs 600 K€**

**New in the project in terms of furthering the research field**

Existing psychological research into health claim effectiveness has largely been focussed on generic health messages such as “Eat Healthy” or “Use condoms” and largely focussed on prevention behaviours. This research extends that research tradition by adding a consumer perspective and a food product-specific dimension (product claims rather than health claims). Also, promotion behaviours will have a more prominent place in this research.

**New for the institutions that participate in this project**

The project brings together various disciplines including nutritional scientists (“what can be said”), psychologists (“how could it be said”), marketers (“how should it be said”) and legal experts (“what is allowed to be said”). This multi-disciplinary nature of health claim formulation is innovative to all of the institutions involved.

**Project Name:** Healthy snacks kids can't resist  
**Principal contact(s):** Prof. JCM van Trijp (WU)  
**Contributing parties:** Universities of Wageningen and Utrecht

<p><b>Project Description</b>          Childhood obesity is a paramount and increasing health problem in today's society. The aim of this integrated project is to understand the motivational basis of children's snack food consumption and to use this understanding for the development of a healthy snack that has high nutritive (but low caloric) quality, appeals to youngster on first encounter (exciting), builds consumption loyalty (high repeat low boredom). The project is a combined effort of four disciplines: marketing &amp; consumer behaviour (van Trijp), psychology of perception (Kroeze), food choice behaviour (de Graaf) and food technology (van Boekel).</p>																			
<p><b>Scientific Background</b>          The project builds and extends on several research streams, including experience marketing, consumer behaviour, psychology of sensory perception including at low levels of awareness, sensory specific satiety and product boredom, integrated food technology, and consumer oriented food product development. These streams are integrated into a fundamental understanding of child motivation for snack consumption and the design of an exemplar snack that is healthy and child attractive upon first encounter as well as generate a desire for repeat consumption (loyalty). The principal route of intervention will be that of engineering out product boredom through optimal product design (complexity in product features), thus circumventing sensory specific satiety to these healthy snacks. Product complexity will be overriding theme to generate child attractiveness both at the product choice level (Van Trijp), the level of sensory specific satiety (de Graaf), the neurological basis (Kroeze) and the level of product design (Van Boekel).</p>																			
<p><b>Research Tools</b></p> <ul style="list-style-type: none"> <li>• Food consumption analysis and survey research</li> <li>• Experimental studies on sensory specific satiety</li> <li>• Neurological studies on the neural substrates for sustained liking</li> <li>• Chemical/physical product research with focus on flavour release studies</li> </ul>																			
<p><b>Deliverables</b></p> <ul style="list-style-type: none"> <li>• Understanding of key drivers in childrens' grazing behaviour</li> <li>• Understanding of the role of product complexity to build loyalty and fight boredom</li> <li>• New product composition and structuring technology for optimal child experience</li> <li>• Understanding of neural and behavioural substrates for sustained liking</li> <li>• Best practice in integrated consumer oriented new product development</li> </ul>	<p><b>Estimated Costs (4 years)</b></p> <table> <tr> <td>- Personnel:</td> <td>:</td> <td>850 K€</td> </tr> <tr> <td>- Overhead</td> <td></td> <td>250 K€</td> </tr> <tr> <td>- Material cost</td> <td></td> <td>600 K€</td> </tr> <tr> <td>- Use of equipment</td> <td></td> <td>200 K€</td> </tr> <tr> <td>- Knowledge transfer</td> <td></td> <td>100 K€</td> </tr> <tr> <td>- <b>Total costs</b></td> <td></td> <td><b>2000K€</b></td> </tr> </table>	- Personnel:	:	850 K€	- Overhead		250 K€	- Material cost		600 K€	- Use of equipment		200 K€	- Knowledge transfer		100 K€	- <b>Total costs</b>		<b>2000K€</b>
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<p><b>New in the project in terms of furthering the research field</b>          The unique contribution of this project comes from the integration of disciplines and the focus on sustained behaviour. For this purpose, the issue of optimal sensory quality (to generate trial) will be integrated with that of optimal product complexity (to counteract product boredom) at the levels of choice behaviour, sensory perception, neural representation and product features.</p>																			
<p><b>New for the institutions that participate in this project</b>          The project brings new infrastructure by integrating food technology, psychology, food acceptance research and marketing and consumer behaviour disciplines around the common theme of optimal product complexity.</p>																			

**Project Name:** **Appealing health foods on-the-go**  
**Principal contact(s):** Prof. JCM van Trijp  
**Contributing parties:** Wageningen University, TNO, ATO

**Project Description**

Food is increasingly consumed out of home and out of traditional consumption contexts (on the go). This provides a new challenge for healthy and functional food development in markets that have not traditionally been catered. This project develops fundamental understanding on how functional foods can be positioned in "on the go" consumption. Offering healthy foods in a format and delivery channel that is easily available may lower an important barrier to healthy food consumption.

This project develops fundamental consumer understanding for convenience products and specifically for consumers' "on-the-go" food consumption. It will zoom in on the consideration set and the strengths and weaknesses of alternative food formats available on the go. From this information, a concept of a healthy snack will be developed and tested with consumers. Alternative distribution channels (e.g. vending machines) will be included in the analysis.

Key research questions:

- What are consumer requirements for on-the-go snacks?
- What are categorizations and strengths and weaknesses of alternatives in the consideration set?
- How can this information in product design targets for a healthy snack?
- How do consumers evaluate this healthy snack in alternative distribution formats?

The research will focus primarily on:

- Identification of consumer consideration in on-the-go consumption?
- Development of a model for on the go food consumption?
- Implications for design of a healthy "on-the-go" product

**Scientific Background**

Most of the consumer behaviour choice models focus on rational processes with considerable levels of consideration on the part of the consumer. This project will build on impulse buying and situational influences in consumer food choice behaviour to build a model for consumer food choice "on-the-go". It will focus primarily on the health motivations and how these are traded-off against situational motives and time constraints.

**Research Tools**

- Literature review and survey research
- Small scale experiments for hypotheses testing
- Real life experiments with the concept of a healthy snack for on the go

**Deliverables**

- A model for on the go food consumption
- A test of a healthy snack concept
- Proof of principle testing of the healthy snack concept for on the go

**Estimated Costs (4 years)**

- Personnel:	200 K€
- Overhead	50 K€
- Material cost	150 K€
- Use of equipment	50 K€
- Knowledge transfer	25 K€
<b>- Total costs</b>	<b>475 K€</b>

**New in the project in terms of furthering the research field**

Most of consumer choice models, including those in the health area, are based on rational and deliberate choices. For many food choices, this is not the reality as more and more food choices are made on the go, largely driven by impulse and availability. The contribution of this project is that it will develop a food choice model for on-the-go and show proof of principle for a healthy snack concept on the go.

**New for the institutions that participate in this project**

Although the contributing parties all have considerable skills and expertise in consumer behaviour research, they have not previously worked together on concrete cases like on-the-go food consumption. Combining of these consumer behaviour expertises is the best basis to develop a sound consumer behaviour model for on the go consumption.

**Project name:** Post prandial wellness  
**Principal contact(s):** Prof. CAMJJ van den Hondel  
**Contributing parties:** TNO Nutrition, Wageningen University

<p><b>Project Description</b>  An important aspect of the appreciation of a health food, is how fit and well people feel after consuming it. At present this concept is applied mainly in so called “high energy” drinks, however the concept could easily be expanded to truly healthy foods, such as high fibre foods, foods containing a balanced nutrient composition, pro-biotics etc.</p> <p>Proposal:</p> <ol style="list-style-type: none"> <li>1. To develop a methodology to describe and measure subjective feelings of well-ness following the consumption of a particular food.</li> <li>2. To use the wellness measuring methodology to characterise the effects of macronutrients, fibres, pro-biotics, satiety promoting ingredients etc.</li> </ol>													
<p><b>Scientific Background</b>  Research on post-prandial wellness has focused mainly on the lack of well-being, hunger and satiety on the one hand, and effects of well-known pharmacologically active food components such as caffeine and alcohol. The present proposal will develop a methodology to measure subjective feelings of wellness, and evaluate the results using principal component analysis, multi-variate analysis etc. The outcome can be the basis of further research into the origins and mechanisms of the observed perceptions.</p>													
<p><b>Research Tools</b>  Consumer panel  Modelling and multivariate statistics  Food technology</p>													
<p><b>Deliverables</b>  1. Method to characterise and measure post-prandial wellness  2. Effects of a number of ingredients on post-prandial wellness</p>	<p><b>Estimated Costs</b></p> <table> <tr> <td>• Personnel:</td> <td>350 K€</td> </tr> <tr> <td>• Overhead:</td> <td>105 K€</td> </tr> <tr> <td>• Material cost</td> <td>75 K€</td> </tr> <tr> <td>• Use of equipment:</td> <td>5 K€</td> </tr> <tr> <td>• Knowledge transfer:</td> <td>30 K€</td> </tr> <tr> <td><b>Total costs</b></td> <td><b>565 K€</b></td> </tr> </table>	• Personnel:	350 K€	• Overhead:	105 K€	• Material cost	75 K€	• Use of equipment:	5 K€	• Knowledge transfer:	30 K€	<b>Total costs</b>	<b>565 K€</b>
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<p><b>What is new in the project in terms of furthering the research field</b>  Most research on product appreciation has focussed on liking during consumption. However a primary motivation of eating is to provide the body with energy and nutrients, hence to feel better after eating. Most literature on post-prandial perception deals mainly with (strongly) negative factors, mainly regarding GI disorders. This project will bring insight into why preferences for foods are developed, based on their post-ingestive effects.</p>													
<p><b>What is new for the institutions that participate in this project</b>  This project will use experience within TNO on satiety and GI physiology to develop reliable and relevant questionnaires on post-prandial wellness, and to use these questionnaires to study factors affecting post-prandial wellness and longer term liking.</p>													

**Project name:** Obesity, food intake and exercise  
**Principal contact(s):** Prof WHM Saris  
**Contributing parties:** Universities of Maastricht, Wageningen and Amsterdam

**Project Description**

This project will focus on identifying key factors that determine the role of both food intake, in particular soft drinks, and physical activity patterns in the development of obesity in particular in young age groups (children and adolescents). To prevent further increase in the prevalence of obesity, it is necessary to focus on the prevention in younger age groups. Both increased food and snack intake as well as decreased levels of physical activity can explain most of the increased prevalence of obesity and type 2 diabetes. At a crossroad between food intake and physical activity stands the use of soft drinks, mineral waters and sports drinks. Over the years this segment has become an important food group in the food basket, affecting the consumer food choice and perhaps activity patterns. The aim of this integrated project is to understand the motivation of the soft drink consumption in the different age groups as well as the relation to physical activity patterns and its impact on health. This understanding will be used for the development of new drink formulas that appeal to youngsters in combination with making physical activity attractive. This is an integrated approach combining expertise in the area of marketing and consumer behaviour, nutrition and (exercise-)physiology and food technology.

**Scientific background**

Obesity and diabetes have become world's most important nutrition related diseases. The availability of food in large proportions and at a low cost is contributing greatly to this epidemic disease. Also low levels of activity even at a young age contribute to the phenomenon. Recently the role of soft drinks in this process has been questioned. On the one hand it is of importance to keep hydration status in balance particularly during exercise, but on the other hand, soft drinks, in particular the sugared drinks and fruit juices, are now consumed in large quantities which could lead to weight gain. So far no systematic analysis has been published on product choice in the different age groups as well as the relation to the physical activity patterns. Also the metabolic information about how specific soft drink and fruit juice ingredients interact with the consumer requirements (taste, satiety) and physical characteristics (weight regulation, physical fitness) is lacking. Based on this type of information, new drink alternatives will be developed as well as a new concept to stimulate physical activity in these age groups.

**Research tools**

- Food consumption analysis and survey research.
- Experimental studies on the physiological aspects of soft drinks and fruit juices in relation to the metabolic response.
- Food technology and product research.
- Health promotion models to integrate the acquired knowledge at a practical level.

**Deliverables**

- Understanding of the role of soft drinks in today's food patterns and nutritional habits in youngsters.
- Understanding of the physical activity patterns in youngsters.
- Understanding of the metabolic consequences of high soft drink intake combined with low levels of physical activity.
- New product composition and structuring technology.

**Estimated Costs**

Personnel	3 AIO's	804K €
Overhead		201K €
Consumables		75K €
Use of equipment	10K €	
Knowledge transfer		10K €
<b>Total</b>		<b>1100K €</b>

- Best practice in integrated consumer orientated product development

**What is new in the project in terms of furthering the research field**

This is the first time that both sides of the energy and weight balance are integrated at the level of a food category which is very closely linked to exercise and sports activities. So far approaches have been largely developed separately at a food intake level or exercise level. This project takes the advantages of the food group images (soft drinks, sports drinks and fruit juices) in relation to activity as a starting point to develop new products and activity concepts to achieve a better energy balance between food intake and energy output.

**What is new for the institutions that participate in this project**

The project intimately brings together consumer behaviour and marketing experts with food technologist and scientists in the area of nutrition and exercise physiology. This new combination of expertises should lead to new insights about what motivates youngsters and what they expect from new concepts both in the field of soft drinks as well as activity.

**Project Name:** Food Behaviour and Health of Adolescents  
**Principal contact(s):** Prof. W.F. van Raaij  
**Contributing parties:** University of Tilburg, Maastricht, Wageningen

**Project Description**

Food behaviour of young people of 14-20 years of age differs considerably of the eating habits of the older generations. Fast food and the increasing use of alcohol, tobacco and drugs constitute a major threat to health. In this research, we focus on the perceived relationships between food and health in the young generation. The emphasis is not on the misuse of alcohol, tobacco and drugs, although this also plays a role in the overall non-healthy behaviour. The emphasis in this project is on time orientation and the perceived short-term and long-term consequences of food behaviour for physical condition, health and well-being. Individual differences related to gender, education level, job, lifestyle and time orientation are included in the design. Pathological cases of anorexia and bulimia are not included.

**Scientific Background**

Most young people tend to have a short-time orientation with regard to physical condition, health and well-being. The concept of time orientation or time preference measures whether people want to have gratifications now rather than later, and do not bother about long-term consequences of present behaviours. Merit goods are characterized by short-term behavioural costs and long-term benefits, whereas demerit goods have the opposite pattern: gratification now and behavioural costs later. Behavioural costs include negative effects on health and well-being. In this project, biased or correct implicit causal reasoning is assessed on the perceived relationships between food behaviour and health consequences.

**Research Tools**

The project consists of literature search to assess the relationships between food behaviour and health, and causal reasoning on these relationships with help of qualitative interviews, scenario analysis, and risk estimates by youth of their future physical condition and health.

**Deliverables**

- Catalogue of explicit and implicit causal reasoning, biased and correct, in the context of food behaviour and health.
- Improved insight in perception and misperceptions of youth with regard to food and health.
- Identification of communication themes and approaches to correct for these biases and misperceptions.
- Symposium to disseminate the obtained knowledge to experts in this area.

**Estimated Costs (4 years)**

- Personnel (AIO): K€ 170
- Overhead: K€ 40
- Material costs: K€ 50
- Use of equipment: K€ 15
- Knowledge transfer: K€ 20
- **Total costs: K€ 295**

**New in the project in terms of furthering the research field**

The existing literature on information extension to change behaviour centres on the desired changes and end states. Little research has been done to identify correct or incorrect causal reasoning of people to start or to maintain food behaviours. In this study, causal reasoning is combined with time orientation/ time preference, and the assumption that young people are less concerned with long-term effects of their present behaviour.

**New for the institutions that participate in this project**

The Department of Economic Psychology at the University of Tilburg has a long-standing experience with consumer and advertising research. The principal investigator has experience with anti-smoking research and programs. This is an opportunity to apply the knowledge and expertise on a specific target group and on food behaviour and health.

**Project Name:** Good sustainable practice standards for the food industry  
**Principal contact(s):** Dr. Arnold Tukker; Dr. Huug de Vries  
**Contributing parties:** TNO-STB, ATO, WUR, TNO

**Project Description**

In the so-called Strategic Agricultural Initiative (SAI), initiated by Unilever, Nestle and Danone, it appeared that the development of product-oriented ‘Good sustainable practice’ standards can be a powerful support in organising food chains that are integer: sustainable, safe and healthy. Of course many companies have their own internal standards and procedures. However, it appears to be a real challenge to formulate a set of standards and practices in such a way that they a) can be applied by more than one company, preferably the whole sector, b) are externally verifiable and certifiable, and c) indeed are accepted and trusted by other stakeholders (general public, politicians). This project actually aims to set up an equivalent of the Marine Stewardship Council or the Forest Stewardship Council certification schemes for the food processing sector. The idea is that companies – on top of minimum legal standards – check their upstream and downstream chains on problems with regard to sustainability, safety, and that standards are developed that overcome these problems. A product-oriented approach appears to be most effective in this respect. The project of course has to look how such standards can be related to eco-labelling schemes, ISO 9000 and 14000 certification procedures, etc. etc. The project has to be elaborated in an interactive way with the industries related to the product groups at stake. But (like in the SAI project) also the insights and demands of external stakeholders on their view on food integrity problems have to be taken on board in best practice development.

**Scientific Background**

The project builds on the body of knowledge in the SAI project, the MSC experience, and many other experiences in ‘green’ or ‘sustainable’ supply chain management or certification of sustainable practices. The will result in practically applicable best practice standards. However, there is also a clear knowledge development component. Self-governance by companies is a relatively new area. The project also includes a reflective learning component concerning the experiences in this project in order to make more generic lessons available with a high value for society.

**Research Tools**

See the bodies of knowledge above.

**Deliverables**

The deliverables are Good sustainable practice documents for a number of product chains or product groups, where possible institutionalised and related to major initiatives in the field (ISO, EPD, SAI, etc.). The product groups will be chosen on the basis of interest of participating companies in the overall program. Added value for industry

- Higher food safety
- More reliable supply chain
- Imago/front runner image on the field of societal responsible entrepreneurship.

**Estimated Costs (1 product group)**

Personnel: 200k€  
 Senior researchers, 1 day/wk, yr (40 days)  
 Researchers, 2 day/wk, 1 yr (80 days)

Overhead: .50 k€  
 Material cost: 16,6. k€  
 Use of Equipment: 16,6...k€  
 Knowledge transfer: 16,6k€

Total Costs: **300 k€**

Note: this is excluding time input by industry

**New in the project in terms of furthering the research field**

As indicated, the project builds on the body of knowledge in the SAI project, the MSC experience, and many other experiences in ‘green’ or ‘sustainable’ supply chain management or certification of sustainable practices. However, there is also a clear

knowledge development component. Self-governance by companies is a relatively new area. The project includes a reflective learning component concerning the experiences in this project in order to make more generic lessons available with a high value for society. This will result in new insights in how self governance within industrial systems and 'sustainable entrepreneurship' can be realised.

**New for the institutions that participate in this project**

See above. The participating institutions will expand their expertise and excellence in these fields. This project fits in the general interest and ambition of TNO-STB to contribute to transition management programmes and to link the theoretical insights on innovation processes with realising and experimenting with innovations in practice. The participating institutions have the following credentials:

- Developing the Strategic Agricultural Initiative (2001-2002, TNO-STB);
- Via the TNO/CML Centre for Chain Analysis: management of the UNEP-SETAC Life cycle initiative, the worlds leading entity on environmental chain analysis and life cycle management (certification, information flows on environmental, social and environmental issues along the value chain, and environmental product declarations)
- A large number (dozens to hundreds) of projects in the field of sustainability analyses and/or technical improvements in food production chains (TNO Voeding, TNO-STB).

**Project Name:** The (D)Innershop  
**Principal contact(s):** Dr. Arnold Tukker  
**Contributing parties:** TNO-STB

<p><b>Project Description</b></p> <p>In the so-called HiCS study (Highly Customised Solutions), that various institutes execute with support funding of the EU, a business concept has been developed in which product chains (of a.o. food) are divided into a central industrialised production part and locally organised ‘platforms’ where ‘customized solutions’ are assembled. One of the concepts proposed in HiCS is the so-called (D)Innershop. The (D)Innershop is a concept that fits with the trend that people have less and less time for all kind of things, including food cooking. It sells easy to use meal ingredients, ready-to-take meals via a take-out system, but also has a restaurant function. In the mature situation this is a chain a la the Bodyshop, and by which a whole new concept of eating has been introduced. The (D)Innershop is focussing (compare the Body shop) entirely on healthy, tasty and safe food. The concept can even be elaborated with a health institute that serves as a back-up for this chain, and that via modern IT services can monitor the food patterns of individuals, can give advices, etc. (compare the dedicated training programmes that modern tools at sport schools generate). Part of the concept can be the ‘health watch’: a device that automatically scans each food intake. The goal of this project is, in relation to the system analysis and foresight project, to develop and test this concept with companies.</p>	
<p><b>Scientific Background</b></p> <p>The project will build upon the large experience of the TNO-TU Delft Centre for Sustainable product design Kathalys, and in this case particularly the HiCS project. Basically, the projects above are examples of organising ‘sustainable business concepts’: start with a normative goal (here: food integrity), and then try to organise the business chain in such a way around it that it will inherently be driven to deliver this normatively desired result. The practical experiments in Kathalys have lead to a practical step wise approach for such projects (method description available). In this approach, many insights from the field of system analysis, foresight and forecasting, and business and value chain management are combined.</p>	
<p><b>Research Tools</b></p> <p>See the bodies of knowledge above, particularly the Kathalys-method and its successors.</p>	
<p><b>Deliverables</b></p> <p>A developed and tested concept of the (D)Innershop. The step-wise approach in the Kathalys design method implies that, depending on the depth of the approach chosen, the result is not only a plan but also a consortium that inherently wants to implement the plan.</p>	<p><b>Estimated Costs</b></p> <p>Personnel: 400k€  - Senior researchers, 2 day/wk, 2 yr (160 days)  - Researchers, 3,5 day/wk, 2 yr (280 days)  Overhead: . 100 k€  Material cost: 33 k€  Use of Equipment: 33 k€  Knowledge transfer: 33k€  Total Costs: <b>600 k€</b>  Note: this is excluding time input by industry</p>
<p><b>New in the project in terms of furthering the research field</b></p> <p>There is rather little experience in organising this form of ‘sustainable business concepts’, i.e. starting with a normative goal (here: food integrity), and then trying to organise the business chain in such a way around it that it will inherently be driven to deliver this normatively desired result. The Kathalys method is one of the first structural approaches in this field. However, the experience is still relatively limited and more cases have to be tested.</p>	

**New for the institutions that participate in this project**

See above. The participating institutions will expand their expertise and excellence in these fields. These projects fit in the general interest and ambition of TNO-STB to contribute to transition management programmes and to link the theoretical insights on innovation processes with realising and experimenting with system innovations in practice. The participating institutions have the following credentials:

- A 5-year cooperation between TNO and TU Delft in the field of sustainable systems development via the centre Kathalys, with some 10 major cases (projects of several 100,000 Euro to 1 Million) executed
- Management of TNO's sustainable development initiative
- Management of the EU Thematic Network on Sustainable Product Development (7 institutes, 30 industrial participants, 1.5 Mio Euro, the key EU entity in this field)
- Editorial board of various journals/book series (a.o. Journal of Sustainable Product Design, Eco-efficiency in Industry and Science)
- Etc.

**Project Name:** Design-tool for fresh snacks for young consumers  
**Principal Contact(s):** Dr. HSM de Vries  
**Contributing parties:** ATO, Universities of Wageningen, Amsterdam and Tilburg

**Project Description**

In food consumption, emotional, physiological, and cognitive internal states determine behavioural decisions. Their complex dependencies make consumer behaviour concerning instant and delayed gratification difficult to describe, let alone understand or predict. Because of the high frequency of the behaviour, both situational and internalised variables determine food choice. A fact- and hypothesis-driven methodology is lacking that facilitates the design of market arrangements (product plus service) that are both emotionally attractive and cognitively preferable (because of integrity arguments). In contrast, most of the 'knowledge ingredients' of such a methodology do exist. Given the amount of such data and experience, current ICT developments can now support the development of a design tool that helps to overcome the trade-off between instant and delayed gratification.

**Focus: Product group:** fresh snacks (e.g. health and dietary aspects), **Consumer segments:** young consumers (3-7 years, 8-12 and above 12 groups). **Buying situation: Impulse-buying (at and outside school, at night)**

**Usage:** The envisioned virtual design methodology helps to

- A) optimise marketing proposition through to process technology
- B) Combine the right extrinsic attributes (such as 'Fun, Global, Local) to intrinsic product characteristics
- C) leverage product sales data, and specify how to collect them.
- D) create a common language to weigh various quality aspects of all stakeholders

**Scientific Background**

- Many statistical, yet isolated knowledge on consumer preferences, business processes (e.g. manufacturing and distribution, retail-display) exist.
- Special research reports on preferences of children and their parents exist, but are not coupled to product design methodologies.
- A 'middle ware' standard for ICT capacity for 'Food Informatics' is being set (e.g. ICESKIS proposal e-science/Virtual Lab/Food Informatics) that will be applied, here.

**Research Tools**

- 'e-science/virtual lab': Food Informatics (ICES KIS II & III proposal B Hertzberger)
- dynamic quality models on safety & specs & processing as developed by this consortium
- LISREL models, i.e. used to analyse consumer behaviour and preferences.
- TRIZ methodology (MIT-valley), i.e. used to find creative solutions

**Deliverables**

- Data base for product composition (flavours, vitamins,..), microbial safety kinetics, process technologies (e.g. mild-preservation, separation tech) and properties of bio-packaging materials and related costs
- Information system for sales data (in schools and recreation areas) including situational factors

**Estimated Costs (4 years)**

Personnel: 1000 kEuro (2.5 sr. and Prof, 2 AIO's)  
 Overhead: 500 kEUR  
 Use of equipment/software: 50 kEUR  
 Material cost 25kEUR  
 Knowledge transfer: 25 kEUR  
**Total cost: 1600 kEUR**

<ul style="list-style-type: none"> <li>• Translate existing (creativity) TRIZ tools to the food domain to couple with the 2 databases mentioned above.</li> <li>• For young consumers three recipes on “paper” (virtually designed) including test procedures to collect data.</li> </ul> <p><b>Overall deliverable: design tool for fresh snacks for children.</b></p>	
<p><b>What is new in the project in terms of furthering the research field</b></p> <p>Coupling of food scientists and marketing researchers is currently taking off. In this project, theories on product design and creative innovation, such as TRIZ are translated and incorporated in the food domain, which is new.</p> <p>New consumer science methodologies can be incorporated as well: Besides classical segmenting approaches (top-down), also emergent properties for groups of consumers in certain contexts (situations and time) are studied as they result from local behavioural rules for highly heterogeneous populations. The field of complex systems has much expertise in these matters and contacts exist. Applying individual-based modelling techniques is still in its very early stages in consumer sciences, especially for the complex food domain.</p> <p>Finally, furthering the study of definitions of product (and service) quality in the food domain is a key scientific objective of this effort, as it will prove crucial for the realisation of effective design. Quality Function Deployment (QFD) is an example of a methodology that still holds a promise for the food domain to facilitate incremental improvements in food product design.</p> <p>In general it can be stated that in analogy to engineering, where process understanding should precede equipment design, in consumer sciences the understanding of psychological and sociological behaviour rules and relationships should precede the formulation of market segment, and product designs. It is this scientific underpinning that can boost the efficacy of future product design for the food sector.</p>	
<p><b>What is new for the institutions that participate in this project</b></p> <ul style="list-style-type: none"> <li>▪ ATO and the academic department of the Agro-technology and food sciences expertise group of Wageningen University and Research Centre are currently active in food science and technology. Sensory research on food products is distributed over a wider group of research institutes, notably WCFS.</li> <li>▪ For Marketing research, collaboration with the respective academic departments of Universities of Wageningen, Tilburg may be envisioned.</li> <li>▪ For psychological and sociological research, a European network is being established.</li> <li>▪ For Complex Systems studies, contacts exist with the Universite Libre de Bruxelles, (Centre for Complex &amp; Nonlinear Studies, of G Nicolis and I Prigogine), and contacts with the SantaFe institute in the US can be easily started.</li> <li>▪ For Virtual design and engineering, many small groups of scientists are active, but have not yet found the ways to tap into each others expertise.</li> </ul> <p>Consequently, this integrated research approach will cover (more disciplinary-oriented) research as described in some of the following papers:</p> <ul style="list-style-type: none"> <li>▪ B Winkless and D. Mann: Food Product Development and the 40 inventive principles; Triz-journal (2001) vol 5</li> <li>▪ De Heij, W., Van Schepdael, L., Van den Berg, R.W., Bartels, P.V. Increasing preservation efficiency and product quality through control of temperature distributions in high pressure applications. High Pressure Reserach, 22 (2002) 653-658, as basis for the virtual factory</li> <li>▪ Tijksens, L.M.M., and E.S.A. Biekman. 1999. [Modelling the quality behaviour induced by processing]. Food technology journal (2-3):86-91.</li> </ul>	

- Luyten, H., Tijssens, L.M.M.2003 Reversed engineering and the texture of food products. Proc. 3<sup>rd</sup> Int. Symp. Food Rheology and Structure, Zürich. pp xxx.

**Project Name:** Social and technological aspects of foodstuffs that aim to counteract environment-related and food-related allergies

**Principal contact(s):** Prof.dr. A.G.J. Voragen

**Contributing parties:** Animal Sciences Group WUR, ATO, WUR, TNO, Maastricht

### Project Description

**Problem:** The incidence of food and environmental allergies is on the rise in the Dutch and the Western European societies. The reasons for this increase seem to be connected with a complex of interrelated factors. Genetic predisposition to allergies and environmental modulation are key causes. The following issues can be mentioned, as examples:

- The hygiene hypothesis: as a result of minimal exposure of the developing immune system to various immunogens and allergens (considering drastic hygienic measures combined with extensive vaccination programs and antibiotic application), the immune system develops a weak regulatory network and various allergies can arise.
- Modifications in micro-flora: changes in the bacterial flora (among others by changed food habits with food products formerly not known such as kiwis and herbs) suggest a diminished protection against local infection and an increased intake of allergens.
- Respiratory and food allergies are related in the sense that respiratory allergies develop into food allergies in more than 30% of the cases, based on possible cross reactivity between allergens and specific IgE antibodies.

The increased incidence of allergies will have a large impact on the quality of life, health care costs, and economic costs as a result of the symptoms, such as loss of working days. These costs are estimated at Bn€40 in the EU alone.

#### Key questions are:

*Socially:* What is the effect of possible development of improved, hypoallergenic or immune response influencing foodstuffs on perception: acceptance, socio-economic impact, role of information and communication on food but also on other factors such as lifestyle.

*Technologically:* Is it possible to:

1. develop a new generation of hypoallergenic foods based on knowledge of structure and mutual relationships?
2. develop food ingredients based on natural raw materials which influence the T-cell mediated immune system and thereby play a decisive role in prevention of food allergies?

**Core issue** in the proposed research is connecting technological dimensions to societal dimensions, centred around the health issue of environmental and food allergies.

### Scientific Background

The project builds on:

- Knowledge of the relation between respiratory and food allergies, such as asthma and peanut allergy, and the relation between pollen allergies and fruit and vegetable allergies
- Knowledge of development of allergies in infants
- Knowledge of measurement systems to quantify allergenicity and immune modulation
- Knowledge of technological aspects (genetics, processing) on allergens
- Development of analytical methods to gain insight into social impact, for example: effects of information campaigns, realisation of additional activities such as adaptation of lifestyle.

### Research Tools:

Year 1, 2: Set-up and validation of test and measurement methods, Development of

hypoallergenic food products, Isolation, characterisation and testing of immune modulating food ingredients. Year 3: Integration of results of first two years to pilot products. Testing of products in pilot studies. Year 4: Integration of feedback in product design and second of testing.

**Deliverables:**

See research Tools & following Products:

- Knowledge of mechanisms of information and perception
- New generation of hypoallergenic food products
- Food ingredients with immune modulatory activity

**Estimated Costs:**

Personnel (2 aio's, 3sr.&Proff&assist):	1.2 M€
Overhead:	0.6 M€
Materials:	0.3 M€
Equipment	0.1 M€
<b>Total:</b>	<b>2.2 M€</b>

**New in the project in terms of furthering the research field**

A new dimension and a new perspective for the prevention and relief of symptoms of allergies can be found in a societal-driven and food technology-driven approach, in which the allergy-provoking agent, the allergen, is placed in the focus of attention. Rephrasing of this question leads to: can we look at allergens in such a way, that the occurrence of symptoms is prevented, and that societal acceptable approaches are chosen for this?

The proposal addresses two routes to achieve its goals:

- The development of a new generation of hypoallergenic foods
- The development of immune modulatory ingredients, to regulate immune response via nutrition

Aim of this program is to develop well targeted probiotics and nutraceuticals to influence the gut microflora in young children to induce an immune regulatory network based on IL-10 producing Tr-cells. The first results are encouraging, and suggest the option for prevention the "allergic march" via this approach.

*The novelty of this approach is the structured analysis of allergen and epitope structure, and to link this to the behaviour of allergens in the food production chain.*

**New for the institutions that participate in this project**

The principal contractor for the project will be the newly established (spring 2002) Allergy Consortium Wageningen (ACW). ACW is formed by the five expertise clusters of Wageningen-UR, and is unique in that it combines that expertise that is gathered WUR-wide at cutting edge technology, and in particular at the interfaces between the expertise clusters. Management of the project will be realised by prof. dr. Huub Savelkoul and dr. Harry Wichers. Alliances with partners outside ACW will be sought ad hoc and their selection will depend on specific research questions. Excellent contacts, that will be of paramount importance to implementation of the project, exist with TNO, University of Maastricht, and the CLB at Amsterdam.

*The novelty of the project for these institutions is the combination of a broad range of scientific disciplines to address this societal important development.*

**Project name:** Attractive and healthy food based on vegetable and fruit  
**Principal contact(s):** Dr. HSM de Vries  
**Contributing parties:** ATO, WUR, University of Maastricht

**Programme Description for 5 projects as defined below:**

This project is directed at aligning consumer opportunity (here, to obtain attractive and healthy food based on vegetable and fruit) with motivation. In the Netherlands, efforts to stimulate the consumption of vegetables and fruits through media campaigns have limited success. The reason for this is unknown. It is possible that the average consumer hesitates to consume large volumes or dislikes certain taste components (such as bitterness) of vegetables and fruits. The aim of this project is to ensure availability of and well-priced fruit- and vegetable-based foods with minimal sacrifice on the part of the consumer in terms of convenience and taste. In the retail and processing of vegetables and fruits into convenience foods, losses are very high (up to 30%). It might be possible to use a part of this side stream for new product development. The 5 main research **projects** are:

1. Consumer attitude. What are main reasons for the low consumption of vegetables and fruits?
2. Consumer oriented product design. Which product groups will be most attractive for design of vegetable- and fruit-based (a) convenience foods and (b) health foods?
3. Attractive new food structures. Which (new) possibilities could be applied to design those?
4. Revaluation raw materials. What type of sustainable procedures can be used to process vegetables and fruits into products that vary in characteristics such as texture, taste and colour?
5. Marketing fruit and vegetable product. What opportunities can be explored for various channels (food service, hospitals, retail, factory outlets) and for other food ingredients like dairy, meat etc.?

**Scientific Background**

The research area of minimal processing of agro raw materials such as potatoes, vegetables and fruits has been intensively addressed. Actually, this area needs to be combined with experience in consumer research and product design to develop consumer attractive new products. Besides this, it would require developing new varieties of vegetables and fruits and new processes in order to remove or mask unaccepted flavour components without changing the texture.

**Research Tools to be used**

1. Consumer research including consumer insight, preference mapping, flavour and taste tools
2. Underlying food physics & chemistry tools for products (structure analysis, barrier techn., etc.)
3. Design tools generated elsewhere in combination with vegetable and fruit processing methods
4. Environmental impact procedures (preservatives, efficient usage of raw material including plant-animal sources, energy, water, etc.

<p><b>Deliverables for each of the projects</b></p> <ol style="list-style-type: none"> <li>1. (a) up-to-date review of main reasons for low consumption (b) improved image means for vegetables and fruit</li> <li>2. (a) definition of matrix characteristics for innovative v&amp;fr snacks and (b) an overall matrix for various products</li> <li>3. (a) Design tool specified to v&amp;fr snacks, (b) 4 Proof of Principles for new generic v&amp;fr snacks and (c) defined processing procedures (focused on texture, bitterness, flavours, product ingredient interactions, stability during processing).</li> <li>4. (a) Set of sustainability indicators (losses, origin, water and energy usage) for v&amp;fr snacks, (b) relative impact of each indicator and (c) revaluation of high losses in v&amp;fr snacks at trade and processing.</li> <li>5. (a) Listed number of opportunities for food service, hospitals, retail, factory outlets and (b) handling procedures for v&amp;fr snacks, (c) spin-off opportunities for other food ingredients such as dairy, meat etc.</li> </ol> <p>Overall deliverable: Increased rate of consumption of vegetables and fruits by offering them in attractive format.</p>	<p><b>Estimated Costst</b> (for the 5 projects within this programme)</p> <table border="0"> <tr> <td>- Personnel</td> <td>1.4 mEuro</td> </tr> <tr> <td>(below)</td> <td></td> </tr> <tr> <td>- Overhead</td> <td>0.7 mEuro</td> </tr> <tr> <td>- Materials</td> <td>0.3 mEuro</td> </tr> <tr> <td>- Equipment</td> <td><u>0.2</u> mEuro</td> </tr> <tr> <td><b>- Total</b></td> <td><b>2.6 mEuro</b></td> </tr> </table> <p>(salary costs is based on 4 aio's, 3 sr. researchers (texture, fruit&amp; vegetable exp., perception, sensory, health), 1.5 technical assistant over 4 years)</p>	- Personnel	1.4 mEuro	(below)		- Overhead	0.7 mEuro	- Materials	0.3 mEuro	- Equipment	<u>0.2</u> mEuro	<b>- Total</b>	<b>2.6 mEuro</b>
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<p><b>What is new in the project in terms of furthering the research field</b></p> <p>The proposed project is new in terms of taking a consumer oriented approach. Investigating the reasons of the consumer for minimal use of vegetables and fruits in food consumption is new and a proper basis for profitable product development. Extension of the field of food technology to new processes and new food structures is important as well, especially the flexibility of production is key issue. One may expect to develop a wider range of products for the various target groups. Next, general themes within the food industry obviously will be taken into account as well for the proposed product developments such as (1) overall cost savings, (2) follow legal requirements (environment, HACCP), (3) constant quality and quality improvement, (4) innovation. This will be a combined action to follow up actions of the organisation 'Voorlichtingsbureau voor de Voeding'. That organisation has tried to stimulate the consumption of vegetables and fruit by media campaigns in 2002. The consumption has not increased significantly according to consumption surveys in the Netherlands.</p>													
<p><b>What is new for the institutions that participate in this project</b></p> <p>Wageningen UR has a track record in processing of agro raw materials such as potatoes, vegetables and fruits. Research is carried out on process technology as well as the quality of half fabricates and end products based on potatoes, vegetables or fruits. Research projects as proposed here are innovative in terms of: Combining experience in consumer research and product design. Consequently this will lead to reversed engineering concepts. It would require developing new varieties of vegetables and fruits and new processes in order to remove or mask unacceptable flavour components without changing the texture.</p>													

**Project Name:** Solving sugar-related health issues via micro structuring  
**Principal contact(s):** Prof. dr. A.G.J. Voragen  
**Contributing parties:** ATO, WUR, Universities of Maastricht and Amsterdam

**Project Description:**

The consumer intake of calories in western countries is on average too high, despite the development and consumption of so-called light products. The consumer apparently not always appreciates these light products. In low calorie soft drinks low-caloric sweeteners replace sugar. However, in other food products the emphasis was put on the reduction of fat. These low-fat products have often an increased sugar content. This high sugar content is of concern as the current consumption of sugars is linked to typical diseases in western countries. A lowering of the sugar content in various products may, therefore, offers possibilities to a more healthy diet via a diminished calorie intake, provided that the texture and taste of the product is conserved. Next to its contribution to the texture of a food, sugar primarily provides a pleasant sweet taste to the food. However, during the consumption of solid foods not all the sugar present in the food bolus will reach the taste buds in the mouth despite the mastication process. In principal it must, therefore, be possible via microparticulation, to modulate the solid food is such a way that the sugar content may be lowered without a concomitant change in the taste and texture perception. Basically the research question is whether via micro structuring of different solid food products sufficient availability of health foods with appealing convenience and taste can be assured for the consumer.

**Scientific Background:**

Although not fully understood, scientific research has shown that the texture of foods is eminent importance for the perception of taste. For many sugar containing solid foods a uniform three-dimensional distribution of sugars in the food is present. The production of specific microstructures in food products may enable a three-dimensional gradient of components over the food or over the food bolus when being eaten. It herewith creates the possibility to modulate the perception of sweetness. The development of both barrier technology as well as micro technology offers the possibilities to create concentration gradients as well as distinct differences in concentrations of different food components.

**Research Tools:**

The research plan is divided into three different tasks:

1. Effect of increased diffusion of sugars from the inside of a food bolus to the surface, thereby creating an increased sweetness perception at a similar sugar content compared to a normal food product.
2. Effect of compartibilisation of foods creating a sugar gradient over the food and/or food bolus.
3. Effect of replacement of sugars by low-caloric substitutes in combination with other ingredients in order to modulate the caloric value as well as sweetness and texture.

<p><b>Deliverables:</b></p> <ul style="list-style-type: none"> <li>- New generation of solid food products with low caloric value</li> <li>- Contribution to a diminished sugar consumption</li> <li>- Desired properties in distinct food products</li> <li>- Knowledge on relations between relations between taste perception and texture</li> </ul>	<p><b>Estimated Costs:</b></p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 60%;">- Personnel</td> <td style="width: 20%; text-align: right;">1.8 mEuro</td> <td style="width: 20%; text-align: right;">Personnel</td> </tr> <tr> <td>- Overhead</td> <td style="text-align: right;">0.9 mEuro</td> <td style="text-align: right;">Overhead</td> </tr> <tr> <td>- Materials/others</td> <td style="text-align: right;">0.4 mEuro</td> <td style="text-align: right;">Materials/others</td> </tr> <tr> <td>- Equipment</td> <td style="text-align: right;">0.2 mEuro</td> <td style="text-align: right;">Equipment</td> </tr> <tr> <td colspan="3" style="text-align: center;">-----</td> </tr> <tr> <td>-Total</td> <td style="text-align: right;">3.3 mEuro</td> <td></td> </tr> </table> <p>(salary costs is based on 4 aio's, 4.5 sr. researchers (2.5 in texture, 1 health, 1 perception), 1.5 technical assistant over 4 years)</p>	- Personnel	1.8 mEuro	Personnel	- Overhead	0.9 mEuro	Overhead	- Materials/others	0.4 mEuro	Materials/others	- Equipment	0.2 mEuro	Equipment	-----			-Total	3.3 mEuro	
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**What is new in the project in terms of furthering the research field**

The texture of different food structures is often measured by use of texture analysis techniques on the product itself. It is new to investigate the change in texture and structure and release of sugar to taste buds in the mouth despite the mastication process. This behaviour will be studied together with sensory analysis on taste perception. Time-intensity measurements are key, due to the changing sensory profile in time.

Besides this it is new to design product textures build on another texture at the inside as at the outside. Three-dimensional food structures will thus be developed. Physical and chemical changes at inner surfaces will be studied at nano-microscale. The proposed microstructuring of low sugar products will result in ways to receive a similar sweetness perception by the consumer.

**What is new for the institutions that participate in this project**

Wageningen UR has a track record in processing of food structures and textures. Some of recent research items are:

- Relation between structure, ingredient functionality and the texture and stability of food.
- Development of models to relate the product demands (consumer, texture, stability, sensory, microbial, etc.) to product formulation and process (texture on demand).
- Ingredients replacement because of allergy, GMO or other issues.
- Extrusion to change food texture.
- Continuous kneading process for dough

In ICES-KIS program research in this field need to be combined with experience in consumer research and product design at WUR and other research institutes. The research proposed here will built-up on publications of Voragen (overall reference list).

**Project Name:** Healthy ingredients using novel, sustainable separation methods  
**Principal Contact(s):** Dr. H.S.M. de Vries  
**Contributing parties:** ATO, WUR, Maastricht

### **Project Description**

Increased consumer interest towards healthy and dedicated foodstuffs is reflected in a growing impact of new, highly specified and generally small production companies. This 'down-scaling' effect implies new advanced production requirements for high-value food ingredients. Novel, dedicated, separation methodologies play a crucial role in this since they contribute to both product quality (incl. functionality) and process sustainability. Although scientifically proven for numerous non-food applications and water purification, implementation of innovative separation methods for food-ingredient production is currently highly restricted. This is mainly due to:

- raw material complexity and therefore required hybridisation of different separation methods;
- lack of background knowledge and 'proven' applications (producer *and* consumer accepted);
- lack of communication between chemical/pharmaceutical industry and food industry.

Since the potential of the (nano-technology based) methods is huge – and may not be disregarded - the envisaged project aims at:

- Determination of producer and consumer opinion and acceptance of these novel methods;
- Identification of relevant novel, highly specific separation methods to be applied for dedicated healthy food-ingredient production, with main emphasis on its advantages from a sustainable point of view;
- Screening of potential generic applications (producer and therefore consumer demands);
- Determination of pilot-scale feasibility of novel (hybrid) separation methods for maximally 5 dedicated food-ingredient applications;

Project-outcome provides insight into consumer opinion and acceptance of novel, sustainable separation methods for healthy food-ingredient production. This outcome will be linked to the opportunities for dedicated companies in this field.

### **Scientific Background**

Novel separation methods are generally first applied for chemical or pharmaceutical product purification, before even being considered for food related applications. Examples are membrane-related processes, preparative chromatography and supercritical processing. Current emphasis on nano-technology and micro-processing related to target-group specific demands speeds up these developments and applications. With the incentive of a growing interest in safe and sustainable production of more high-value ingredients, research institutes and universities have already strategically invested into new developing novel separation methods. This is illustrated by innovative ideas such as application of reverse micelles, ionic-liquids and electrostatic (dry) separation as well as the combination ('hybridisation') of complex processes (e.g. supercritical extraction with reversed micelles or combined membrane-adsorption techniques). The envisaged project combines innovative knowledge with food-specific requirements. Consumer perception, sustainability of production and performance are equally described.

### **Research Tools:**

- Literature and relevant network screening (universities, research institutes, food-ingredient producers, consumer organisations) with emphasis on what can be learned from other areas;
- Related consumer approaches in the area of mild preservation
- Integrated process and product evaluation methodologies (instrumental product characterisation, consumer panels);
- Pilot-scale facilities.

<p><b>Deliverables</b></p> <ul style="list-style-type: none"> <li>• Answer to the question whether social acceptance is relevant for these methods.</li> <li>• List of potential applications in food, based on know-how in other research areas.</li> <li>• Inventory and assessment of needed novel separation methods for healthy food production.</li> <li>• Max. 5 case studies on paper up to pilot level; insight into technological and economic feasibility.</li> </ul>	<p><b>Estimated Costs:</b></p> <ul style="list-style-type: none"> <li>• Personnel: 440 k€ (1 sr. researcher, 1 AIO), techn. Assistance)</li> <li>• Overhead: 220 k€</li> <li>• Materials: 100 k€</li> <li>• Equipment: 150 k€</li> </ul> <p><b>Total costs: 910 k€</b></p>
<p><b>What is new in the project in terms of furthering the research field</b></p> <p>Due to changing demands of consumers (functional foods, nutraceuticals, natural ingredients), changing needs of industries (process intensification) and more stringent legislation (safety, water and energy reduction) the need for new processing techniques, especially separation techniques has increased. To be able to develop new or improved separation techniques, carrying out scientific research projects is a prerequisite. These projects should –among others- aim at better understanding of the physical mechanisms that underlie the separation process in order to be able to define their opportunities and limitations. As a result scientific knowledge will become available that will also have spin-off to other working fields, e.g to catalysis or food chemistry and physics. Furthermore, research projects should be carried out that show the technical and economic feasibility of the investigated process. Finally, combining the expertise of research and industrial parties will lead to the development of complete new concepts as well as to a proper tuning of the unit operations in separation processes.</p> <p>Already several years ago research projects have started research projects that aim at developing novel separation processes or that further develop existing processes in order to apply them in the food industry. A not extensive list of research projects and related publications of ATO is given below. Potential partners such as TNO-MEP, Wageningen University (Proceskunde), TU Delft (Kluyver Laboratory), TU Eindhoven (Dep. of Chemical Engineering and Chemistry) carry out their own programs on separation processes, but are not listed.</p>	
<p><b>What is new for the institutions that participate in this project</b></p> <p>In this project the expertises of many institutes (universities, research institutes) and industrial parties are combined. As all these parties have their own specialties, collaboration will lead to the development of new combinations of separation technologies resulting in among others complete new separation concepts and process intensification. One such example is the development of Membrane Assisted Affinity Sorption for recovery of valuable compounds from by-products where adsorption and membrane processes are combined by two partners TNO-MEP, ATO and Amersham Biosciences. They combined their backgrounds with respect to respectively water treatment with MAAS, recovery of biomolecules from complex feed stocks and industrial chromatography.</p>	

**Program Name:** Consumption, trade and processing of convenience foods in sustainable manner  
**Principal contact(s):** Dr. H.S.M. de Vries, Prof. J.C.M. van Trijp  
**Contributing parties:** ATO, WUR, Universities of Amsterdam (IVAM)

#### **Program Description for 4 projects as defined below**

The product losses for fresh-convenience (fr-c; shelf life at max 5-10 days) food products are substantial. For the USA, these losses are recently quantified to be 30% of the total fresh flow. For the Netherlands, overall percentages are unknown; however, losses of 35% for leafy vegetables indicate that total losses for fr-c may as well be severe. Next, an overall reduction of 13 PJ of energy may be achievable at the food processing stage and 25% during consumption. What the (either positive or negative) impact for the shift towards convenience foods is not yet estimated. The same holds for the use of fresh water (e.g. actually up to 20 litres per kg minimally processed salads). An upsurge in fresh-convenience also leads to more and more packaging materials (in the Netherlands, for all industrial sectors currently amounting to 40 billion packages per year; the convenience sector attributes substantially to this upsurge). One may not be surprised that valorisation of fr-c waste streams is not yet attentively considered, except for bio-mass.

Key issues - to be addressed - are:

- What are the indicators (qualitative and quantitative) for the sustainable load of fr-c (at max 5-10 days shelf-life, integrated meals and minimal processed foodstuffs) at the consumer, industrial and trade level?
- Which solutions are foreseen at the short term using existing know-how and how can those be realized?
- What substantial reductions can be achieved using a sustainable innovative approach?
- What implications will this approach have for producers and for the various outlet channels such as food service (canteen, restaurants, snack bars), hospitals, retail, factory outlets?

These issues are dealt with in this program, and are addressed in the following *separate projects*:

1. Trend analysis of fresh-convenience foods, especially focusing on sustainability indicators
2. Review of current processing and handling (including at home/kitchen preparation) procedures
3. Innovative, sustainable procedures including development of a limited number of proof of principles.
4. Guidelines for handling fresh-convenience at all outlet channels.

Herewith, the overall program focuses on the balance between an increase in fresh-convenience consumption and its sustainable impact, leading to improved food integrity in the convenience sector.

#### **Scientific Background**

Consumers, producers, retail, food service and scientists are not aware (and cannot yet be) of trade-offs, here especially related to sustainable impact. For the traditional food sector, some life cycle analysis studies have been carried out for meal components; however not for integrated foodstuffs such as fresh-convenience. Also, innovative sustainable flexible processing and handling procedures do not yet exist for the rapidly growing convenience sector. The opportunities to reduce its sustainable load are therefore unknown. Guidelines do not exist. Also, introduction of ICT and micro-processing (link to nanotechnology) is not achieved so far, but may seem to be attractive because of needed flexibility and temporal shelf-life restrictions in the convenience sector.

<p><b>Research Tools to be used</b></p> <ul style="list-style-type: none"> <li>• Trend analysis and life cycle analysis tools for food components to be applied for integrated foodstuffs.</li> <li>• Processing and handling procedures for fresh convenience products.</li> <li>• Pilot-facilities for fresh-convenience foods, including monitoring equipment for sustainable impact and know-how concerning micro-processing and ICT.</li> <li>• Perception studies as developed in other projects within this businessplan.</li> </ul>	
<p><b>Deliverables for each of the projects</b></p> <ol style="list-style-type: none"> <li>1. (a) up-dated trend analysis of fresh-convenience (fr-c), (b) set of sustainability indicators for fr-c, (c) sustainability impact based on trend analysis</li> <li>2. (a) overview of processing and handling procedures for fr-c, (b) limitations of these procedures</li> <li>3. (a) scheme for realistic innovations (incl. micro-processing and ICT) leading to reduced sustainable load, (b) development of three proof of principles</li> <li>4. (a) guidelines for stakeholders, (b) implementation protocol and training of stakeholders</li> </ol> <p>Overall deliverable: quantified reduced levels of product losses, energy &amp; water use, transport miles, preservatives.</p>	<p><b>Estimated Costs (4 projects):</b></p> <ul style="list-style-type: none"> <li>- Personnel 1.0 mEuro (below)</li> <li>- Overhead 0.5 mEuro</li> <li>- Materials 0.3 mEuro</li> <li>- Equipment 0.5 mEuro</li> </ul> <p><b>Total costst: 2.3 mEuro</b></p> <p>(salary costs are based on 3 aio's, 3 sr. researchers (texture, fruit &amp; vegetables exp., perception, sensory, health), 1.5 technical assistant over 4 years)</p> <p>Option: setup of a test-demo kitchen.</p>
<p><b>What is new in the project in terms of furthering the research field</b></p> <p>Instead of gut feeling, underlying research is needed to pinpoint the bottlenecks and opportunities for an improved sustainable standard. Life Cycle Analysis or Exergy Analysis studies need to be carried out for integrated foodstuffs, based on existing knowledge for the traditional food sector, especially for meal components. Next to answering the above mentioned questions, the following topics will furthering the related research fields:</p> <ul style="list-style-type: none"> <li>- Investigation of the environmental load due to product losses, packaging material, flexible production means, etc;</li> <li>- Determination of shelf-life restrictions for integrated meals either from a microbiological, chemical or physiological origin and approaches to overcome hurdles;</li> <li>- Finding innovative solutions – that can be provided and incorporated in the convenience sector - to improve the performance of flexible production systems, e.g. the introduction of micro-processing (link to nanotechnology) and mild preservation methodologies like cold plasma, high pressure, continuous microwave and/or natural preservatives;</li> <li>- Set-up of fresh convenience food protocols for sustainability and hygiene as well as their implementation in households, chains and industry;</li> <li>- Methodology to support these developments by stakeholders and to communicate to consumer e.g. in real life in a demonstration canteen/kitchen.</li> </ul> <p>Finally, with these topics researched, one deals with the basic question of food-integrity. In what way will the consumer respond to the sustainable impact of convenience foods taking into account its trendy and convenience aspects?</p> <p>This all will further the food research field and extend our existing knowledge on consumer attitude towards and handling of convenience foods (in their own kitchen). Next, this will also include new knowledge on shelf life and intrinsic quality of integrated complex products, large-scale production and packaging processes, and insight in flexible production and logistic chains.</p>	

### **What is new for the institutions that participate in this project**

For this project, the institutions that participate in this project have experience in shelf life and intrinsic quality of meal *components*, food processing methodologies, packaging, logistics, environmental issues and sensory science. The extension towards integrated meals, flexible micro-processing based production means and at home/food-service handling is new. The latter will now lead to a chain approach that includes the consumer as active participant as well. Except for sensory science and human physiology, this direct relation between consumer and production has previously not been established. This may be regarded as an additional challenge comparable to the research on the acceptance of new preservation processes and products, such as new protein ingredients.

Other new approaches include:

- from a physical-chemical and sensorial point of view, one will from now on deal with source-sink relations between meal components during handling (e.g. transfer of ingredients and water from one product towards the other and vice versa);
- from a flexible processing point of view one will deal with zero-loss concepts, water and energy recycling systems, hygiene issues and from batch to continuous production means based on product orders by consumer (via retail or food service);
- from a logistic point of view one addresses the complexity problem of minimizing transport kilometers for the various convenience chains.

**Project Name:** A monitor for consumer sentiment to food  
**Principal contact(s) :** Prof. JCM van Trijp, Prof. WF van Raaij  
**Contributing parties** Universities of Wageningen and Tilburg

**Project Description**

The popular statement is that consumer confidence in food is decreasing, due to many factors including the distance between consumption and production. However, data to support this contention are scarce. Yet, both for marketing and public policy it is of crucial importance to track changes in consumer sentiment to food, to understand the reasons and consequences of such changes and to build consumer-evidence based strategies to respond to such changes. The aim of this project is (1) to build such monitor at the national level, (2) to understand the determinants and consequences of consumer sentiment to food, and (3) to develop and test selective marketing and governmental strategies to influence consumer sentiment to food.

**Scientific Background**

The project will build on the literatures of economic and psychological indices for consumer sentiment and satisfaction. For example, in several countries (e.g. US, Sweden) there is a tradition of national consumer satisfaction indices. These monitors will form an important inspiration for the present project as these are typically conducted at the aggregate level as well as the level of specific product sectors within the economy. We will refine these measures for our specific purposes, particularly the link to food and food integrity. From this we will learn how satisfied consumers are with the delivery of various food categories in terms of several dimensions including intrinsic product quality and dimensions of food integrity (e.g. safety, healthiness, sustainability etc.). The tracking of these satisfaction measures over time allows us to build the understanding why sentiment changes over time and what strategies can be adopted to achieve this.

**Research Tools**

- Literature review and focus groups
- Psychometric scale development and analysis
- Econometric analyses to account for changes over time
- Experimentation on effect of marketing and public strategy on consumer sentiment

**Deliverables:**

- A national consumer satisfaction barometer for food
- Understanding of changes over time in consumer sentiment to food
- Insight into most appropriate marketing and public policy to affect consumer sentiment

**Estimated Costs (4 years):**

- Personnel: : 250 K€
- Overhead 50 K€
- Material cost 200 K€
- Use of equipment 50 K€
- Knowledge transfer 25 K€

**Total costs 575 K€**

**New in the project in terms of furthering the research field**

In many areas outside the food domain, scientific tools have been developed to monitor consumer appreciation of product and service delivery (e.g. national customer satisfaction index) as well as sentiment toward the economy (Index of Consumer Sentiment). Such monitoring tools provide a good basis to track developments and evaluate effectiveness of strategies and policies. For foods such scientific monitoring tools don't exist and hence they are developed within this project.

**New for the institutions that participate in this project**

The tool to be developed requires integration between two fields of research: economic psychology and food marketing. To our knowledge collaborations between these two fields of expertise are virtually non-existent despite the great potential given the economics importance of the food sector in the Netherlands.

**Project Name:** Innovation templates for (health) foods  
**Principal investigator:** Prof. JCM van Trijp, Prof. AGJ Voragen  
**Contributing parties:** Wageningen, Maastricht, ATO

**Project Description**

Idea generation is a crucial step in the product development process of new health foods. Many companies rely on highly unstructured approaches such as brainstorm-sessions. In the psychological literature there is a growing awareness that this is not a very efficient and effective approach (“the illusion of group productivity”). Several studies in more high tech industries show that more structured approaches based on the notion of innovation templates (e.g Goldenberg 2001) are more successful in generating innovation success. However, these innovation templates do not directly translate to the food domain (Michaut, 2000). The aim of this project is to refine the innovation template approach to the development of health foods, using the principle of learning by analogy. It will result in new innovation templates that can be applied for more successful product innovation in the food domain.

**Scientific Background**

The project will build on the Goldenberg approach to innovation templates for high tech products. It will translate these templates to the food domain. Goldenberg identified five principle templates for product innovation and has extended these finding to templates for successful advertising approaches. We will refine these templates for foods, to build a structured approach for health food communication and product innovation. These templates will be applied to food innovation databases and linked to market success of these innovations. We will test whether the superiority of structured innovation extends to the food domain and develop best practice for idea generation and early screening of new food product concepts.

**Research Tools**

- Literature review and focus groups
- Concept development for food innovation
- Experimentation to test effectiveness of template-based food innovations

**Deliverables:**

- A template-based innovation approach to for food product innovation and communication strategy
- Best practice for structured innovation in the food domain

**Estimated Costs (4 years):**

- Personnel:	:	175 K€
- Overhead		50 K€
- Material cost		200 K€
- Use of equipment		50 K€
- Knowledge transfer		25 K€
<b>Total costs</b>		<b>500 K€</b>

**New in the project in terms of furthering the research field**

Outside the food domain, the innovation templates have proven a very powerful tool to increase innovation success rates. However, first experiences have shown that the existing templates do not directly translate into the food domain, but rather require an adjustment. This project will adapt the innovation templates for the food domain and validate them against market success.

**New for the institutions that participate in this project**

Food innovation by definition require a balanced input between what is feasible from a technological point of view and what is desirable from a market(ing) point of view. This project integrates those two functional disciplines around a common tool of innovation templates, thus contributing to improved collaboration that the marketing – R&D interface and stimulating beta-gamma interaction.

**Project name:** How intrinsic and extrinsic consumer motivations combine in food choice behaviour

**Principal contact(s):** Prof. CAMJJ van den Hondel, Prof. van Trijp, Prof. van der Pligt

**Contributing parties:** ATO, TNO, WUR, Univ. Amsterdam, Tilburg

<p><b>Project description</b></p> <p>Human food choice behaviour is under the control of both intrinsic (direct gratification derived from taste, convenience etc.) and extrinsic (delayed gratification derived from health, safety, sustainability etc.) motivation. We aim to understand how these two sorts of motivations are interrelated and traded off by consumers and how they interact in perceptions, attitudes and behaviour. For example, to what extent and under what conditions do consumers want to trade off taste and convenience for health and sustainability? How do consumers form perceptions of healthiness and sustainability and how do these relate to product features?</p> <p>Aim of this project is to:</p> <ol style="list-style-type: none"> <li>1. Understand intrinsic and extrinsic motivations for food choice and their interrelationship</li> <li>2. Understand how credence, experience and search attributes drive intrinsic and extrinsic motivations</li> <li>3. Understand how perceptions and motivations find their basis in product features</li> <li>4. Develop reverse engineering procedures to optimise product features for perception</li> </ol>	
<p><b>Scientific Background</b></p> <p>Psychological literature (e.g. Deci and Ryan) has revealed that extrinsic motivations (such as integrity) combine and interact with intrinsic motivations (such as taste and consumption pleasure). Through their product features, foods trigger consumer (benefit) perceptions that are relevant to both intrinsic and extrinsic motivations (e.g. Steenkamp and Van Trijp, 1996). Hence for food design, it is critically important to understand the exact nature between features, benefits and motivations and how the complex of these relationships affects choice behaviour. Such understanding should allow for reverse engineering for optimal integrity in food choice behaviour. The project builds on research traditions in motivational psychology (Deci and Ryan), Quality Guidance (Steenkamp and Van Trijp), Informational and inferential belief formation (Fishbein and Ajzen) and reverse engineering (Moskowitz).</p>	
<p><b>Deliverables:</b></p> <ol style="list-style-type: none"> <li>1. Methods to disentangle the food product contribution to intrinsic and extrinsic consumer motivations</li> <li>2. Models to reverse engineer food products such that food integrity is not hindered by negative expectations on intrinsic motivation (e.g. taste)</li> </ol>	<p><b>Estimated Costs</b></p> <ul style="list-style-type: none"> <li>• Personnel: 350 K€</li> <li>• Overhead: 105 K€</li> <li>• Material cost: 75 K€</li> <li>• Use of equipment: 5 K€</li> <li>• Knowledge transfer: 30 K€</li> </ul> <p><b>Total Costs 565 k€</b></p>
<p><b>What is new in the project in terms of furthering the research field</b></p> <p>The concept of intrinsic and extrinsic motivation as developed in motivational and organisational psychology has had little application in the food domain. This project achieves exactly that and combines it with the aim to make these insights actionable for physical new product design</p>	
<p><b>What is new for the institutions that participate in this project</b></p> <p>The institutions that participate in this project each have their specific strengths in certain sub-domains such as psychology, consumer behaviour and food design that need to be integrated for this project's objective. So far, this systematic combination and integration of expertises between the institutions has not yet been achieved.</p>	

**Project Name:** DATACHAT, Consumer tool to ensure product keepability

**Principal contact(s):** Prof.dr. A.G.J. Voragen  
**Contributing parties:** ATO, WUR

<p><b>Project Description</b>  The Datachat project is on developing a chip that deals with all relevant surrounding conditions (eg Temperature) and directly translates these into information for the supply chain and also the consumer, eg about the keepability, and the logistic consequences, of the food product.  Key questions are:  - Till what moment is it safe for a consumer to eat food with limited keepability?  - What is the best moment for consumption?  - What kind of information do consumers want and in what way?  The aim of this project is to improve the consumers trust in perishable products.</p>	
<p><b>Scientific Background</b>  Most research on Tracking and Tracing deals with chains that go (downstream) no further than the retailer. The new element of Datachat is that it becomes possible to directly communicate with consumers through a chip on the food-packaging. No longer estimated keepabilities (bases on estimated, average chain conditions) but real time keepabilities.</p>	
<p><b>Research Tools</b>  Laboratory for development of quality decay models especially for meat and vegetables. Laboratory for the development of sensor and communication technology. Laboratory for simulation of supply chain and logistic issues.  Focus groups and concept tests with consumers.</p>	
<p><b>Deliverables</b>  - Programming quality decay models in hardware  - Combining communication- and sensor technology  - Miniaturisation of energy sources  - Datachat chip combined with ID-tech.  - Passive Datachat chip  - Active Datachat chip  - Consumer relevant and appealing Datachat</p>	<p><b>Estimated Costs</b>  - 0.8 staffmember/4 years research 200k€  - overhead 200k€  - software/hardware/ chips/batteries 100k€  - consumer studies 80k€  <b>Total 580k€</b></p>
<p><b>What is new in the project in terms of furthering the research field</b>  Combining communication- and sensor technology  Direct communication with consumers  Measuring real time keepability</p>	
<p><b>What is new for the institutions that participate in this project</b>  Post harvest chain management is thus far based on single or sometimes double expertise approaches e.g. either physiology or packaging or logistics. New solutions are needed that integrate these fields and include motivations of all relevant stakeholders. This study will allow ATO to make a step forward in the development of post harvest precision chains, taking consumer interest into account.</p>	

**Project Name:** Differentiation of integer foods on intrinsic product quality  
**Principal contact(s):** Prof.dr. AGJ Voragen  
**Contributing parties:** ATO, WUR, University of Amsterdam

**Problem definition**

Often it is difficult to recognise quality aspects of fresh products by the outside appearance. This is valid for experts but even more so for consumers. To allow batch differentiation based on aspects such as expected shelf-life, food safety, sensory quality, ecological production or even animal welfare it is necessary to develop a monitoring tool based on intrinsic aspects. The results of this monitoring can be translated into a hallmark that ensures specific integrity aspects. In addition, such a monitoring tool can be used to enhance specific product characteristics, e.g. by applying smart post-harvest (storage) conditions. For instance: the amount of oxygen during apple storage influences the sensory component 'sour'.

**Our aim is:** To develop means for batch differentiation of fresh and minimally processed products in order to allow identification by professionals or consumers of integer food and food products. An important target group for this new development is the restaurant sector. Top cuisiniers will be able to select fresh products of guaranteed high quality or even order products with specific sensory characteristics.

**Scientific Background**

The project will build on state of the art knowledge in the fields of product/plant physiology, production and distribution chain logistics, sensory science, ICT, Bioinformatics, genomics, mathematics and quality change modelling. Knowledge from these fields will be combined into a new research field that can be described as 'Quality Dynamics'. This research field will add a new and needed dimension to crop science. It will identify the main metabolic routes that affect post-harvest quality and describe how regulation of these routes is influenced by post-harvest handling. This project will focus on a few plant products for which post harvest quality changes are an important factor for processing or consumer preference. In addition research will be conducted into the influence of pre- and post-harvest conditions on various sensory characteristics and into the feasibility of providing fresh products with custom-sensory profile, upon demand by e.g. restaurants. The results will form a proof of concept for the effectiveness of the described approach.

**Research Tools**

- consumer preference study to identify important integrity aspects
- chain analysis to identify economically important traits for processing industry
- detailed analysis of intrinsic product aspects in order to make links between these characteristics and integrity features
- development of mathematical quality change models to predict effect of condition changes given a defined initial quality

**Deliverables**

- proof-of-concept for batch differentiation based on intrinsic parameters
- proof of concept for custom sensory profiled products
- enhanced knowledge on quality dynamics and its biological background

**Estimated Costs**

Salary costs	
(2 aio, 1 senior scientist, 4 years)	450 kEuro
Consumables	200 kEuro
Equipment	50 kEuro
Knowledge transfer	<u>50 kEuro</u>
	<b>950 kEuro</b>

**What is new in the project in terms of furthering the research field:**

- Development of the research field of Quality Dynamics as part of crop science
- Integration of sensory science and molecular profiling

**What is new for the institutions that participate in this project**

Post harvest chain management is thus far based on single or sometimes double expertise approaches. New solutions are needed that integrate these fields and include motivations of all relevant stakeholders. This study will allow ATO to make a step forward in the development of post harvest precision chains, taking consumer interest into account.

**Project Name:** Utilizing post-harvest handling for optimizing health aspects and quality of fresh products  
**Principal contact(s):** Prof. dr. A.G.J. Voragen; Dr. HSM de Vries  
**Contributing parties:** ATO, WUR, University of Maastricht

<p><b>Problem definition</b>          Post harvest treatments such as cold storage, modified atmosphere storage and minimal processing influence the metabolic processes that are still active in the fresh product. The effect of post harvest treatments depends on the type of treatment and on the initial quality of the product. Accurate knowledge on these metabolic effects will allow a large reduction in post harvest quality decline and, more specific, will allow steering of several important quality characteristics. For instance it is possible to modify the concentration of important health-related metabolites such as glucosinolates and vitamin C by changing post-harvest conditions. Processing characteristics such as sugar content in potatoes or firmness of tomatoes also depend on post harvest conditions.</p> <p><b>Our aim is:</b>          To develop means for post-harvest batch differentiation of fresh and minimally processed products in order to optimally meet the demands of retailers, consumers and processing industry. In this project we will focus on health-related aspects of food quality, such as vitamin concentration.</p>													
<p><b>Scientific Background</b>          The project will build on state of the art knowledge in the fields of product/plant physiology, production and distribution chain logistics, sensory science, ICT, Bioinformatics, genomics, mathematics and quality change modelling. Knowledge from these fields will be combined into a new research field that can be described as 'Quality Dynamics'. This research field will add a new and needed dimension to crop science. It will identify the main metabolic routes that affect post-harvest quality and describe how regulation of these routes is influenced by post-harvest handling. This project will focus on a few plant products for which post harvest quality changes are an important factor for processing or consumer health. The results will form a proof of concept for the effectiveness of the described approach.</p>													
<p><b>Research Tools</b></p> <ul style="list-style-type: none"> <li>- consumer preference study to identify preferred health traits</li> <li>- chain analysis to identify economically important traits for processing industry</li> <li>- detailed analysis of post harvest metabolic processes in de selected products in varying post-harvest conditions</li> <li>- development of mathematical quality change models to predict effect of condition changes given a defined initial quality</li> </ul>													
<p><b>Deliverables</b></p> <ul style="list-style-type: none"> <li>- proof-of-concept for post-harvest quality management</li> <li>- Ability to optimize health status of fresh produce</li> <li>- Enhanced knowledge on quality dynamics and its biological background</li> <li>- Quality change models</li> </ul>	<p><b>Estimated Costs</b></p> <table border="0"> <tr> <td>Salary costs (1 aio, 0.5 senior)</td> <td style="text-align: right;">235 kEuro</td> </tr> <tr> <td>Overhead</td> <td style="text-align: right;">115 kEuro</td> </tr> <tr> <td>Materials</td> <td style="text-align: right;">100 kEuro</td> </tr> <tr> <td>Equipment</td> <td style="text-align: right;">15 kEuro</td> </tr> <tr> <td>Knowledge transfer</td> <td style="text-align: right;"><u>50 kEuro</u></td> </tr> <tr> <td></td> <td style="text-align: right;">515 kEuro</td> </tr> </table>	Salary costs (1 aio, 0.5 senior)	235 kEuro	Overhead	115 kEuro	Materials	100 kEuro	Equipment	15 kEuro	Knowledge transfer	<u>50 kEuro</u>		515 kEuro
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<p><b>What is new in the project in terms of furthering the research field</b></p> <ul style="list-style-type: none"> <li>-Development of the research field of Quality Dynamics as part of crop science</li> <li>-Integration of biochemistry with chain management in order to produce custom-made fresh products.</li> </ul>													

**What is new for the institutions that participate in this project**

Post harvest chain management is thus far based on single or sometimes double expertise approaches. New solutions are needed that integrate these fields and include motivations of all relevant stakeholders. This studie will allow ATO to make a step forward in the development of post harvest chains, taking consumer interest into account.

**Project name:** Selection and further development of (mild) preservation techniques using outcomes of studies on consumer/ citizen acceptability of development and application of these techniques

**Principal contact(s) :** Prof. C.A.M.J.J. van den Hondel

**Contributing parties:** TNO, ATO

**Project Description**

This project focuses at further development of (mild) preservation technologies and selection food stuffs for further application of these technologies. Aim of this project is to develop:

- Study the possibilities to further develop new (mild) preservation techniques based on the outcome of studies on consumer acceptability. Identifying the technologies and products that have a high level of acceptability level
- tools to allow efficient and effective feed back of consumers during the development and application process.
- Further develop some application of these accepted technologies and products with effective feed back of consumers

**Scientific Background**

The project will build on state of the art knowledge of (mild) preservation technologies and knowledge regarding consumer guidance and trade-off of requirements from all stakeholders using Quality Function Deployment during the development process.

**Research Tools**

Quality Function Deployment  
 Application of selected new (mild) preservation techniques (PEF, UHP, HIL, e-beam, plasma-technology) on specific selected products

**Deliverables**

- Structured translation of consumer requirements in technological requirements
- Better understanding of technological strength and weaknesses of the innovative (mild) preservation technologies
- Detailed research programs for high potential innovative (mild) preservation technologies

**Estimated Costs**

Personnel: 250 k€  
 Overhead: 50 k€  
 Material cost 50 k€  
 Equipment: 25 k€  
 Knowl.transf. 25 k€  
**Total cost 400 k€**

**New in the project in terms of furthering the research field**

The application of new (mild) preservation technologies as well as new combinations of these technologies will bring new insight and knowledge to the field of mild conservation. This together with knowledge regarding consumer guidance and trade-off of requirements from all stakeholders using Quality Function Deployment during the development process will make the evaluation in the future more efficient and focussed.

**New for the institutions that participate in this project**

Further analysis of the possibilities of a great variation of preservation technologies , better understanding of technology strength and weakness together with Structured translation of consumer requirements in technological requirements swill give TNO better opportunities for their task as translator of knowledge to application by Dutch and international; food industries



# Appendix B: Participating researchers and research groups

## Index:

Prof.dr. C.A.M.J.J. van den Hondel	TNO-Nutrition
Prof.dr. J. van der Pligt	University of Amsterdam
Prof.dr. W.F. van Raaij	Tilburg University
Prof.dr. W.H.M. Saris	University of Maastricht
Prof.dr.ir. R.E.H.M. Smits	Utrecht University
Prof.dr. J.C.M. van Trijp	Wageningen University (Social Sciences)
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**Personal information**

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 Work address: TNO Nutrition and Food Research Institute  
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**Degrees**

1971 MsC, Biochemistry, Graduated at the State University of Utrecht,  
*Main subject: Biochemistry, Second subject: Microbiology.*  
 1976 PhD, *Thesis: Localization of the structural genes and regulatory  
 elements on the genome of bacteriophage M13*  
 1997 - Professor at the University of Leiden, *Research topic: Molecular-  
 Genetics, Cell Biology and Genomics of filamentous fungi*

**Positions held**

1971 – 1975 PhD study at the Laboratory of Molecular Biological of Catholic  
 University of Nijmegen,  
 1975 – 1981 Post-doctoral fellow at the Institute of Molecular Genetics of the  
 State  
 University of Utrecht, *Research topic: Development and application  
 of a molecular-genetic analysis-system for cyanobacteria.*  
 1981 – present Permanent-position at TNO Nutrition and Food Research Institute  
 1985 Head of the *Aspergillus*-research group consisting of 14 scientists  
 and eight technicians  
 1997 Head of the workgroup Microbial Biotechnology comprising four  
 research groups working on Gene Technology of lower Eucaryotes  
 like filamentous fungi and yeast's  
 2003 - Principal scientist of TNO Nutrition and Food Research Laboratory  
 involved in leading programmes on Food research, Food safety, Food  
 Preservation, Nutri-, Food-safety- and Microbial-Genomics  
 1997 Professor at the University of Leiden  
 Head of the workgroup Molecular-Genetics and Cell Biology of  
 filamentous fungi  
 2003 Head of the section of Metabolomics of Filamentous fungi and  
 Plants

**Membership of professional bodies**

- Member of the organizing committee of the EMBO-Workshops on Gene-Expression in Filamentous Fungi held in 1984, 1986, 1989, 1991, 1993, 1995.

- Coordinator of a Concerted-Action project of seven European groups funded by the E.U. (framework III. Biotech program).
- Coordinator of a Research Project of seven European groups funded by the E.U.- Biotech (framework III. Biotech program).
- Coordinator of a Concerted-Action project of 38 European groups funded by the Framework IV Biotechnology program.
- Deputy-coordinator of a Research Project, EUROFUNG I, of 28 European groups funded by the Framework IV Biotechnology program.
- Coordinator of a Research Project, EUROFUNG II, of 28 European groups funded by the Framework V Biotechnology program.
- Workgroup leader within the "research school" BSDL of the Filamentous Fungal research project.
- Member of the scientific committee of the Institute of Biology of the University of Leiden.
- Member of the board of the Mycological section of the Dutch Society of Microbiology.
- Chairmen of the organizing committee of the 2nd European Conference of Fungal Genetics (1994).
- Chairmen of the Scientific committee of the 4<sup>th</sup> (1998), 5<sup>th</sup> (2000), 6<sup>th</sup> European (2002) and 7<sup>th</sup> Conference (2004) of Fungal Genetics.
- Member of several consumer committees for research projects of the Dutch Foundation for Technical Sciences (STW).
- Member of the scientific committee of "het Centraal bureau voor Schimmelcultures" (KNAW institute).
- Chairman of the "judgment committee on Microbiology" from ALW-NW
- Editor of Molecular and General Genetics.
- Member of the scientific commission of the First and second International Nutrigenomics Conference (2002 and 2003).
- Member of the scientific commission of the 8<sup>th</sup> Fungal Biology Conference (2002).
- Editor of Molecular and General Genetics, since 1985. Reviewer of articles submitted for Nature, science, Cell, PNAS and other scientific journals.

### **Research Grants and awards**

Grants have been obtained from the following sources:

Netherlands: NOW, ALW, STW, IOP, (B)TS

Europe: EC - BAp, BEP, Framework 3, 4, 5

Industries: Unilever, DSM, Hoffman-la Roche, Novozyme, BASF, Hanssen, Dyadic, Rhone-Polenc, Amylum, Alco, Biochemie, Genencor.

Senior Research Fellow TNO, March 1994; Second appointment as Senior Research Fellow TNO, 1999.

### **Research interests**

*Microbial and toxicological and aspects of food safety.*

*Consumer Science*

Consumer Risk Perception and Risk Information Systems (integration of scientific assessment and consumer perception of risks)

Consumer-led Product development: initial and advanced design of Foods (health, safety, convenience)

Determinants of consumer food choice behavior Sensory Science

Sensory informatics in particular preference modeling

Sensory aspects of satiety and post prandial wellness

Physiology of perception

### Research on food preservation

Genomics (Transcriptomics, Proteomics, Metabolomics and bioinformatics) of lower Eukaryotes and Plants.  
Molecular-Genetics, Cell biology and Biochemistry of Lower Eukaryotes and Prokaryotes.

### Selection of papers in peer reviewed journals

- Van den Hondel, C.A. & J.G.G. Schoenmakers (1973). Cleavage of bacteriophage M13 DNA by *Haemophilus influenzae* endonuclease-R. *Mol. Biol. Rep.* 1, 41.
- Van den Hondel, C.A. & J.G.G. Schoenmakers (1975). Studies on bacteriophages M13 DNA I. A. cleavage map of the M13 genome. *Eur. J. Biochem.* 53, 547.
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- Van den Hondel, C.A., Pennings, L. & J.G.G. Schoenmakers (1976). Restriction-enzyme-cleavage maps of bacteriophage M13: Existence of an intergenic region on the M13 genome, *Eur. J. Biochem.* 55, 212.
- Van den Hondel, C.A. & J.G.G. Schoenmakers (1976). Cleavage maps of the filamentous bacteriophages M13, fd, fl, and ZJ2, *J. Virol.* 18, 1034.
- Van den Hondel, C.A.M.J.J. (1976) Localisation of structural genes and regulatory elements on the genome of bacteriophage M13. Thesis.
- Van den Hondel, C.A.M.J.J., Keegstra, W., Borrias, W.E. & G.A. van Arkel (1976). Homology of plasmids in strains of unicellular cyanobacteria, *Plasmid* 2, 323.
- Van den Hondel, C.A.M.J.J., Verbeek, S., van der Ende, A., Weisbeek, P.J., Borrias, W.E. & G.A. van Arkel (1980), Introduction of the transposon Tn901 into a plasmid of *Anacystis nidulans*: Preparation for cloning in cyanobacteria, *Proc. Nat. Acad. Sci. USA* 77, 1570.
- Van den Hondel, C.A.M.J.J. & G.A. van Arkel (1980). Development of a cloning system in cyanobacteria, *Anthonie van Leeuwenhoek*, 46, 228.
- Reaston, J., van den Hondel, C.A.M.J.J., van der Ende, A., van Arkel, G.A., Stewart, W.P.D. & M. Herdman (1980). Comparison of plasmids from the cyanobacterium *Nostoc* PCC 7524 with two mutants strain unable to form heterocysts, *FEMS Microbiol. letters* 9, 185.
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- Kuhlemeier, C.J., Borrias, W.E., van den Hondel, C.A.M.J.J. & G.A. van Arkel (1981). Vectors for cloning in cyanobacteria: Construction and characterization of two recombinant plasmids capable of transformation to *Escherichia coli* K12 and *Anacystis nidulans* R-2", *M.G.G.* 184, 249.
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### Group represented

At the **TNO Nutrition and Food Research Institute** a multidisciplinary team consisting of expert in the fields of chain management, risk management, risk assessment, consumer science and sensory science, Food safety research and Food preservation will carry out the proposed research on consumer involvement for optimal chain

management, post prandial wellness and trade off of intrinsic and extrinsic motivations in food choice behavior. During the last 10 years the members of this team have been involved in front-line research projects dealing with research focused on understanding psychological and physiological determinants of consumer food choice behavior and translation of this knowledge into integrated design of healthy and safe foods, understanding the dynamics of chains and the exchange of information to reduce the potential consequences of food safety incidents, development of new and advance methods to measure and interpret microbial and toxicological food safety data, and develop and evaluate new preservation methods including the impact on public acceptance. Extension of these studies will be the topics which will be studied in the proposed program.

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**Positions held**

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1984–1987            Senior Lecturer, Institute for Environmental Studies, Free  
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1977–1978            British Council Scholarship, Institute of Psychiatry, University of  
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### **Memberships of professional bodies**

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Member Committee preparing the Research Assessment Exercise of Psychology Research in the Netherlands, 1993  
Member Quality Control Committee on Research Assessments in Psychology, History, Biology, and Engineering, 1994–1995
- *Netherlands Science Foundation (NWO)*  
Member, Committee on Environmental Sciences, 1985–1988  
Vice Chair, Committee on Social and Organizational Psychology, 1986–1990  
Member, Medical Sciences Committee (MEDIGON; Preventive Medicine) 1991–1993  
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Member, Foundation for Economic, Social and Geographical Sciences, Research Committee, 1994–1996  
Member, Selection Committee postdoctoral fellowships in Behavioral and Social Sciences (MaGW), 1996–1997  
Chair, Research Audit Committee, Netherlands Institute of the Study of Criminality and Law Enforcement (NISCALE/NSCR), 1996  
Member, Program Committee National Research Program ‘Energy and Sustainability’, 1998–  
Member Program Committee National Research Program ‘Nutrition, Sustainability and Health’, 1998–  
Member, Program Committee of the National Research Program ‘Profetas: Protein Foods, Environment, Technology, and Society’, 1999–2002
- *National Research Programs*  
AIDS Research committee (Scientific Steering Group), 1989–1994  
Member, Committee National Research Program on Global Climate Change, 1989–1995  
Chair, Research Appraisal Committee, Netherlands’ Institute of the Study of Criminality and Law Enforcement (NISCALE/NSCR), 2000
- *Ministry of Justice*  
Chair appraisal committee of research on high security prisons in the Netherlands, 2000–
- *National Advisory Council for Environmental Research (RMNO)*  
Social Science Research Committee (GAMIN), 1994–1995
- *Social Psychology Association (ASPO)*  
Member since 1982  
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- *European Association of Decision Making (EADM)*  
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- *Society for Experimental Social Psychology (SESP)*  
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- Member of Editorial Board, *Gedrag en Gezondheid* ('Behavior and Health') (1986–)
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- Member of Editorial Board, *British Journal of Social Psychology* (1989–1994)
- Member of Editorial Board, *European Journal of Social Psychology* (1990–1994)
- Member of Editorial Board, *Tijdschrift voor Sociale Gezondheidszorg* ('Journal of Public Health') (1993–1998)
- Member of Editorial Board, *Journal of Behavioral Decision Making* (1994–)
- Member of Editorial Board, *Milieu* ('Journal of Environmental Sciences') (1994–1995)
- Member of Editorial Board, *British Journal of Health Psychology* (1996–)
- Member of Editorial Board, *Risk, Decision, and Policy* (2000–)
- Guest editor of Special Issue of *Journal of Environmental Psychology* (1990, 10, 99-176). 'Psychological Fallout from the Chernobyl Nuclear Accident' (with C. Midden).
- Guest editor of Special Issue of *Acta Psychologica* (1992, 80, 1–350). 'Current Themes in Psychological Decision Research' (with O. Huber, J. Mumpower, & P. Koele).
- Guest editor of Special Issue of *Journal of Applied Social Psychology* (1998, 28, 1313-1464) 'Expectancy value models of attitudes and behavior' (with A.S.R. Manstead).
- Guest editor of Special Issue of *Acta Psychologica* (2000, 104, 281-417) 'Decision Making' (with P. Koele, H.V. Teigen, and G. Wu).
- Guest editor of Special Issue of *Acta Psychologica* (2001, 108, 91-207) 'Time and Judgment' (with P. Roelofsma).

#### Research grants and awards

1984–1986	NWO (Netherlands' Science Foundation) 'Public reactions to contaminated soil' (co-principal investigator) fl. 150,000
1985	Department of the Environment (VROM) 'Cost-benefit analysis of noise reduction programs' (principal investigator) fl. 50,000
1985–1986	European Foundation for the Improvement of Living and Working Conditions 'Public perception of technological risks' (co-principal investigator) fl. 70,000
1986–1987	Department of the Environment (VROM) 'Public reactions to contaminated soil and policy solutions' (co-principal investigator) fl. 110,000
1987	Department of Interior Affairs 'The development of Risk communication programs around hazardous facilities' (co-principal investigator) fl. 180,000
1987–1991	Dutch Health Research Council (RGO) 'Aids in heterosexual high risk groups: Psychological and medical characteristics' (co-principal investigator) fl. 1,300,000

1988–1989	Department of the Environment (VROM) ‘Developing a Risk Communication Manual’ (co-principal investigator) fl. 200,000
1988–1992	NWO (Netherlands' Science Foundation) ‘Attitudinal Judgment and Willingness-to-pay’ (co-principal investigator) fl. 250,000
1989–1993	NWO (Netherlands' Science Foundation) ‘Categorization processes and attitudinal change’ (co-principle investigator) fl. 250,000
1989–1993	Department of Psychology, University of Amsterdam ‘False consensus: antecedents and consequences’ (principal investigator) fl. 200,000
1989–1991	Dutch Health Research Council (RGO) ‘Models of preventive health behavior applied to sexual risk taking’ (principal investigator) fl. 230,000
1989–1996	EC ERASMUS Student Exchange Program on Applied decision-making research (principal coordinator) average annual grant fl. 20,000
1990–1993	Dutch Health Research Council (RGO) ‘Perceived risk, unrealistic optimism and AIDS-preventive behavior among adolescents’ (principal investigator) fl. 250,000
1991-1995	NWO (Netherlands' Science Foundation) ‘Expectations and Illusory Correlation’ (principal investigator) fl. 250,000
1991–1993	Department of Health (Research Program on Determinants of Health) ‘Adolescents and health risks: framing, risk perception and behavior’ (principal investigator). fl. 250,000
1993–1997	NWO (Netherlands' Science Foundation) ‘Assimilation and Contrast in Social Judgment (co-principal investigator) fl. 230,000
1994–1998	Department of Psychology, University of Amsterdam ‘The role of regret and disappointment in decision-making’ (principal investigator). fl. 240,000
1998–2000	European Science Foundation (ESF) ‘Research Network on reasoning and decision-making (co-principal coordinator) fl. 80,000
1999–2004	NWO (Netherlands' Science Foundation) ‘Regret and Disappointment over time’ (principal investigator) fl. 250,000
2000–2004	NWO (Netherlands' Science Foundation). ‘Food related consumer judgment and decision making (in collaboration with the University of Maastricht and Wageningen University and Research Center) (co-principal coordinator) fl. 1,400.000.
2000–2004	NWO (Netherlands' Science Foundation). ‘Food related decisions of policy makers and consumers (in collaboration with the Free University, Amsterdam, Twente University and University of Groningen) (co-principal coordinator) fl. 1,500.000.

## Research interests

### *Attitudes*

- structure of attitudes
- expectancy value-models of attitudes
- attitude change processes

### *Decision under uncertainty*

- risk perception and risk acceptability
- role of (anticipated) emotions in judgment and decision making
- risk perception and preventive health behavior

### **Selection of papers in peer-reviewed journals**

- Eiser, J.R. & Van der Pligt, J. (1979) Beliefs and values in the nuclear debate. *Journal of Applied Social Psychology*, 9, 524-536.
- Eiser, J.R., Van der Pligt, J. & Gossop, M. (1979) Categorization, attitudes and memory for the source of attitude statements. *European Journal of Social Psychology*, 9, 243-251.
- Van der Pligt, J. & Van Dijk, J.A. (1979) Polarization and preference for judgmental labels. *European Journal of Psychology*, 9, 233-241.
- Eiser, J.R., Gossop, M. & Van der Pligt, J. (1980) Drug attitudes and discrimination between drugs among a group of English school-children. *Drug and Alcohol Dependency*, 5, 57-62.
- Van der Pligt, J. & Eiser, J.R. (1980) Negativity and descriptive extremity in impression formation. *European Journal of Social Psychology*, 10, 415-419.
- Eiser, J.R. & Van der Pligt, J. (1982) Accentuation and perspective in attitudinal judgment. *Journal of Personality and Social Psychology*, 234-238.
- Van der Pligt, J., Van der Linden, J. & Ester, P. (1982) Attitudes to nuclear energy: Beliefs, values and false consensus. *Journal of Environmental Psychology*, 2, 221-231.
- Eiser, J.R., Van der Pligt, J. & Friend, P. (1983) Adolescents' arguments for and against smoking. *Journal of the Institute of Health Education*, 21, 73-78.
- Ester, P., Mindell, C., Van der Linden, J. & Van der Pligt, J. (1983) The influence of living near a nuclear power plant on beliefs about nuclear energy. *Zeitschrift für Umweltpolitik*, 6, 349-362.
- Spears, R., Eiser, J.R., & Van der Pligt, J. (1983). Nuclear Energy and its alternatives: Attitudes and beliefs in South West England. *Architectural Psychology Newsletter*, XIII, 11-13.
- Van der Pligt, J. & Eiser, J.R. (1983) Actors' and observers' attributions, self-serving bias and positivity bias. *European Journal of Social Psychology*, 13, 95-104.
- Van der Pligt, J. & Eiser, J.R. (1983) Value connotations, perspectives and self-perception. *European Journal of Social Psychology*, 13, 127-141.
- Van der Pligt, J., Ester, P. & Van der Linden, J. (1983) Attitude extremity, consensus and diagnosticity. *European Journal of Social Psychology*, 13, 437-439.
- Van der Pligt, J. (1984) Attributions, false consensus and valence: Two field studies. *Journal of Personality and Social Psychology*, 46, 57-68.
- Van der Pligt, J. & Eiser, J.R. (1984) The attribution of traits to self and others: Situationality versus uncertainty. *Current Psychological Research and Reviews*, 3, 45-51.
- Van der Pligt, J., Eiser, J.R. & Spears, R. (1984) Public attitudes to nuclear energy. *Energy Policy*, 12, 302-306.
- Van der Pligt, J. & Taylor, C. (1984) Trait Attribution: evaluation, description and attitude extremity. *European Journal of Social Psychology*, 14, 211-221.
- Eiser, J.R. & Van der Pligt, J. (1985) Attitudinal and social factors in adolescent smoking: In search of peer group influence. *Journal of Applied Social Psychology*, 14, 348-363.
- Eiser, J.R., Van der Pligt, J., Raw, M. & Sutton, S.R. (1985) Trying to stop smoking: Effects of perceived addiction, attributions for failure and expectancy of success. *Journal of Behavioral Medicine*, 8, 321-341.
- Spears, R., Van der Pligt, J. & Eiser, J.R. (1985) Illusory correlation and the perception of group attitudes. *Journal of Personality and Social Psychology*, 48, 863-875. (Corrections to Spears et al. in *Journal of Personality and Social Psychology*, 49, 1437.
- Van der Pligt, J. (1985) Public attitudes to nuclear energy: Salience and anxiety. *Journal of Environmental Psychology*, 5, 87-97. Reprinted in T. O'Riordan (Ed.). (1995). *Readings in Environmental Psychology: Perceiving Environmental Risk.*, pp. 91-102. London: Academic Press.
- Van der Pligt, J. (1985) Energy conservation: Two easy ways out. *Journal of Applied Social Psychology*, 15, 3-15.
- Van der Pligt, J. & Eiser, J.R. (1985) Nuclear energy, beliefs, values and acceptability. *Interdisciplinary Science Reviews*, 10, 147-150.

- Eiser, J.R. & Van der Pligt, J. (1986) Attribution, expectancy of success and smoking cessation. *Journal of Social and Clinical Psychology, 4*, 60-70.
- Eiser, J.R. & Van der Pligt, J. (1986) "Sick" or "hooked": Smokers' perception of their addiction. *Addictive Behaviors, 11*, 11-15.
- Spears, R., Van der Pligt, J. & Eiser, J.R. (1986) Evaluation of nuclear power and renewable alternatives as portrayed in UK local press coverage. *Environment and Planning (A), 18*, 1639-1647.
- Spears, R., Van der Pligt, J. & Eiser, J.R. (1986) Generalizing the illusory correlation effect. *Journal of Personality and Social Psychology, 51*, 1127-1134.
- Van der Pligt, J., Eiser, J.R. & Spears, R. (1986) Attitudes to nuclear energy: Familiarity and salience. *Environment and Behavior, 18*, 75-93.
- Van der Pligt, J., Eiser, J.R. & Spears, R. (1986) Construction of a nuclear power station in one's locality: Attitudes and salience. *Basic and Applied Social Psychology, 7*, 1-15.
- Spears, R., Eiser, J.R. & Van der Pligt, J. (1987) Further evidence for expectation-based illusory correlations. *European Journal of Social Psychology, 17*, 253-258.
- Spears, R., Van der Pligt, J. & Eiser, J.R. (1987) Sources of evaluation of nuclear and renewable energy contained in the local press. *Journal of Environmental Psychology, 7*, 31-43. Reprinted in T. O'Riordon (Ed.) (1995). *Readings in Environmental Psychology: Perceiving Environmental Risk*, pp. 195-208. London: Academic Press.
- Van der Pligt, J., Eiser, J.R. & Spears, R. (1987) Comparative judgments and preferences: The influence of the number of response alternatives. *British Journal of Social Psychology, 26*, 269-280.
- Van der Pligt, J., Eiser, J.R. & Spears, R. (1987). Nuclear waste: Facts, fears and attitudes. *Journal of Applied Social Psychology, 17*, 453-470.
- Eiser, J.R., Van der Pligt, J. & Spears, R. (1988) Local opposition to the construction of a nuclear power station: Differential salience of impacts. *Journal of Applied Social Psychology, 18*, 654-663.
- Eiser, J.R., & Spears, R., Webley, P. & Van der Pligt, J. (1988) Local residents' attitudes to oil and nuclear developments, *Social Behaviour, 3*, 237-53..
- Van der Pligt, J. (1988) Applied decision research and environmental policy. *Acta Psychologica, 68*, 293-311.
- Eiser, J.R., Van der Pligt, J. & Spears, R. (1989) Local residents' attributions for nuclear decisions. *Basic and Applied Social Psychology, 10*, 141-148.
- Hooykaas, C., Van der Pligt, J., van Doornum, G.J.J., Van der Linden, M.M.D., & Coutinho, R.A. (1989). Heterosexuals at risk for HIV: Differences between private and commercial partners in sexual behavior and condom use. *AIDS, 3*, 525-532.
- Spears, R. Eiser, J.R. & Van der Pligt, J. (1989) Attitude strength and the perceived prevalence of attitude positions. *Basic and Applied Social Psychology, 10*, 43-55.
- Van der Pligt, J. (1989) Transgressive decision making: Prospects and boundaries. *Acta Psychologica, 69*, 71-75.
- Eiser, J.R., Hannover, B, Mann, L., Morin, M., Van der Pligt, J., Webley, P. (1990). Nuclear attitudes after Chernobyl: A cross-national study, *Journal of Environmental Psychology, 10*, 101-110. Reprinted in T. O'Riordon (Ed.) (1995). *Readings in Environmental Psychology: Perceiving Environmental Risk*, pp. 103-112. London: Academic Press.
- Van der Pligt, J., & Midden C.J.H. (1990). Chernobyl: Four years later, *Journal of Environmental Psychology, 10*, 91-99
- Van Schie, E.C.M., & Van der Pligt, J. (1990). Problem presentation, frame preference and risky choice. *Acta Psychologica, 95*, 243-259.
- Hooykaas, C., Van der Linden, M.M.D., van Doornum, G.J.J., Van der Velde, F.W., Van der Pligt, J., & Coutinho, R.A. (1991). Limited changes in sexual behaviour of heterosexual men and women with multiple partners in the Netherlands. *AIDS Care, 3*, 21-30..
- Richard, R., & Van der Pligt, J. (1991). Factors affecting condom use among adolescents *Journal of Community and Applied Social Psychology, 1*, 105-116.
- Van der Velde, F.W. , & Van der Pligt, J. (1991). AIDS-related health behaviour: Coping, protection motivation and previous behaviour. *Behavioral Medicine, 14*, 429-451.

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- Hartgers, C., van den Hoek, J.A.R., Coutinho, R.A., & Van der Pligt, J. (1992). Psychopathology, stress and HIV-risk among drug users. *British Journal of Addiction*, 87, 857-865
- Martijn, A.C., Spears, R., Van der Pligt, J., & Jakobs, E. (1992). Negativity and positivity effects in person perception and inference: Ability versus morality. *European Journal of Social Psychology*, 22, 453-464.
- Otten, W., & Van der Pligt, J. (1992). Risk and Behavior: The mediating role of risk-appraisal. *Acta Psychologica*, 80, 325-346.
- Van der Velde, F.W., Hooykaas, C. & Van der Pligt, J., (1992). Risk perception and behavior: Pessimism, realism and optimism about AIDS-related behavior. *Psychology and Health* 6, 23-38.
- Van Schie, E.C.M., Van der Pligt, J., & Van Baaren, K. (1993). Judging risk behaviour and risk preference: The role of the evaluative connotation of risk terms, *European Journal of Social Psychology*, 23, 597-611.
- Bonini, N., Van Schie, E.C.M., Van der Pligt, J., & Legrenzi, P. (1994). Gli effetti della manipolazione del contesto di giudizio sull'invarianza della stima probabilistica dell'accadimento di eventi. *Giornale Italiano di Psicologia*, 21, 1, 47-61.
- Bosveld, W., Koomen, W., & Van der Pligt, J. (1994). Selective exposure and the false consensus effect: The availability of similar and dissimilar others. *British Journal of Social Psychology*, 33, 457-466.
- Van der Pligt, (1994). Healthy thoughts about unhealthy behaviour? *Psychology and Health*, 9, 187-190.
- Van der Pligt, J., & Richard, R. (1994). Changing adolescents' sexual behaviour: perceived risk, self-efficacy and anticipated regret. *Patient Education and Counseling*, 23, 187-196.
- Van der Velde, F.W., Van der Pligt, J., & Hooykaas, C. (1994). Perceiving AIDS-related risks: Accuracy as a function of differences in actual risk. *Health Psychology*, 13, 25-33.
- Van Eijndhoven, J.C.M., Weterings, R.A.P.M., Worrell, C.W., De Boer, J., Van der Pligt, J., & Stallen, P.J.M. (1994). Risk communication in the Netherlands: The Monitored Introduction of the EC 'Post Seveso' Directive. *Risk Analysis*, 14, 1, 87-96.
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- Van Schie, E.C.M., Martijn, C., & Van der Pligt, J. (1994). Evaluative language, cognitive effort and attitude change. *European Journal of Social Psychology*, 24, 707-712.
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- Hartgers, C., van den Hoek, J.A.R., Coutinho, R.A., & Van der Pligt, J. (1995). Psicopatología, estrés y comportamiento de riesgo de HIV del consumo endovenoso en adictos a las drogas. *Revista de Toxicomanías*, 2, 3-11.
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- Van Schie, E.C.M., & Van der Pligt, J. (1995). Influencing risk-preference in decision-making: The effects of framing and salience. *Organizational Behavior and Human Decision Processes*, 63, 264-275.
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- Richard, R., Van der Pligt, J., & De Vries, N.K. (1996). Anticipated affect and behavioral choice *Basic and Applied Social Psychology, 18*, 111-129.
- Richard, R., Van der Pligt, J., & De Vries, N.K. (1996). Anticipated regret and time perspective: Changing sexual risk-taking behavior. *Journal of Behavioral Decision Making, 9*, 185-199.
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- Van der Pligt, J. (1996) Risk perception and self-protective behaviour. *European Psychologist, 1*, 34-43.
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- Zeelenberg, M., Beattie, J., Van der Pligt, J., & De Vries, N.K. (1996). Consequences of regret aversion: Effects of expected feedback on risky decision making. *Organizational Behavior and Human Decision Processes, 65*, 148-158.
- Stapel, D.A., Koomen, W., & Van der Pligt, J. (1997). Categories of category accessibility: The impact of trait versus exemplar priming on person judgments. *Journal of Experimental Social Psychology, 33*, 44-76.
- Van Dijk, W., & Van der Pligt, J. (1997). The impact of probability and magnitude of outcome on disappointment and elation. *Organizational Behavior and Human Decision Processes, 69*, 277-284.
- Berndsen, M., Spears, R., C. McGarty & Van der Pligt, J. (1998). Dynamics of differentiation: Similarity as the precursor and product of stereotype formation. *Journal of Personality and Social Psychology, 74*, 1451-1463.
- Manstead, A.S.R. & Van der Pligt, J., (1998). Should we expect more from expectancy-value models of attitude and behaviour? *Journal of Applied Social Psychology, 28*, 1313-1316.
- Richard, R., De Vries, N.K., & Van der Pligt, J. (1998). Anticipated regret and precautionary sexual behavior. *Journal of Applied Social Psychology, 28*, 1411-1428.
- Van der Pligt, J. (1998). Perceived risk and vulnerability as predictors of precautionary health behaviour. *British Journal of Health Psychology, 3*, 1-14.
- Van der Pligt, J., & De Vries, N.K. (1998). Belief importance in expectancy-value models of attitudes. *Journal of Applied Social Psychology, 28*, 1339-1354.
- Van der Pligt, J., & De Vries, N.K. (1998). Expectancy-value models of health behaviour: The role of salience and anticipated affect. *Psychology & Health, 13*, 298-305.
- Van der Pligt, J., Van Schie, E.C.M., & Hoevenagel, R. (1998) Understanding and valuing environmental risk: The effects of availability and anchoring on judgment. *Zeitschrift für Experimentelle Psychologie, 45*, 286-302.
- Van der Pligt, J., Zeelenberg, M., Van Dijk, W.W., De Vries, N.K., & Richard, R. (1998). Affect, attitudes, and decisions: Let's be more specific. In W. Stroebe & M. Hewstone (Eds.), *European Review of Social Psychology, Vol. 8*, pp. 33-66. Chichester: John Wiley & Sons.
- Zeelenberg, M., Van der Pligt, J., & Manstead, A.S.R. (1998). Undoing regret on Dutch Television: Apologizing for interpersonal regrets involving actions or inactions. *Personality and Social Psychology Bulletin, 24*, 1113-1119.
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- Zeelenberg, M., Van Dijk, W.W., Van Empelen, P., Reinderman, D., Van der Pligt, J., & Manstead, A.S.R. (1998). Emotional reactions to the outcomes of decisions: The role

- of counterfactual thought in the experience of regret and disappointment. *Organizational Behavior and Human Decision Making*, 75, 117-141.
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- Van Dijk, W., Zeelenberg, M., & Van der Pligt, J. (1999). Not having what you want versus having what you don't want: The impact of type of negative outcome on the experience of disappointment and related emotions. *Cognition and Emotion*, 13, 129-148.
- Van Dijk, W.W., Van der Pligt, J., & Zeelenberg, M. (1999). Effort invested in vain: The impact of effort on the intensity of disappointment and regret. *Motivation and Emotion*, 23, 203-220.
- Van Harreveld, F., Van der Pligt, J., & De Vries, N.K. (1999). Attitudes toward smoking and the subjective importance of attributes: Implications for changing risk-benefit ratios. *Swiss Journal of Psychology*, 58(2), 65-72.
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- Berndsen, M., McGarty, C., Van der Pligt, J., & Spears, R. (2001). Meaning-seeking in the illusory correlation paradigm: The active role of participants in the categorization process. *British Journal of Social Psychology*, 40, 209-233.
- Berndsen, M., & Van der Pligt, J. (2001). Time is on my side: Optimism in intertemporal choice. *Acta Psychologica*, 108, 173-186.
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- Van Dijk, W.W., Zeelenberg, M., & Van der Pligt, J. (2002). Blessed are those who expect nothing: Lowering expectations as a way of avoiding disappointment. *Journal of Economic Psychology* (in press).
- Berndsen, M., Van der Pligt, J., Doosje, B., & Manstead, A.S.R. (2002). Guilt and regret: The determining role of interpersonal and intrapersonal harm. *Cognition and Emotion* (in press).

### Group represented

The **Social Psychology Research Unit, University of Amsterdam** has a long standing track record in basic and applied research in social psychology. Current research programs that are most relevant to the present proposal concern the antecedents of perceived risk and the acceptability of risk, expectancy-value approaches to human judgment and choice, and the role of moral norms and (anticipated) emotions in attitudinal judgment. Both basic and applied research at the department addresses these themes, including a number of Ph.D.'s and post-doctoral fellows. This research is funded by National Science Foundations as well as national and international applied research programs on issues such as health risks and behaviour, traffic and risk behaviour, and the acceptability of technological risk. In the recent national research assessment exercise the program received the highest possible score (only 2 out of 61 programs in psychology obtained this score in the Netherlands).

*Program title:*

“The Bases of Human Social Behavior: Judgment and Decision-Making, Emotion, and Social Identity”

*Size of the group:*

Senior staff: 10; Postdoctoral fellows: 3; Ph.D.'s: 12.

*Research:*

The heart of our research program concerns two research domains: *social cognition*, with special emphasis on social judgment, attitudinal, and decision-making processes, and *emotion*, with special emphasis on the role played by social and cultural factors in shaping the emotion process.

*Ph.D. output:*

Over the past 10 years approximately 25 Ph.D.'s obtained their degree. These dissertations addressed both basic and more applied issues.

*Current Research Projects:*

The group participates in a number of NWO-research programs on issues such as social perception, decision-making and the regulation of emotions. It also participates in the NWO-program on food safety and sustainability as well as in EC-research programs.

*Editorial and related activities*

Staff is represented in a wide variety of international journals on social psychology, decision-making and health psychology. Staff is also active as assessors for science foundations in the Netherlands, UK, US and Australia.

**Personal Information**

Name                      Willem Frederik van Raaij  
Date of birth            December 16, 1944  
Place of birth            Brummen, Gld., The Netherlands  
Nationality              Dutch  
Work address            Department of Behavioral and Social Sciences,  
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                                 5131 RK Alphen N.Br., The Netherlands  
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                                 (married, four children)

**Degrees**

1966                      B.Sc., University of Leiden, Netherlands (Psychology)  
1969                      M.Sc., University of Leiden, Netherlands (Psychology)  
                                 (Data Theory, Psychology of Work & Organization)  
January 13, 1977      Ph.D., University of Tilburg (Katholieke Hogeschool Tilburg)  
                                 Dissertation: 'Consumer Choice Behavior: An Information-  
                                 Processing Approach'  
                                 Supervisor: Gery M. van Veldhoven (University of Tilburg).  
                                 Committee members: J.M. (Hans) Dirken (Delft University of  
                                 Technology), John B. Rijsman (University of Tilburg), Jagdish N.  
                                 Sheth (University of Illinois at Urbana-Champaign, USA), and  
                                 Paul J. Willems (University of Tilburg)

**Positions held**

2000– present        Professor of Economic Psychology, University of Tilburg, The  
                                 Netherlands  
1993–2000            Professor of Marketing Management, Department of Management,  
                                 Erasmus University, Rotterdam  
1979–1993            Professor of Economic Psychology, Department of Economics,  
                                 Erasmus University, Rotterdam  
1977–1979            Associate Professor, Department of Psychology, Section Economic  
                                 Psychology, University of Tilburg  
1976-1977            Visiting Assistant Professor, Department of Business  
                                 Administration, University of Illinois, Urbana-Champaign, USA  
1972–1976            Assistant Professor, Department of Psychology, Section Economic  
                                 Psychology, University of Tilburg  
1970–1972            Assistant Professor, Technical University of Twente, Enschede  
1966–1969            Research Assistant, Department of Psychology, Section Data Theory,  
                                 University of Leiden

## **Membership of Professional bodies**

- Member of the Nederlands Instituut van Psychologen (NIP) [Institute of Psychologists], Amsterdam (1970-1982)
- Member of the Nederlandse Vereniging van Marktonderzoekers (NVvM), later: Marktonderzoek Associatie (MOA) [Market Research Association], Amsterdam (1972-present)
- Member of the (American) Association for Consumer Research (ACR), Provo, Utah, U.S.A. (1973-present)
- Member of the European Marketing Academy (EMAC), Brussels (1975-2000)
- Member of the International Association for Research in Economic Psychology (IAREP), Exeter, U.K. (1975-present)
- Member of the Society for Advancement of Behavioral Economics (SABE), Newark, NJ, U.S.A. (1984-1989)
- Member of the Society for the Advancement of Socio-Economics (SASE), Washington, DC, U.S.A. (1989-1993)
- Member of the International Association of Applied Psychology (IAAP), Oxford, U.K. (1989-present), and chairman of division 9 (Economic Psychology)
- Member of the Nederlands Instituut voor Marketing (NIMA), Amsterdam (1990-present)
- Chairman of the GVR Centrum voor Marketingcommunicatie, Amsterdam (1999-present)
- Praeses of the Nederlandse Interacademiale Organisatie van Psychologiestudenten in Nederland (NIOPS), Leiden (1967-1968)
- Member of the Preparation Committee National Research Program Rationeel Energieverbruik Gebouwde Omgeving (REGO) by Integraal Ontwerpen, Projectbureau Energieonderzoek, Apeldoorn (1980-1982)
- Member of the scientific staff of the European Doctoral Colloquium Marketing, Copenhagen Business School, Copenhagen, Denmark (1981)
- Member of the Executive Committee of the International Conferences on Consumer Behaviour and Energy Policy (Banff, Alberta, Canada, en Noordwijkerhout) (1981-1983)
- Chairman of the Advisory Committee Bestedingenindex [Expenditures Index], Economisch Instituut voor het Midden- en Kleinbedrijf (EIM), 's-Gravenhage (1982-1984)
- Member of the Program Committee, 1983 Conference of the Association for Consumer Research, Chicago, IL, U.S.A. (1982-1983)
- Chairman of the program committee of the annual conference of the European Marketing Academy (EMAC), Nijenrode, Breukelen (1983-1984)
- Member of the Working Group Informative Value of Advertising, Committee for Consumer Affairs, Sociaal-Economische Raad (SER), 's-Gravenhage (1983-1986)
- Board member and chairman of the Consumentenbond, 's-Gravenhage (1983-1989)
- Member of the Scientific Advisory College for Media Research, Stichting Onderzoek Massacommunicatie, Bussum (1984-1991)
- Member of the Advisory Board, Society for Advancement of Behavioral Economics, Newark, NJ, U.S.A. (1984-1989)
- Member of the Scientific Committee of the annual conference of the European Marketing Academy (EMAC), Bielefeld, West-Germany (1985), Bradford, U.K. (1988), Athens (Greece) (1989), Innsbruck (Austria) (1990), Stockholm, Sweden (1998), Berlin, Germany (1999), and Rotterdam, The Netherlands (2000)
- Member of the Advisory Council of Science & Strategy, Amsterdam-Utrecht (1985-present)

- Chairman of the Stichting Research, Direct Marketing Instituut Nederland (DMIN), Amsterdam (1988-2001)
- Member of the Board of ECOZOEK, Werkgemeenschap of NWO, the Nederlandse Organisatie voor Wetenschappelijk Onderzoek, 's-Gravenhage (1988-1991)
- Member of the Advisory Board of the Stichting Beheer Voedingswaardewijzer, Utrecht (1988-1989)
- Member of the Organizing Committee of the international conference Consumer Satisfaction/Dissatisfaction and Complaining Behavior, Scheveningen (1988-1989)
- Chairman of the Stichting Continu Vakantie Onderzoek (CVO) of the Nederlands Bureau voor Toerisme, Leidschendam, and the Nederlands Research Instituut voor Recreatie en Toerisme, Breda (1988-2000)
- Organizer of the Europese conference of the Association for Consumer Research, Amsterdam (1992)
- Member of the Academic Advisory Group of the Consumer Research Unit, University of Birmingham, Department of Commerce, U.K. (1990-1997)
- Member of the scientific staff of the EMAC European Doctoral Colloquium in Marketing, University of Dublin, Ireland (1991), Cergy-Pontoise, France (1995), Budapest, Hungary (1996), and Warwick, Coventry, U.K. (1997)
- Member of the College of Experts, Hof van Justitie, Amsterdam, Van Tuin Limonade-fabrieken versus Marcel van Dam and VARA (1993-1997).
- President of the International Association for Research in Economic Psychology (1993-1995)
- Member of the Program Committee, 1996 Conference of the Association for Consumer Research, Tucson, Arizona, U.S.A. (1995-1996)
- Member of the Advisory Council of the Association for Consumer Research, Provo, Utah, U.S.A. (1995-1997)
- Program chairperson of the 24th International Research Seminar on Marketing, Marketing Communications and Consumer Behavior, La Londe les Maures, Rivière, France: Institut d'Administration des Entreprises d'Aix-Marseille, (1995-1997).
- Member of the scientific staff for the course European Economics, Fudan University, Shanghai, VR China (sponsored by the Confederation of European Union Rectors' Conferences, Brussels) (1996).
- Member of the Program Committee, 1997 European Conference of the Association for Consumer Research, Stockholm, Sweden (1996-1997).
- Program chairperson of the 24th International Research Seminar on Marketing: Marketing Communications and Consumer Behavior, Institut d'Administration des Entreprises d'Aix-en-Provence, Université d'Aix-Marseille, France (1996-1997)
- Member of the Scientific Committee of the XXII International Colloquium of Economic Psychology IAREP, Valencia, Spain (1996-1997).
- Member of the Wetenschappelijk Forum Detailhandel, Hoofdbedrijfschap Detailhandel, 's-Gravenhage (1996-present).
- Member of the Board of the Nederlandse Organisatie voor Bedrijfskundig Onderzoek (NOBO), Enschede (1997-1999).
- Member of the Wetenschapscommissie of the Nederlands Instituut voor Wetenschappelijke Informatiediensten (NIWI), KNAW, Amsterdam (1997-1998).
- Member of the Advisory Committee for the Statistics of Income and Consumption, Centraal Bureau voor de Statistiek, Voorburg (1987-1993)
- Member of the Committee Prijsindexcijfer, Centraal Bureau voor de Statistiek, Voorburg (1999-2001)
- Member of the Curatorium of the Stichting Wetenschappelijk Onderzoek Commerciële Communicatie (SWOCC), University of Amsterdam (2001-present)

- Member of the editorial board of the *Journal of Psychology Gedrag*, Nijmegen (1973-1985)
- Member of the editorial board of the *Tijdschrift voor Marketing*, Nederlands Instituut voor Marketing (NIMA), Kluwer, Deventer (1975-1978)
  - Editor of the *Jaarboek of the Nederlandse Vereniging van Marktonderzoekers*, later: *Jaarboek of the Nederlandse Vereniging voor Marktonderzoek en Informatiemanagement*, Amsterdam (1978-2000)
  - Member of the editorial board of the *Journal of Consumer Research*, Los Angeles, CA, U.S.A. (1978-1987)
  - Editor of the *Journal of Economic Psychology*, Elsevier Science Publishers, Amsterdam (1979-1990)
  - Resource editor of the *Annals of Tourism Research*, Menomonie, WI, U.S.A. (1982-1993)
  - Member of the Editorial Review Board of the *Journal of Macromarketing*, Burnaby, BC, Canada (1982-1993)
  - Editor of the journal *Massacommunicatie*, Nijmegen (1985-1996)
  - Editor of the *Journal of Global Marketing*, Harrisburg, PA, U.S.A. (1987-1993)
  - Editor of the *Maandblad voor Accountancy en Bedrijfseconomie (MAB)*, Groningen (1989-2001)
  - Member of the Editorial Board of the *International Journal of Research in Marketing*, Leuven, Belgium (1990-1993)
  - Member of the Editorial Board of the *Journal of Consumer Psychology*, Urbana-Champaign, IL, U.S.A. (1991-present)
  - Member of the Editorial Board of *Applied Psychology: An International Review*, Haifa, Israël (1991-2002)
  - Editor of a special issue 'Economic Psychology of Travel and Tourism' of the *Journal of Travel & Tourism Marketing*, New York: The Haworth Press, U.S.A. (1992-1994)
  - Member of the Herausgeberbeirat of *Marketing. Zeitschrift für Forschung und Praxis*, Koblenz, Germany (1993-present).
  - Associate editor of the *Journal of Marketing Communications*, Belfast, U.K. (1993-present)
  - Member of the Editorial Board of the *CEMS Business Review*, Jouy-en-Josas, France (1994-2000).
  - Member of the editorial board of the *Journal of Business Research*.(1997-2000)
  - Member of the editorial board of the *Corporate Reputation Review*, Londen (1997-2000).
  - Founder and research director of ERIM, Erasmus Research in Management, research institute of the departments of Management and Business Economics, Erasmus University, Rotterdam (1995-2000)
  - Member of the management team, responsible for research, at the Department of Management, Erasmus University, Rotterdam (1995-1999)

## Research Interests

### *Consumer Behavior*

- Structure of consumer motivation
- Expectancy value-models of attitudes
- Attitude change processes
- Consumer information processing
- Communication and persuasion processes
- Financial services

### *Decision under uncertainty*

- Risk perception and risk acceptability
- Information acquisition

### *The use of new media (Internet)*

- Consumer information search
- Internal and external pacing

- Integrated communication
- Media synergy

### Publications (Books)

- W.F. van Raaij, *Geprogrammeerde Instructie Wiskunde*. Voorschoten: VAM, 244 pp., ISBN 90 405 4004 7. Five editions, 1966-1983.
- W.F. van Raaij, *Geprogrammeerde Instructie Matrix-Algebra*. Voorschoten: VAM, 1974, 182 pp., ISBN 90 405 4009 8.
- W.F. van Raaij, *Consumer Choice Behavior: An Information-Processing Approach*. Tilburg: Katholieke Hogeschool, 1977, dissertation, 205 pp.
- W.F. van Raaij, *Geprogrammeerde Instructie Moderne Wiskunde*. Overberg (Amerongen): Delta Press, 229 pp., ISBN 90 6674 806 0, Three editions, 1983-present.
- P. Ester, G. Gaskell, B. Joerges, C.J. Midden, W.F. van Raaij & T. de Vries (Eds.), *Consumer Behavior and Energy Policy*. Amsterdam - New York: North-Holland, 1984, 441 pp., ISBN 0444 86849 6.
- B. Wierenga & W.F. van Raaij, *Consumentengedrag: Theorie, Analyse en Toepassingen*. Leiden: Stenfert Kroese, 1988, 291 pp., ISBN 90 207 1574 7.
- W.F. van Raaij, G.M. van Veldhoven & K.-E. Wärneryd (Eds.), *Handbook of Economic Psychology*. Dordrecht: Kluwer Academic Publishers, 1988, 683 pp., ISBN 90 247 3720 6.
- J. Beijk & W.F. van Raaij, *Schemata: Informatieverwerking, Beïnvloedingsprocessen en Reclame* (pre-advies). Amsterdam: VEA, Nederlandse Vereniging van Erkende Reclame-Adviesbureaus, 1989, 112 pp., ISBN 90 72512 03 0.
- J.M.G. Floor & W.F. van Raaij, *Marketing-Communicatie Strategie*. Leiden: Stenfert Kroese, 597 pp., ISBN 90 207 1916 5, Four editions, 1989-2002.
- G. Antonides, W.A. Arts & W.F. van Raaij (Eds.), *The Consumption of Time and the Timing of Consumption. Toward a New Behavioral and Socio-Economics*. Amsterdam: North-Holland, 1991, 285 pp., ISBN 0 444 85733 8.
- R.G.M. Pieters & W.F. van Raaij, *Reclamewerking*. Leiden: Stenfert Kroese, 1992, 394 pp., ISBN 90 207 2178 X.
- W.F. van Raaij & G.J. Bamossy (red.), *European Advances in Consumer Research. Volume 1*. Provo, Utah: Association for Consumer Research, 1993, 574 pp., ISBN 0-915552-31-0.
- W.F. van Raaij & G. Antonides, *Consumentengedrag. Een Sociaal-Wetenschappelijke Benadering*. Utrecht: Lemma, 672 pp., ISBN 90 5189 328 0; Three editions, 1994-2002.
- W.F. van Raaij, G. Schuijt, J. Stappers, J. Wieten, C. van Woerkum & C. of ther Linden (Eds.), *Communicatie en Informatie. Een Stand van Zaken*. Houten: Bohn Stafleu Van Loghum, 1994, 324 pp., ISBN 90 313 1596 6.
- J.C. Crotts & W.F. van Raaij (Eds.), *Economic Psychology of Travel and Tourism*. New York: The Haworth Press, 1994, 133 pp., ISBN 1-56024-705-3.
- W.F. van Raaij, *Geïntegreerde Communicatie. Een Ontvangersperspectief* Utrecht: Lemma, 1995, 46 pp., ISBN 90 5189 541 0.
- M.J. Evans, L. Moutinho & W.F. van Raaij, *Applied Consumer Behaviour*. Harlow, U.K.: Addison-Wesley, 382 pp., ISBN 0-201-56501-3. Two editions, 1996-1998.
- G. Antonides, W.F. van Raaij & S. Maital (Eds.), *Advances in Economic Psychology*. Chichester, U.K.: John Wiley & Sons, 1997, 314 pp., ISBN 0-471-97087-5.
- W.F. van Raaij, A.G. Woodside & A. Strazzieri (Eds.), *Proceedings 24th International Research Seminar in Marketing: Marketing Communications and Consumer Behavior*. Aix-en-Provence, France: Institut d'Administration des Entreprises, Université d'Aix-Marseille, 1997, 510 pp.
- M. Lambkin, G.R. Foxall, W.F. van Raaij & B. Heilbrunn (red.), *European Perspectives on Consumer Behaviour*. Londen, U.K.: Prentice Hall, 1998, 432 pp., ISBN 0-13-552382-6.
- G. Antonides & W.F. van Raaij, *Consumer Behaviour. A European Perspective* Chichester, U.K.: John Wiley & Sons, 1998, 619 pp., ISBN 0-471-97513-3.
- W.F. van Raaij, G. Antonides, W.M. Oppedijk van Veen & J. Schoormans, *Product & Consumption*. Utrecht: Lemma, 430 pp., ISBN 90-5189-762-6. Two editions, 1998-1999.

- M. Logman, P. Matthyssens & W.F. van Raaij, *Marketing Communicatie in Zakelijke Markten. Strategische en Geïntegreerde Communicatie voor b-to-b Marketeers*. Alphen aan den Rijn: Samsom (STEM), 2000, 265 pp., ISBN 90-267-3039-x.
- M. Lambkin, G. Foxall, F. van Raaij & B. Heilbrunn (red.), *Zachowanie konsumenta. Koncepcje i badania europejskie* [Poolse vertaling]. Warszawa, Polen: Wydawnictwo Naukowe PWN (Educational Enterprise Foundation), 2001, 503 pp., ISBN83-01-13299-X.
- T.B.C. Poiesz & W.F. van Raaij, *Synergetische Marketing. Een Visie op Oorzaken en Gevolgen van Veranderend Consumentengedrag*. Amsterdam: Financial Times/Prentice Hall, 2002, 204 pp., ISBN 90-430-0518-5.

### Publications

- W.F. van Raaij, 'Consumer information processing for different information structures and formats'. In: W.D. Perreault, Jr. (Ed.), *Advances in Consumer Research*. 4, 1977, pp. 176-184.
- W.F. van Raaij, 'The utility of consumer choice models'. *European Research*. 5(3), 1977, pp. 131-135.
- K. Wandwossen & W.F. van Raaij, 'Motivation-need theories and consumer behavior'. In: H.K. Hunt (Ed.), *Advances in Consumer Research*. 5, 1978, pp. 590-595.
- W.F. van Raaij, 'Cross-cultural research methodology as a case of construct validity'. In: H.K. Hunt (Ed.), *Advances in Consumer Research*. 5, 1978, pp. 693-701.
- W.F. van Raaij, 'Theory of theories of consumer information processing? A comment on the paper by Diller'. *Journal of Consumer Policy* 2(2), 1978, pp. 185-189.
- W.F. van Raaij, 'Economic psychology and marketing'. In: G. Fisk, J. Arndt & K. Gro/nhaug (red.), *Future Directions for Marketing*. Cambridge, MA: Marketing Science Institute, June 1978, pp. 144-162.
- W.F. van Raaij, 'Consumer research in Europe: Frontier issues'. In: W.L. Wilkie (Ed.), *Advances in Consumer Research*. 6, Association for Consumer Research, 1979, pp. 18-19.
- W.F. van Raaij, 'Das Interesse für ökologische Probleme und Konsumentenverhalten'. In: H. Meffert, H. Steffenhagen & H. Freter (Eds.), *Konsumentenverhalten und Information*. Wiesbaden: Gabler, 1979, pp. 355-374.
- A.A.A. Kuijlen & W.F. van Raaij, 'Consumer participation in a glass recycling program'. In: *Marketing des Services; Gestion de la Distribution*. 6e Séminaire International de Recherche en Marketing, June 1979, pp. M1-M20.
- B.T. Ratchford & W.F. van Raaij, 'The relation between information acquisition strategy and monetary losses due to incorrect choice'. In: R.P. Bagozzi et al (Eds.), *Marketing in the 80's: Challenges and Changes*. Chicago: American Marketing Association, 1980, pp. 168-171.
- W.F. van Raaij, 'Die Erleichterung von Wahlentscheidungen der Konsumenten durch optimale Informationsdarbietung'. In: K. Hartmann & K. Koepler (red.), *Fortschritte der Marktpsychologie*. Frankfurt: Fachbuchhandlung für Psychologie, 1980, pp. 259-279.
- W.F. van Raaij, 'Economic psychology'. *Journal of Economic Psychology*. 1(1), 1981, pp. 1-24.
- D.A. Francken & W.F. van Raaij, 'Satisfaction with leisure time activities'. *Journal of Leisure Research*. 13(4), 1981, pp. 337-352.
- Th.M.M. Verhallen & W.F. van Raaij, 'Household behavior and the use of natural gas for home heating'. *Journal of Consumer Research*. 8(3), 1981, pp. 253-257.
- Th.M.M. Verhallen & W.F. van Raaij, 'Household behavior and energy use'. In: J.D. Claxton, C.D. Anderson, J.R.B. Ritchie & G.H.G. McDougall (Eds.), *Consumers and Energy Conservation*. New York: Praeger, 1981, pp. 32-45.
- W.F. van Raaij & H.J. Gianotten, 'Business investments as a function of income and willingness to invest'. In: *Studies on Investment Behaviour*. CIRET Study Number 31, München: IFO Institute for Economic Research, 1982, pp. 1-28.

- W.F. van Raaij, 'Consumer classification based on behavioural measures'. *Proceedings ESOMAR Seminar 'Classifying Consumers: A Need to Rethink'*. Brugge: Holiday Inn, 1982, pp. 177-193.
- W.F. van Raaij & H.J. Gianotten, 'Consumer confidence, expenditure, and curtailment'. *Proceedings 35th ESOMAR Congress 'Fitting Research to Turbulent Times', Volume 1*. Amsterdam: ESOMAR, 1982, pp. 97-123.
- W.F. van Raaij & Th.M.M. Verhallen, 'A behavioral model of residential energy use'. *Journal of Economic Psychology*. 3(1), 1983, pp. 39-63.
- W.F. van Raaij, 'Techniques for process tracing in decision making'. In: L. Sjöberg, T. Tyszka & J.A. Wise (Eds.), *Human Decision Making*. Bodafors: Bokförlaget Doxa AB, 1983, pp. 179-196.
- W.F. van Raaij, 'Affective and cognitive reactions to advertising'. In: *Comportement du Consommateur; Strategies de Communication*. 10e Séminaire International de Recherche en Marketing, June 1983, pp. 418-436.
- W.F. van Raaij & G. Eilander, 'Consumer economizing tactics for ten product categories'. In: R.P. Bagozzi & A.M. Tybout (Eds.), *Advances in Consumer Research*. 10, 1983, pp. 169-174.
- W.F. van Raaij & J.M.G. Floor, 'Retailing developments in The Netherlands'. *International Journal of Physical Distribution & Materials Management*. 13(5/6), 1983, pp. 128-137.
- W.F. van Raaij & Th.M.M. Verhallen, 'Patterns of residential energy behavior'. *Journal of Economic Psychology*. 4(1/2), 1983, pp. 85-106, en in: P. Ester, G. Gaskell, B. Joerges, C.J.H. Midden, W.F. van Raaij & T. de Vries (Eds.), *Consumer Behavior and Energy Policy*. Amsterdam: North-Holland, 1984, pp. 97-118.
- W.F. van Raaij, 'Economics and psychology: The broadening of consumer research'. In: T.C. Kinnear (Ed.), *Advances in Consumer Research*. 11, 1984, pp. 729-730.
- D.A. Francken & W.F. van Raaij, 'Vacation decisions, activities, and satisfactions'. *Annals of Tourism Research*. 11(1), 1984, pp. 101-112.
- W.F. van Raaij, 'Een model van het voedingsgedrag'. *Voeding*. 45(11), 1984, pp. 376-382.
- Th.M.M. Verhallen & W.F. van Raaij, 'Energy conservation through behavioral change: The use of natural gas for home heating'. *Journal A. Quarterly Journal of Automatic Control*. 25(3), 1984, pp. 144-149.
- W.F. van Raaij, 'Micro and macro economic psychology'. *Journal of Economic Psychology*. 5(4), 1984, pp. 385-401.
- W.F. van Raaij, 'Economic psychology'. In: M. Wallendorf & G. Zaltman (Eds.), *Readings in Consumer Behavior*. New York: John Wiley & Sons, 1984 (2nd edition), pp. 23-34.
- W.F. van Raaij, 'Attribution of causality to economic actions and events'. *Kyklos*. 38(1), 1985, pp. 3-19.
- W.F. van Raaij & Th.M.M. Verhallen, 'A behavioral cost-benefit approach to the explanation and prediction of behavior'. In: H. Brandstätter & E. Kirchler (Eds.), *Economic Psychology, Proceedings of the 10th IAREP Annual Colloquium*. Linz: Trauner Verlag, 1985, pp. 37-53.
- W.F. van Raaij, 'Mass communication theories and consumer behavior'. In: *Recherches sur la Communication/Promotion*. 12e Séminaire International de Recherche en Marketing, May 1985, pp. 298-311.
- W.F. van Raaij, 'The psychological foundations of economics: The history of consumer theory'. In: C.T. Jan & J.N. Sheth (Eds.), *Historical Perspective in Consumer Research: National and International Perspectives*. Singapore: National University, 1985, pp. 8-13.
- D.A. Francken & W.F. van Raaij, 'Socio-economic and demographic determinants of consumer problem perception'. *Journal of Consumer Policy*. 8(3), 1985, pp. 303-314.
- W.F. van Raaij, 'Cognitive and affective effects of advertising on children'. In: S. Ward, T. Robertson & R. Brown (Eds.), *Commercial Television and European Children*. Aldershot, Hants., U.K.: Gower, 1986, pp. 99-109.
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- W.F. van Raaij, 'The first five years of the Journal of Economic Psychology'. *Journal of Economic Psychology*. 7(1), 1986, pp. 1-15.

- W.F. van Raaij & Th.M.M. Verhallen, 'Determinants of home insulation intentions'. In: R.J. Lutz (Ed.), *Advances in Consumer Research*. 13, 1986, pp. 476-480.
- Th.M.M. Verhallen & W.F. van Raaij, 'How consumers trade-off behavioural costs and benefits'. *European Journal of Marketing*. 20(3/4), 1986, pp. 19-34.
- W.F. van Raaij, 'The affective value of brand name and campaign style in advertising'. In: *Etudes Commerciales. Analyse du Comportement du Consommateur*. 13e Séminaire International de Recherche en Marketing, May 1986, pp. 441-476.
- W.F. van Raaij, 'Economic phenomena from a psychological perspective: Economic psychology'. In: A.J. MacFadyen & H.W. MacFadyen (Eds.), *Economic Psychology. Intersections in Theory and Application*. Amsterdam: North-Holland, 1986, pp. 9-23.
- W.F. van Raaij, 'Causal attributions in economic behavior'. In: A.J. MacFadyen & H.W. MacFadyen (Eds.), *Economic Psychology. Intersections in Theory and Application*. Amsterdam: North-Holland, 1986, pp. 353-379.
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- W.F. van Raaij, 'Difficultés économiques et comportement des consommateurs: L'exemple Néerlandais'. *Revue Française du Marketing*. Cahier 110, 1986, pp. 39-50.
- W.F. van Raaij, 'Informatieverwerving en -verwerking door consumenten'. *Voedingsmiddelentechnologie*. 20(8 and 10), April-May 1987, pp. 13-15 en 12-15 (parts 109 and 110 of the course 'Voedingsmiddelen van Grondstof tot Consument').
- R.G.M. Pieters & W.F. van Raaij, 'Functions and management of affect: Applications to economic behavior'. *Journal of Economic Psychology*. 9(2), 1988, pp. 251-282.
- W.F. van Raaij, 'Corporate communications. Het communicatiebeleid of the onderneming'. *International Marketing Management*. December 1988, pp. 30-33.
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- W.F. van Raaij, 'How consumers react to advertising'. *International Journal of Advertising*. 8(3), 1989, pp. 261-273.
- W.F. van Raaij, 'Economic news, expectations, and macro-economic behaviour'. *Journal of Economic Psychology*. 10(4), 1989, pp. 473-493.
- W.F. van Raaij & V. Schouten, 'Consumer problems and satisfaction in a retail setting'. *Journal of Consumer Satisfaction, Dissatisfaction and Complaining Behavior*. 3, 1990, pp. 56-60.
- W.F. van Raaij, 'The effect of marketing communication on the initiation of juvenile smoking'. *International Journal of Advertising*. 9(1), 1990, pp. 15-36.
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- W.F. van Raaij, A. Strazzieri & A. Woodside, 'New developments in marketing communications and consumer behavior'. *Journal of Business Research*. 53(2), 2001, pp. 1-3.
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- T. Poiesz, J. de Heer & W.F. van Raaij, 'Consumer research implications of marketing and ICT developments'. *European Advances in Consumer Research*, 5, Association for Consumer Research, 2002, pp. 66-72.
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- M. Dijkstra, H.E.J.J.M. Buijtels & W.F. van Raaij, 'The separate and joint effects of medium type on consumer responses: A comparison of television, print and the Internet'. *Journal of Business Research*, 54, 2003, pp.



2000 – Chairman of the Board of the graduate school Food, Technology and Agro-Biotechnology, Nutrition and Health Sciences (VLAG), University of Wageningen and Maastricht University

### **Membership of professional bodies**

#### Past

- Chairman of the RDA Committee of the Dutch Nutrition Council, 1982-1992
- Member of the Advisory Board Voorlichtingsbureau voor de Voeding, 1984-
- Member of the committee for the 'Dutch Prize for Dietetics' (Sandoz Nutrition Dietetic prize), 1984-1990
- Chairman of the committee on Vitamins in Sport Nutrition Supplements of the Dutch Nutrition Council, 1985-1986
- Chairman of the Committee for the Dutch Price of Sport Medicine, 1986-1992
- Chairman of the Dutch Association for the Study of Obesity, 1986-1993
- Member of the Dutch Nutrition Council, 1986-1995
- Examiner at School for Dietetics, Nijmegen, 1986-1992
- Treasurer organizing committee European Pediatric Work Physiology meeting, Papendal in 1988
- Member of the Board of the Institute of Movement Science, Maastricht University, 1988-1995
- Dean for Science Affairs, Faculty of Health Sciences, Maastricht University,
- Coordinator of the annual European Clinical Nutrition Course (Maastricht (NL) and Leuven (B)), 1989-1997
- Coordinator Erasmus/Socrates Nutrition Program, with participants from England, Belgium, Finland and The Netherlands, 1989-1996
- Member of the Board of the Dutch Nutrition Foundation (SVN), 1990-1998
- Chairman Science Committee Faculties of Medicine and Health Sciences, Maastricht University, 1992-1999
- Chairman of the organizing committee of the European Obesity Conference, Noordwijkerhout, The Netherlands in 1992
- Member of the committee for Scientific Collaboration between the Maastricht University and the Technical University Eindhoven, 1992-2000
- Member of the Scientific Advisory Board of the Dutch Heart Foundation, 1993-1998
- Member of the Advisory Committee on Exercise of the Dutch Heart Foundation,
- Chairman of the Scientific Committee on Nutrition within the International Life Sciences Institute (ILSI) Europe, Brussels, 1994-2000
- Member of the Board for the Section Health Sciences, Dutch Organization for Scientific Research (NWO), 1995-2000
- Member of the WHO, International Obesity Task Force, 1995-1999
- Council member of The Nutrition Society, United Kingdom, 1996-1999
- Chairman of the International Development Group of The Nutrition Society, United Kingdom, 1996-1999
- Chairman of the European Society of Pediatric Exercise, Physiology, 1991-2000
- Member of the Scientific Advisory Board of Eridania Béghin-Say, 2000-2001
- Member of the Council of Europe Committee on "Functional Foods and Health Claims", Strassbourg, France, 1999-2001
- Member of the task force 'Nutrition', Nederlandse Vereniging voor Kindergeneeskunde (Pediatric Society), 1989-2001
- Chairman of the organizing committee of the International Congress on Functional Foods in Europe, Paris, France, 2001
- Member of the External Advisory Committee of DG-12, Key Action I- 'Food Nutrition and Health', Fifth Framework of the European Commission, Brussels, Belgium, 1998-2002

- Chairman SCOOP activity EU commission on Very Low Calorie Diets (VLCD's) in Europe 1999-2002

*Present*

- Member of the Board of the Human Nutrition Institute, Washington DC, USA, 1998-
- Member of the Scientific Committee on Food of the European Commission, Belgium, 1998-
- Member of the Health Council of The Netherlands, 1995-
- Vice-chairman of the Nutrition Working Group 2001-
- Member of the Ad Hoc Committee 'Upper Safe Limits of vitamins and minerals' of DG-24, European Commission, Brussels, Belgium, 1999-
- Coordinator and principal investigator of the European Community FAIR Program called 'CARMEN' 1996-1999; partner in FeMMES, FATLINK and NUGENOB, programs 5<sup>th</sup> framework 1999-
- Chairman of the Research Program Committee on 'Food, Nutrition and Health', Dutch Organization for Scientific Research (NWO), 1998-
- Member Program Committee Chronic Diseases. Gene Nutrient Interaction. NWO 1997-
- Board Member of the South African Institute of South Africa, 1999 -
- Member Scientific Committee National Research of Nutrition Napels, 2002 -
- Medical advisor of the Scientific Board of Novartis - Nutrition branch, Benelux, 1982-
- Member of:
  - Koninklijke Maatschappij der Geneeskunde
  - Nederlandse Fysiologische Vereniging
  - Koninklijk Genootschap Wageningse Ingenieurs
  - Nederlandse Vereniging van Voedingsleer en Levensmiddelen Technologie
  - Nederlandse Associatie voor de Studie van Obesitas (NASO)
  - European Society of Enteral / Parenteral Nutrition (ESPEN)
  - European Pediatric Exercise Physiology Working Group
  - American College of Sports Medicine
  - British Nutrition Society
  - European College of Sport Science
- Editorial Board member of:
  - International Journal of Obesity
  - Annual Nutrition Metabolism
  - Current Opinion in Clinical Nutrition and Metabolic Care
  - International Journal of Sports Nutrition
  - Innovative Food Science and Emerging Technologies
  - Nederlands Tijdschrift voor Dietetiek
  - Geneeskunde en Sport

**Research interests**

- Human nutrition
- Obesity / Diabetes
- Exercise physiology
- Energy and substrate metabolism
- Sports nutrition
- Clinical nutrition

**Publications**

- publication in peer reviewed international journals
- chapters in books and proceedings
- books: author or co-author
- patents

### **Selection of publications in peer reviewed journals**

- Jeukendrup AE, WHM Saris, AJM Wagenmakers. Fat metabolism during exercise: a review. Part I: Fat mobilization and oxidation. *Int.J.Sports Med.*, 1998; 4: 1-14
- Jeukendrup AE, WHM Saris, AJM Wagenmakers. Fat metabolism during exercise: review. Part II: Regulation and the effect of training. *Int.J.Sports Med.*, 1998; 19: 1-10
- Jeukendrup AE, WHM Saris, AJM Wagenmakers. Fat metabolism during exercise: A review. Part III: Effects of Nutritional Interventions. *Int.J.Sports Med.*, 1998; 19: 1-9
- Kempen KPG, WHM Saris, H Kuipers, JFC Glatz, GJ van der Vusse. Skeletal muscle metabolic characters before and after energy restriction in human obesity: fibre type, enzymatic B-oxidative capacity and fatty acid binding protein content. *Eur.J.Clin.Invest.*, 1998; 28: 1030-1037
- Westerterp-Plantenga MS, KPG Kempen, WHM Saris. Determinants of weight maintenance in women after diet-induced weight reduction. *Int.J.Obes.*, 1998; 22: 1-6
- Schrauwen PJ, WD van Marken Lichtenbelt, WHM Saris, KR Westerterp. Fat balance in obese subjects: role of glycogen stores. *Am.J.Phys.*, 1998; 274: E1027-E1033
- Pasman WJ, MS Westerterp-Plantenga, WHM Saris. The effect of exercise training on leptin levels in obese males. *Am.J.Phys.*, 1998; 274: E280-E286
- Saris WHM, JMG Senden, F Brouns. What is a normal red-blood cell mass for professional cyclists. *The Lancet*, 1998; 352: 1758 (Res.Let.)
- Saris WHM, NGL Asp, I Björck, E Blaak, F Bornet, F Brouns, KN Frayn, P Fürst, G Riccardi, M Roberfroid, M Vogel. Functional food science and substrate metabolism. *Brit.J.Nutr.*, 1998; 80: S47-S75
- Jeukendrup AE, JJHC Thielen, F Brouns, AJM Wagenmakers, WHM Saris. Effect of MCT and carbohydrate ingestion on substrate utilization and subsequent cycling performance. *Am.J.Clin.Nutr.*, 1998; 67: 397-404
- Berg van den-Emons RJ, MA van Baak, L Speth, WHM Saris. Physical training of school children with spastic cerebral palsy: effects on daily activity, fat mass and fitness. *Int.J. of Rehab. Res.*, 1998; 21: 179-194
- Schuit AJ, EG Schouten, TP Miles, WJ Evans, WHM Saris, FJ Kok. The effect of six months training on weight body fatness and serum lipids in apparently healthy elderly Dutch men and women. *Int.J.Obes.*, 1998; 22: 847-853
- Kerckhoffs DAJM, EE Blaak, MA van Baak, WHM Saris. Effect of aging on  $\beta$ -adrenergically mediated thermogenesis in men. *Am.J.Phys.*, 1998; 274: E1075-1079
- Bijnen F, C Caspersen, E Feskens, W Saris, W Mosterd, D Kromhout. Physical Activity and 10-year mortality; From cardiovascular diseases and all causes: The Zutphen Elderly Study. *Arch Intern Med.*, 1998; 158: 1499-1505
- Schiffelers SLH, EMC Brouwer, WHM Saris, MA van Baak. Inhibition of lipolysis reduces  $\beta$ 1-adrenoceptor mediated thermogenesis in men. *Metabolism*, 1998; 47: 1462-1467
- Saris WHM. Fit, fat and fat free: The metabolic aspects of weight control. *Int.J.Obes.*, 1998; 22, S15-S21
- Saris WHM. In search of factors regulating body weight. *Curr.Opinion in Clin.Nutr.Met.Care*, 1998; 11: 549-551
- van Hall G, WHM Saris, AJM Wagenmakers. Effect of carbohydrate supplementation on plasma glutamine during prolonged exercise and recovery. *Int.J.Sports Med.*, 1998; 19: 82-86
- Schiffelers SLH, VJA van Harmelen, HAJ De Grauw, WHM Saris, MA van Baak. Dobutamine as selective  $\beta$ 1-adrenoceptor agonist in in vivo studies on human thermogenesis and lipid utilization. *J.Appl.Phys.*, 1999; 87: 977-981
- Pasman WJ, MS Westerterp-Plantenga, WHM Saris. The effect of body weight changes and endurance training on 24 h substrate oxidation. *Int.J.Obes.*, 1999; 23: 1223-1232
- Blaak EE, MA van Baak, WHM Saris.  $\beta$ -Adrenergically stimulated fat oxidation is diminished in middle-aged compare to young subjects. *J.Clin.Endocr.Met.*, 1999; 84: 3764-3769
- Pasman WJ, WHM Saris, MS Westerterp-Plantenga. Predictors of weight maintenance. *Obes.Res.*, 1999; 7: 43-50

- Aggel van DPC, MA van Baak, R Tenenbaum, LA Campfield, WHM Saris. Regulation of average 24h human plasma leptin level: the influence of exercise and physiological changes in energy balance. *Int.J.Obes.*, 1999; 23: 151-158
- Pasman WJ, WHM Saris, E Muls, G Vansant, MS Westerterp-Plantenga. Effect of exercise training on long-term weight maintenance in weight-reduced men. *Metabolism*, 1999; 48: 15-21
- Pasman WJ, WHM Saris, MS Westerterp-Plantenga. Voorspellers van gewichtshandhaving. *Ned.Tijdschr.Diet.*, 1999; 54: 14-19
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- Blaak EE, WHM Saris, BHR Wolffenbuttel. Substrate utilization and thermogenic responses to  $\beta$ -adrenergic stimulation in obese subjects with NIDDM. *Int.J.Obes.*, 1999; 23: 411-418
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- Melanson KJ, MS Westerterp-Plantenga, LA Campfield, WHM Saris. Blood glucose and meal patterns in time-blinded males, after aspartame, carbohydrate, and fat consumption, in relation to sweetness perception. *Brit.J.Nutr.*, 1999; 82: 437-446
- Blaak EE, GJ Kemerink, MTW Pakbiers, BHR Wolffenbuttel, GA Heidendal, WHM Saris. Microdialysis assessment of local adipose tissue lipolysis during  $\beta$ -adrenergic stimulation in upper-body-obese subjects with type II diabetes. *Clin.Sci.*, 1999; 97: 421-428
- Loon van LJC, AE Jeukendrup, WHM Saris, AJM Wagenmakers. Effect of training status on fuel selection during submaximal exercise with glucose ingestion. *J.Appl.Phys.*, 1999; 87: 1413-1420
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- Schiffelers SLH, VJA van Harmelen, HAJ de Grauw, WHM Saris, MA van Baak. Dobutamine as selective B1-adrenoceptor agonist in in vivo studies on human thermogenesis and lipid utilization. *J.Appl.Phys.*, 1999; 87: 977-981
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- Schrauwen P, G Schaart, WHM Saris, LJ Slieker, JFC Glatz, H Vidal, EE Blaak. The effect of weight reduction on skeletal muscle UCP2 and UCP3 mRNA expression and UCP3 protein content in Type II diabetic subjects. *Diabetologia*, 2000; 43: 1408-1416
- Hukshorn CJ, WHM Saris, MS Westerterp-Plantenga, AR Farid, FJ Smith, LA Campfield. Weekly subcutaneous pegylated recombinant native human leptin (PEG-OB) administration in obese men. *J.Clin.Endocrinol.Met.*, 2000; 85: 4003-4009
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- van Baak MA, GBJ Hul, S Toubro, A Astrup, KM Gottesdiener, M DeSmet, WHM Saris Acute effect of L-796568, a novel  $\beta_3$ -adrenergic receptor agonist, on energy expenditure in obese men. *Clin.Pharm.Ther.* 2002; 71: 272-279
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Effect of a 28-d treatment with L-796568, a novel  $\beta_3$ -adrenergic receptor agonist, on energy expenditure and body composition in obese men Am.J.Clin. Nutr. 2002; 76: 780-788
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- Konings EJM, RA Goldbohm, HAM Brants, WHM Saris, PA van den Brandt Intake of dietary folate vitamers and risk of colorectal carcinoma. Results from The Netherlands Cohort Study Cancer 2002; 95(7): 1421-33
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### Group represented

The **Nutrition and Toxicology Research Institute Maastricht (NUTRIM)** has a long standing record in Nutrition and Nutrition Toxicology research in The Netherlands. It is an interfaculty institute between the faculty of Medicine and Health Science. Within NUTRIM 21 biomedical and clinical departments co-operate in the field of nutrition, nutrition toxicology and nutrition and health.

Within the institute 51 fulltime equivalents of scientific staff, 20 postdocs and 70 supportive staff are working in multidisciplinary teams in four divisions; Nutrition and metabolism, Clinical aspects of nutrition, Epidemiological and behavioural-science research and health hazards in living environments and nutrition.

NUTRIM is part of the Graduate school VLAG together with the Wageningen University Research Centre and 89 PhD students( Including medical assistance in clinical training) are active and receiving their scientific training within the institute. NUTRIM also participate in the Wageningen Centre of Food Science (WCFS), a centre of excellence where food industry and research institutes are working together

The research within NUTRIM is significantly supported by non-profit organisation and industry. In the last four years, there has been a remarkable increase in benefits from grants ( non-profit organisations, e.g.) and contracts ( industry; food and pharmaceutical) made up now about 55 % of the total institute budget.

As an indicator of the scientific quality of the institute, it turned out in a recent analysis executed by the editorial board of the American Journal of Clinical Nutrition which is the highest ranked ( I.P. 5.1) non review journal in the category Nutrition in the Impact factor list, that groups from The Netherlands had published the highest number of papers over the last 5 years outside the US. Within The Netherlands NUTRIM was the number one institute related to the number of publications.

Senior scientists of relevance for this application:

- Prof.dr. A Bast, Human Nutritional Toxicology
- Prof.dr. P.A. Van de Brandt, Human Epidemiology
- Prof.dr. H. Brug, Nutritional Health Education
- Prof.dr. R.J.M. Brummer, Clinical Nutrition and Dietetics
- Prof.dr. W.A. Buurman, Metabolism and Immunity
- Prof. M.H. Hofker, Molecular Genetics
- Prof.fr. E.C.M. Mariman, Functional Genetics
- Prof.dr. H. Kuipers, Exercise Physiology
- Prof.dr. W.H. Lamers, Developmental Biology
- Prof.dr. R.P. Mensink, Molecular Lipid metabolism
- Prof.dr. F.J. van Schooten, Genetic Toxicology





## **Memberschip of professional bodies**

- Member of the international scientific advisory board in charge with the evaluation of the STOA-program of the European Parliament (1994).
- Member of the ethical committee dealing with public R&D-organizations installed by the Dutch Minister of Education, Culture and Science (1995).
- Member of the board of trustees of the endowed chair 'Innovation and external organisation', Technical university Eindhoven (1997)
- Member of the editorial board of ZENO (Magazine for Science and Society, 1992 - 1997).
- Member of the Dutch advisory board of the EC Targetted Socio Economic Research Program (1995 - 1998).
- Vice-chairman of the VSNU Visiting Committee 'Technology and Policy' (1997-1998).
- Member of the steering committee of the 'Futures Project' of the Institute for Prospective Technological Studies, one of the Joint Research Centers of the European Commission (1998).
- Member of the steering committee of the Foresight Program of the Dutch Ministry of Economic Affairs (1996-2000).
- Member of the advisory board of PNO Consultants Hengelo B.V. (1996 - 2000).
- Chairman of the steering committee of the Six Countries Program: the Innovation Network (1992 - 2002);
- Lecturer Tilburg Institute for Academic Studies (TIAS, 1994 - now).
- Member of the editorial board of 'Euroscientia forum', the journal of the European Science and Technology Forum (1995 - now)
- Member of the advisory board of 'Science, Technology and Society' (1996- now).
- Member of the High Level Advisory Group of the Institute for Prospective Technological Studies, one of the Joint Research Centers of the European Commission. (1998 – now)
- Member of the advisory committee 'Science and Technology Statistics' of the Central Bureau for Statistics (1998 – now).
- Chairman of the department of Innovation Studies of the Faculty of Spatial Sciences of Utrecht University (1999-now).
- Research co-ordinator of the Department of Innovation Studies of the Faculty of Spatial Sciences of Utrecht University (1999-now).
- Member of the editorial board of 'Poiesis & Praxis' (2000-now)
- Member of the Innovation Sciences Network (cooperation Technical University of Eindhoven, Technical University of Delft, University of Twente, University of Maastricht, University of Rotterdam, University of Utrecht (2000-now)
- Member of the research school WTMC (Science, Technology and Modern Culture, since 2000-now).
- Member of the board of the Copernicus Institute on Innovation and Sustainable Development of Utrecht University (2001-now).
- Member of the Interdepartmental Budget Research committee on technology policy (IBO), Ministry of Finance (2001-2002).
- Member of the selection committee of the endowed chair 'Energy and global change' (2002).
- Member of the selection committee of the endowed chair 'Bio business' (2002).
- As external expert member of the international committee evaluating South-African Innovation Policy (2002, not completed because of personal circumstances).
- Member of the international evaluation panel of the German FUTUR-process (2002, not completed because of personal circumstances).

- Member of the editorial board of Euroscientia forum, the journal of the European Science and Technology Forum (1995 – now).
- Member of the editorial board of Poiesis & Praxis (2000 – now).
- Member of the advisory board of Science, Technology and Society (1996 – now).

### **Research interests**

*Research, teaching and consultancy related to the following areas:*

- International comparative research after the development of innovation policies and –strategies with special emphasis on more user oriented types of policy.
- Methods and techniques of policy oriented research
- Role of strategic intelligence (foresight, technology assessment, evaluation research, benchmarking,...) in innovation policies and –strategies.
- Role of intermediaries in changing (national) innovation systems.

### **Research grants and awards**

Hekkert, M.P., R.E.H.M. Smits (2002). Dealing with Uncertainties in the Transition to a Sustainable Energy Infrastructure: An integrative Approach. Program proposal for NWO – NOVEM energy research program.

Hekkert, M.P., R.E.H.M. Smits (2002). Quantified Back Casting: Methodological design of transition strategies in the area of sustainable transportation chains. Program proposal for NWO – NOVEM energy research program.

Hekkert, M.P., R.E.H.M. Smits (2002). S3 - Strategies towards Sustainable energy infrastructure in Sustainable industrial areas. Program proposal for NWO – NOVEM energy research program.

Lente, H. van, S. Kuhlmann en R.E.H.M. Smits (2002). NWO research proposal Governance for Sustainability – Achieving Horizontal Policy Coordination. Ingediend bij NWO programma Shifts in Governance, September 2002.

### **Selected publications**

Klabbers, J., J. Geurts & R. Smits (1978) 'Interactive simulation of social systems: two cases of computer assisted gaming/simulation.', paper presented at the IXth annual ISAGA Conference, Lund, Zweden.

Davies, D., R. Smits, R. Tweehuysen & W. Wils (1980) 'Mobility of researchers in the Netherlands.', in: *Proceedings of the 1981 System Dynamics Conference*, Renselaerville, New York.

Smits, R. & J. Geurts (1982) 'Technology policy and the utilization of knowledge. Traditional views versus future realities.', report submitted to the Minister for Science Policy, TNO & Katholieke Universiteit Nijmegen, Apeldoorn/Nijmegen.

Smits, R., A. Leyten & J. Geurts (1985) 'The possibilities and limitations of Technology Assessment. In search of a useful approach.', Staatsuitgeverij, Den Haag.

Leyten, A. & R. Smits (1986) 'The organization of Technology Assessment: a comparative analysis of five European countries.', in: *H.A. Becker & A. L. Porter (eds), 'Impact Assessment today, volume 2.'*, Jan van Arkel, Utrecht.

Smits, R. with the cooperation of J.P. Moatti (1987) 'Aspects of the integration of science and technology in the French society.', band 2, Published in the context of the European Congress on Technology Assessment (Amsterdam, 2-4 february 1987) by the Dutch Ministry of Education and Science in cooperation with the Forecasting and Assessment of Science and Technology Programme of the European Communities (FAST, EC-DGXII), Den Haag/Brussel.

- Smits, R. with the cooperation of S. Hart (1987) 'Aspects of the integration of science and technology in American society.', band 4, Published in the context of the European Congress on Technology Assessment (Amsterdam, 2-4 february 1987) by the Dutch Ministry of Education and Science in cooperation with the Forecasting and Assessment of Science and Technology Programme of the European Communities (FAST, EC-DGXII), Den Haag/Brussel.
- Leyten, A. & R. Smits 'Improving the use of TA in the decisionmaking process.', full papers, Published in the context of the European Congress on Technology Assessment (Amsterdam, 2-4 february 1987) by the Dutch Ministry of Education and Science in cooperation with the Forecasting and Assessment of Science and Technology Programme of the European Communities (FAST, EC-DGXII), Den Haag/Brussel.
- Leyten, A. & R. Smits (1987) 'A revival of Technology Assessment, the development of TA in five European countries and the U.S.', band 1 van 'Technology Assessment, an opportunity for Europe.'. Published in the context of the European Congress on Technology Assessment (Amsterdam, 2-4 february 1987) by the Dutch Ministry of Education and Science in cooperation with the Forecasting and Assessment of Science and Technology Programme of the European Communities (FAST, EC-DGXII), Den Haag/Brussel.
- Hoo, S. de, R. Smits & R. Petrella (eds.) (1987) 'Technology Assessment an opportunity for Europe. Proceedings and full papers of the 1st European Congress on Technology Assessment.'. Published in the context of the European Congress on Technology Assessment (Amsterdam, 2-4 february 1987) by the Dutch Ministry of Education and Science in cooperation with the Forecasting and Assessment of Science and Technology Programme of the European Communities (FAST, EC-DGXII), Den Haag/Brussel.
- Smits, R. & A. Leyten (1988) 'Highlight on Technology Assessment: Key issues in the institutionalisation of Technology Assessment.', in: *FUTURES*, vol. 20 nr. 1, pp. 19-37, Butterworth & Co, Londen.
- Enzing, C. & R. Smits (1990) 'Research foresight in the Netherlands. An analysis.', Staatsuitgeverij, Den Haag.
- Enzing, C. & R. Smits (1990) 'Governments role in the internationalisation of R&D: the increasing demand for strategic decisionmaking in science and technology.', in: *Science and Public Policy*, Vol. 17, nr. 5, Beech Tree Publishing, Guildford, Surrey, United Kingdom.
- Smits, R. & T. Weijers (1990) 'Technology Assessment: watchdog or integrated part of technology policy?' keynote paper presented at the second European Congress on Technology Assessment, Milan, Italy.
- Leyten, A., R. Smits & P. den Hertog (1990) 'State of the art and main trends of Dutch information and telecommunication technology policy.', paper prepared for the EC-DGXIII Public Strategy Observer, TNO, Apeldoorn.
- Hertog, P. den & R. Smits (1991) 'Direct and indirect policy instruments for stimulating R&D in IT&T in the Netherlands.', paper prepared for the EC-DGXIII Public Strategy Observer, TNO, Apeldoorn.
- Smits R. (1991) 'Technikfolgen-Abschätzung in den Niederlanden mit besonderer Berücksichtigung der Niederländischen Organisation für Technikfolgen Abschätzung (NOTA)' in: *Petermann (Hg.) Th. 'Technikfolgen-Abschätzung als Technikforschung und Politikberatung'*. Campus Verlag, Frankfurt, Deutschland.
- Smits, R. & A. Leyten (1991) 'Technology Assessment: waakhond of speurhond' (Technology assessment: watchdog or tracker? Towards an integral technology policy.) dissertation Vrije Universiteit Amsterdam, Kerckebosch, Zeist.

- Smits, R., P. den Hertog & J. Kuijper, (1993) 'Towards a strong and effective European Technology Assessment Infrastructure (ETAI)', report prepared in behalf of EC-DGXIII/VALUE, TNO, Apeldoorn.
- Smits, R. (1993) 'Situació actual de l'avaluació de tecnologia a Europa' in: *Quaderns de Tecnologia*, 7, octubre 1993, Institut Català de Tecnologia.
- Smits, R. (1994) 'Elk land krijgt de technologie die het verdient, maar lang niet altijd die welke het nodig heeft.' (Every country gets the technology it deserves, but by far not always the technology it needs.) inaugural speech on the occasion of the acceptance of the endowed chair 'Technology, Policy and Society' at the Catholic University of Tilburg, Tilburg University Press.
- Smits R., et al (1994) 'TNO als change agent' (TNO as change agent), report submitted to the board of TNO within the framework of the development of the TNO-strategic paper: Technology at work, TNO-STB Apeldoorn.
- Smits R., A. Leyten & P. den Hertog (1995), 'Technology Assessment and technology policy in Europe: new concepts, new goals, new infrastructures.', in: *Policy Sciences* (28), 272-299.
- Smits, R. & T. Weijers (1995) 'Technologie is meer dan een kwestie van bijbenen', in: *ZENO*, 95(1).
- Smits, R. (1995) 'De vermaatschappelijking van de besluitvorming over technologie', (The socialization of decision making on technology.) in: *Achter-huis, A., R. Smits, J. Geurts, A. Rip en E. Roelofs (red.) (1995) 'Technology and society.'*, Open University, Garant, Leuven/Apeldoorn.
- Achterhuis, H., R. Smits, J. Geurts, A. Rip en E. Roelofs (eds.) (1995) 'Techniek en samenleving' (Technology and society.), Open University, Garant, Leuven/Apeldoorn.
- Smits, R. (1995) 'Technology and users: a necessary and fruitful symbiosis.' in: *Samenleving en Politiek*, november, Brussel (in Dutch).
- Schaffers, H. & R. Smits (1995) 'The Dutch science and technology portfolio: challenges in strengthening and management of technology competences.' paper presented at the Six Countries Workshop 'Reinventing the future', Stockholm, 30-31 october.
- With Schaffers et al (1995) 'Technology and society in four scenario's', study commissioned by the Dutch Ministry of Transport, TNO-STB, Apeldoorn.
- Leijten, A. & R. Smits, (1996) 'The role of Technology Assessment in contemporary technology policy', in: *International Journal of Technology Management*, Volume 11, nos 5/6, 688-702.
- With Den Hertog et al (1996) 'User involvement in RTD. Concepts, practices and policy lessons.' report commissioned by EC DGXIII VALUE II Programme, TNO-STB, Apeldoorn.
- Smits, R. (1996) 'Het internationale beleid van het Rathenau Instituut (The international strategy of the Rathena Institute)' report in behalf of the Rathenau institute.
- Schaffers, H. & R. Smits (1996) 'Foresight and strategic technology management: three examples from the Netherlands.' paper presented at the 4S-EASST Conference, October, Bielefeld.
- Smits, R. & M. Rogers (1996) 'European Research Towards the XXIst Century.' report of the IPTS workshop in support of the European Parliament, Seville 29-30 august .
- With Holland et al (1996) 'Pre-phase Technology Scanning (in Dutch)', report prepared in behalf of the Programme Technology and Society from the Dutch Ministry of Economic Affairs.

- Smits, R. (1996) 'The problematic but promising relation between Technology Assessment, Foresight and Evaluation.' paper presented at the international workshop on Technology Assessment organised within the framework of the Advanced Science and Technology Policy Planning Network, 29 october - 1 november, Amsterdam.
- Smits, R. & P. den Hertog (1996) 'The role of Technology Assessment in an European Strategic Intelligence System on Science and Technology Policy' paper presented at the international workshop on 'Strategic Intelligence and European S&T-policy' organised within the framework of the Advanced Science and Technology Policy Planning Network, Strasbourg, december 1996.
- Smits, R. & J. Geurts (1997) 'Blauwdruk voor een beleidslaboratorium.' (Starting points of a policy laboratory. On high level support of strategic innovation processes.), TNO-Apeldoorn, KUB-Tilburg.
- Smits, R. (1997) 'De rol van de Contract Research Organisatie met een publieke missie op de vrije markt', (The role of a contract research organisation with a public mission on the free-market), in: *F. Zwetsloot (ed.) 'Sturing van wetenschappelijk onderzoek'*, Delwel Uitgeverij, Den Haag.
- Den Hertog, P. & R. Smits (1997) 'Is there an industrial and societal demand for strategic intelligence? A plea for strengthening user involvement in S&T.' paper presented at the fifth workshop of the Advanced Science and Technology Planning Network, Bordeaux may 27-28.
- Kuhlmann, S. & R. Smits (1997) 'The potential for integration of technology foresight, technology assessment and S&T-policy evaluation in Europe.' progress report of the Advanced Science and Technology Planning Network, spring 1997.
- Den Hertog, P. & R. Smits (1997) 'Gebruikersparticipatie in trajecten voor ontwikkeling van wetenschap en technologie'. (User-participation in trajectories for the development of science and technology), in: *P. Ester, J. Geurts & M. Vermeulen (eds) 'De makers van de toekomst'*, Tilburg University Press.
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- Smits, R. (2000) 'Inventies en innovaties: over de opkomst van de innovatiewetenschap', in: *Tijdschrift voor Wetenschap, Technologie & Samenleving*, jaargang 8, nr. 4.
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- Glasbergen, P. & R. Smits (2002) 'The Policy Laboratory for Sustainable Development and Innovation Management. A new learning context for environmental scientists', in: *International Journal of Sustainability in Higher Education* Vol. 3, no. 2 (forthcoming).
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- Moors, E., C., R. Smits, C. Enzing & A. van der Giessen (2002) 'Innovation in the field of functional genomics: a users' perspective', essay within the framework of the NWO-Program *Societal acceptance of genomics*.

Nahuis, R., & R. Smits (2002) 'The role of users in public transport innovation: the case of selfservice in the Amsterdam trams', paper presented at the 4S conference, 7-8-9 November, Milwaukee, USA.

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**Degrees**

1985                                        Wageningen University, The Netherlands. MSc in Human Nutrition  
    with majors in Marketing and Marketing Research and  
    Psychophysics and minors in Communication and Didactics  
1995                                        Ph.D. Dept. of Marketing and Marketing Research, Wageningen  
    University, The Netherlands  
    Dissertation: "Variety seeking in product choice behaviour: theory  
    with applications in the food domain"  
    Supervisors: MTG Meulenberg (Wageningen University)  
    JEBM Steenkamp (Wageningen University)

**Positions held**

2001-present                            Professor of Marketing and Consumer Behaviour, Wageningen  
    University, The Netherlands  
2000-present                            Senior Scientist Consumer Behaviour for Functional Foods. Unilever  
    Health Institute, Unilever Research and Development Vlaardingen,  
    The Netherlands (part time since 2001)  
1998 - 2001                             Professor of Consumer Behaviour for new product development  
    (part-time endowed chair) at Dept of Marketing and Consumer  
    Behaviour Wageningen University  
1996 - 2000                             Consumer Behaviour Scientist, Consumer Science Unit, Unilever  
    Research and Development Vlaardingen, The Netherlands  
1990 - 1996                             Assistant Professor in Marketing and Marketing Research,  
    Wageningen University, The Netherlands  
1988 – 1990                             Research Fellow at Dept. of Marketing and Marketing Research,  
    Wageningen University, The Netherlands

1986 – 1988	Research Assistant at Dept. of Marketing and Marketing Research., Wageningen University, The Netherlands
1985	Research Assistant at Dept. of Food Science and Food Technology, Reading University, UK

### Memberships in professional bodies

- Member of Scientific Committee of Unilever Symposium: Performance and Wellbeing (2003)
- Member of Scientific Board of KLICT (2002- present)
- Scientific Advisor of Food Choice Conference (2002)
- Member Scientific Committee of Unilever Symposium: Trends in Weight Management (2002)
- Member of the Education Assessment Committee on Dutch Polytech education programs on Food and Nutrition (2001)
- Member of Advisory Board of CCL Research, Veghel (2001-present)
- Member of Scientific Committee of Unilever Symposium: Kids Nutrition (2001)
- Member of Advisory Board of Innovaction, Leiden (1999- present)
- Member Sci. Committee of 3<sup>rd</sup> Pangborn Sensory Symposium Sense & Sensibility (1996)
- Member of Marketing Research Council of Commodity Board for Livestock, Meat and Eggs (PVE) (1995-1996)
- Secretary of Sensory Group of Dutch Market Research Foundation (1995-2000)
- Committee member of Dutch Food Consumption Survey (1993-1996)

### Research grants and awards

2002-2006	NWO (Netherlands Science Foundation), section Societal Aspects of Genomics, Seeing the future first and most clearly: an experimental approach to information acceleration for (nutri-)genomics. 262 kEuro
2002-2006	NWO (Netherlands Science Foundation), section Genomics, A research guidance model for sustainable new product on the basis of genomics expertise, 534 kEuro.
2002-2006	VWA (Dutch Food Safety Authority), A monitor for consumer confidence in food safety, 150kEuro

### Research Interests

#### *Consumer behaviour in relation to (food) marketing*

- Consumer behaviour and new product development
- Consumer behaviour and (new) food technology
- Consumer behaviour and food choice

### Publications (selection of papers in peer-reviewed journals)

- Van Kleef, E., J.C.M. van Trijp, P. Luning and W. Jongen (2002), Consumer-oriented functional food development: how well do functional disciplines reflect the “voice of the consumer”. *Trends in Food Science and Technology* 13 (3), 93-101.
- Zandstra EH, C. de Graaf and J.C.M. van Trijp (2000), Effects of variety and repeated in-home consumption on product acceptance. *Appetite* 35, 113-119
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- Schifferstein HNJ, MJJM Candel and J.C.M. van Trijp (1998), A comprehensive approach to image research: an illustration for fresh meat products in the Netherlands. *Tijdschrift voor Sociaal-Wetenschappelijk Onderzoek in de Landbouw* 13(3), 163-175
- Nijssen, E.K. and J.C.M. van Trijp (1998), Branding Fresh Food Products: exploratory evidence from the Netherlands. *European Review of Agricultural Economics* 25(2), 228-242.

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- Van Trijp, J.C.M., W.D. Hoyer and J.J. Inman (1996), Why switch? Variety seeking behavior as a product x individual interaction, *Journal of Marketing Research* 33 (August), 281-292.
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- Van Dam, Y.K. and J.C.M. van Trijp (1994), Consumer perceptions of and preferences for beverage containers, *Food Quality and Preference* 5 (4): 253-261.
- Van Trijp, J.C.M., L. Lähteenmäki and H. Tuorila (1992), Variety seeking in the consumption of spread and cheese, *Appetite* 18: 155-164.
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- De Graaf, C., J.E.R. Frijters and J.C.M. van Trijp (1987), Taste interaction between glucose and fructose assessed by functional measurement, *Perception and Psychophysics*, 41 (5): 383-392.

### Group represented

The **Marketing and Consumer Behaviour Group of Wageningen University**, led by Prof. van Trijp houses a Research Professor in Consumer Behaviour and Food Safety (Prof. L. Frewer) and a part time professor in Marketing and Consumer Behaviour (Prof. J. Pennings). The group further consists of 6 Assistant and 1 Associate Professor and 10 PhD students.

The Marketing and Consumer Behaviour Group has been the driving force behind the foundation of the Wageningen Expertise Centre for Consumer Studies (WECCS; under development). This centre brings together the Wageningen Departments in the area of consumer behaviour, including Economics of Consumers and Households (Prof. G. Antonides), Sociology of Consumers and Households (Prof. Niehof), Communication and Innovation Studies (Prof. C. Leeuwis), Communication Management (Prof. van Woerkum), Sociology and the Environment (Prof. A. Mol and Prof. G. Spaargaren), Applied Philosophy (Prof. Korthals), Agricultural History (Dr. A. Schuurman), Household Technology and Product Use (Prof. Terpstra), Product Design and Quality (Prof. Van Boekel) and Human Nutrition (Dr. C. de Graaf). The WECCS resource can be made available for this knowledge project if appropriate.

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**Degrees**

1981                      B.Sc., Rijksuniversiteit Utrecht, Netherlands  
                                  (Chemistry)  
1987                      M.Sc., Rijksuniversiteit Utrecht, Netherlands  
                                  (Analytical chemistry, economics, pedagogics and  
                                  didactics)  
1998                      Ph.D., Katholic University Brabant, Tilburg (supervisor:  
                                  Mrs. Prof. Dr. J.M. Cramer; title: Frames in the Toxicity  
                                  Controversy, Risk assessment and policy analysis  
                                  related to the Dutch chlorine debate and Swedish PVC  
                                  debate)

**Positions held**

1981-1987                Inspector food legislation (part time), CIVO-TNO,  
                                  Zeist, NL  
1988-1990                Waste management policy and enforcement  
                                  development specialist, Inspectorate for the  
                                  Environment, Ministry of Housing, Physical Planning  
                                  and Environment  
1990-1993                Senior consultant / deputy section manager, section  
                                  Chain-policy, Study Centre for Environmental Research  
                                  of TNO (SCMO).  
1993-1994                Interim section manager, section Chain-policy, Study  
                                  Centre for Environmental Research of TNO (SCMO)  
1994-now                Senior researcher and advisor, Sustainable  
                                  Development department, TNO Institute of Strategy,  
                                  Technology and Policy (TNO-STB), since 2002 scientific  
                                  manager of the Sustainable Innovation research  
                                  program

### Membership of professional bodies

1986-now	Royal Dutch association of chemists (KNCV).
1990-1998	Various positions in National (NEN) and European (CEN) standardisation committees on analytical methods for waste characterisation, including chairperson of the national NEN Committee in this field
1992-1998	Society of Environmental Toxicology and Chemistry (SETAC); member of various working groups on Life cycle assessment
2002-now	Dutch commission for Environmental Impact Assessment (Appointed by Royal decree of May 2002); member of review boards of about 10 EIA projects since 1996
2002-now	UNEP-SETAC Life cycle initiative. Member of the author team on Life cycle Management (LCM)
2003-now	Society for Industrial Ecology
1998 – present	Series editor of Book series Eco-efficiency in Industry and Science, Kluwer Academic Publishers
2000 – present	Editorial Board International Journal of Life cycle Assessment
2001 – present	Editorial Board Journal of Sustainable Product Design
2002 – present	Editorial Board Journal of Industrial Ecology
1992 – 1997	Member of the Editorial Board of the 'Praktijkboek Milieu' (Handbook for the environment), editor of the chapter 'Solid waste', Kluwer Publishers, Deventer, Holland
1996 – 1999	Member of the Editorial Board of the 'Handboek afvalstoffen', Sdu Publishers, den Haag

### Primary research interests

- Risk assessment
- Product life cycle assessment
- Risk communication
- Sustainable product- and service development
- Innovation studies, system analysis and foresight, with an emphasis on radical innovations for sustainable development

### Research grants and awards

- Listed in Marquis 'Who is who in Science and Engineering' 2002
- Manager EU Thematic Network on Sustainable Product Development (1.5 Million Euro, 2002-2004) comprising of 7 key research institutes in the EU (a.o. TNO, VITO and INETI) and some 30 industrial companies (a.o. Agfa, Nokia, Alcatel Bell, Interface, etc.)
- Responsible for managing cluster activities with 5 other adjacent projects similar in size (2002-2004)
- Some 80 other research grants from industry and government for projects up to 500.000 Euro and including up to 10 part-time research staff, in part dealing with political sensitive issues (discussions on chlorine, PVC and phthalates; national waste management planning in the Netherlands, Ireland and Argentina)

### Publications

- Tukker, A., A. Jasser and R. Kleijn (1997). Material suppliers and industrial metabolism. Environmental Science and Pollution Research, Vol. 4, No. 2
- Kleijn, R., A. Tukker and E. v.d. Voet (1997) Chlorine in the Netherlands Part I: An overview. Journal of Industrial Ecology Vol. 1., No. 1
- Tukker, A., R. Kleijn, E v.d. Voet and E. Smeets (1997) Chlorine in the Netherlands Part II: Risk management in uncertainty, Journal of Industrial Ecology Vol. 1, No. 2
- Klostermann, J.E.M. and A. Tukker (eds.) (1998). Product Innovation and Eco-efficiency. Kluwer Academic Publishers, Dordrecht/Boston/London

- Tukker, A., R. Kleijn, L. van Oers and E. Smeets (1998). Combining SFA and LCA: The Swedish PVC Analysis. *Journal of Industrial Ecology*, Vol. 1 No. 4
- Tukker, A. (1998) Practical Experiences with Life Cycle Impact Assessment of Toxic Releases - Arguments for a Reductionalistic Approach ? *International Journal of Life Cycle Assessment* Vol. 3, No. 5
- Tukker, A. (1999) Denkramen in het toxiciteitsdebat. [Frames in the toxicity controversy]. *Tijdschrift voor Wetenschap, Technologie en Samenleving* [Journal for Science, Technology and Society].
- Tukker, A.(1999) Frames in the Toxicity Controversy. Risk Assessment and Policy Analysis related to the Dutch Chlorine Debate and the Swedish PVC Debate. Kluwer Academic Publishers, Dordrecht/Boston/London
- Tukker, A. (1999) LCAs for Waste. Part I: Overview, Methodology and Scoping Process. *International Journal of Life Cycle Assessment*, Vol 4. No. 5
- Tukker, A. (1999) LCAs for Waste. Part II: A Comparison of Thermal Treatment Processes for Hazardous Waste. *International Journal of Life Cycle Assessment*, Vol. 4., No. 6
- Tukker, A. (2000) LCAs for Waste. Part III: The Case of Paint Packaging Separation and General Conclusions. *International Journal of Life Cycle Assessment*, Vol. 5, No. 2
- Tukker, A. (2000) Philosophy of Science, Policy Science and the Basis of Decision Support with LCA. *International Journal of Life Cycle Assessment*, Vol. 5, No. 3
- Tukker, A. (2000) Life-cycle Assessment as a Tool in Environmental Impact Assessment. *Environmental Impact Assessment Review*, Vol. 20 (2000), pp. 435-456
- Wilt, J.G. de, P.J.M. Diederer, M. Butter, and A. Tukker (2001). Innovation Challenges for European Agriculture Foresight, Vol. 3 No. 4, p341-352
- Simons, L.Ph., A.Slob, H. Holswilder and A. Tukker (2001). The Fourth Generation. New Strategies Call for New Eco-indicators. *Environmental Quality Management*, Winter 2001, p.51
- Tukker, A. (2002). Life-cycle Assessment and the Precautionary Principle. *Environmental Science and Technology*, February 2002, p. 71A
- Tukker, A., P. Eder, M. Charter, E. Haag, A. Vercauteren, and T. Wiedmann (2002). Ecodesign: A European State of the Art *Journal for Sustainable Product Design* Vol. 1, issue 3, 2001, p. 147
- Tukker, A. (2002). Risk assessment, Life-cycle Assessment: the common challenge of dealing with the precautionary frame. *Risk Analysis*, Vol. 22, No. 5, 2002, p.821-832
- Bruijn, T. de and A. Tukker (eds.) (2002) Partnership and Leadership: Building alliances for a Sustainable Future. Kluwer Academic Publishers, Dordrecht/Boston/London
- Bruijn, T. de and A. Tukker (2002). Introduction: Collaboration as the New Paradigm in Industrial Transformation. In: T. de Bruijn and A. Tukker, Partnership and Leadership: Building Alliances for a Sustainable Future
- Tukker, A. and T. de Bruijn (2002). Conclusions: The Prospects of Collaboration. In: T. de Bruijn and A. Tukker, Partnership and Leadership: Building Alliances for a Sustainable Future
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### Group represented

The **TNO Institute of Strategy, Technology and Policy (TNO-STB)** is one of the 14 institutes of the Netherlands Organisation for Applied Scientific Research (TNO). TNO is an independent public contract research organisation. TNO-STB is a multidisciplinary group of about 50 researchers and consultants working on the problems and challenges of technological, economic and societal innovation. Together, the researchers of TNO-STB have in-depth knowledge of the interactions between technology, economics, markets, organisational structures, environment, culture and policy, and know how to turn it into useful concepts and strategies. TNO-STB has fast

access to specialised knowledge in most areas of technology and its applications in the other TNO institutes. It has a vast network of relations with similar institutes throughout Europe.

The core areas of research and consultancy in TNO-STB are the following:

1. strategic innovations in clusters and networks of firms
2. analysis and evaluation of science-, technology- and industrial policies
3. policies and strategies in information, communications and media
4. policies and strategies for sustainable development

Typical products of TNO-STB are the following:

- technological, sectorial or societal foresight studies, including scenario reports;
- research and consultancy on social implications of technological developments (technology assessment);
- cluster- and sectoranalyses, analyses of competitive position;
- international policy-comparison (best-practices, benchmarks);
- usability and strategic market analyses;
- consultancy in implementing strategies.

About 25% of the work is carried out in the framework of a 4-year strategic plan which is negotiated and agreed with the Dutch government. All other work is done in research or consultancy contracts with a wide range of clients:

- government departments such as Economic Affairs, Education, Social Affairs, Agriculture, Transport and Watermanagement, Housing and Environment, etc.;
- regional and local governments;
- the European Commission, other international organisations and foreign governments;
- branch organizations and firms;
- government advisory bodies, in particular those concerned with science, technology and industrial policies;
- the research community, including the TNO-organization itself.

**Personal information**

Name:                   Alphons G.J. Voragen  
Date of birth:         20 April 1943  
Place of birth:        Heerlen, The Netherlands  
Nationality:           Dutch  
Family:                Married to L.J.M.C. Hanraets  
                            Son (1969), Daughter (1971)

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**Degrees**

1968-1971             Research assistant carrying out Ph.D. research.  
                            Ph.D. Degree 1972. Title thesis: Characterisation of pectin lyases on  
                            pectin's and methyl oligogalacturonates.  
1961-1968             Student in Food Science, Chemical-Biological Orientation.  
                            Major: Food Chemistry,  
                            Minors: Food Microbiology, Physical and Colloidal Chemistry.  
1955-1961             Bernardinus College (Lyceum, HBS-b) at Heerlen.

**Positions held**

2002-present         Scientific Director of Science Unit Agrotechnology and Nutrition  
                            Wageningen-UR  
2000- 2002            Director Department of Agrotechnology and Food Sciences  
1998-2000            Director Department of Food Technology and Nutritional Sciences  
1995-1998            Chairman Cluster " Food Science and Nutrition"  
1994-present         Management Team/Board Centre of Protein Technology (WAU/TNO)  
1989-present         Professor of Food Chemistry; Department of Agrotechnology and  
                            Food  
                            Sciences. Wageningen University  
1986-1989            Senior Lecturer (UHD, equivalent to Associate professor)  
                            Department of Agrotechnology and Food Sciences Wageningen  
                            University  
1987                    Part time (1 day per week) 'ad interim' Head of Application  
                            Laboratory  
                            "Food and Fine Chemicals, AVEBE, Foxhol, The Netherlands  
1983-1984            Visiting Consultant H.J. Heinz Co., Pittsburgh, USA.  
1978-1986            Senior staff member (equivalent to Associate professor) Department  
                            of Agrotechnology and Food Sciences, Wageningen University  
1971-1978            Junior staff member (equivalent to assistant professor)  
                            Department of Agrotechnology and Food Sciences, Wageningen  
                            University  
1974-1976            Research Associate in Plant Biochemistry with Prof.dr. P. Albersheim,  
                            Department of Chemistry, University of Boulder, Colorado, USA.

## Membership of professional bodies

- Dutch Royal Chemical Society
- Dutch Society for Nutrition and Food Technology (Vice-Chairm., '87 to '95):
- On behalf of this Society Dutch Delegate to:
  - IUFoST (International Union of Food Science and Technology).
  - EFFOST (European Federation of Food Science and Technology, (till 1998).
- Dutch Biotechnological Society
- American Institute of Food Technologists
- Representative of the Netherlands in the Federation of European Chemical Societies – Food Chemistry Division, 1989 ->
- Nutrition Counsel of Dutch Government, 1989 – 1995:
  - Member Committee “Addition essential nutrients to foodstuffs” (1991 –1993).
  - Member Committee “Ingredient replacers in foodstuffs” (1993 – 1995),
- SON working party on Proteins, 1995 ->
- Task Group Technology of Netherlands Council of Agricultural Research, ca.1990 – 1995.
- Advisory Board FAIR/CPRA, DWK, Ministry of LNV, 1996 –1998.
- Advisory Board Processing, Nutrition and Health, NRLO, 1995-1997.
- Member Program Committee Innovative Research Program “Carbohydrates (IOP-K)”, 1987-1993.
- Member Program Committee Innovative Research Program “Industrial Proteins” (IOP-IE), 1996 ->
- Board of Graduate School VLAG, 1995 – 2001
- Board Education Institute T&V (OWI T&V), 1995 ->
- Program Council WCSF, 1997-2000.
- Advisory Committee LiFT: Graduate School for Food Production, Sweden
- Graduate School International Advisory Board, LMC, Copenhagen, Denmark.
- Taskgroup “AgriFoodValley”, InnovatieNetwerk Groene Ruimte en Agrocluster, 2001 ->
- Mitglied der Senatskommission zur Beurteilung der gesundheitlichen Unbedenklichkeit von Lebensmittel (SKLM) der Deutsche Forschungsgemeinschaft. 2000 ->
- Member editorial Boards of:
  - Food Hydrocolloids
  - Journal of Food Biochemistry
  - International Food Ingredients.
  - Carbohydrate Polymers
  - Carbohydrate Research
  - Journal of Food Science
  - Innovative Food Science & Emerging Technologies
  - Fruit, Vegetable and Potato Processing.
  - Voedingsmiddelentechnologie

## Main research interests

Chemistry and Enzymology of Food Polysaccharides.

Plant cell wall biochemistry.

Processing of raw materials of plant origin.

Oligo- and Polysaccharides as Food Ingredient.

Raw material utilisation and improvement.

Food Proteins.

## Publications

- Author or co-author of ca. 250 scientific publications in Peer reviewed international journals
- Ca. 60 scientific publications as conference proceedings.
- Ca. 40 other publications, 16 book chapters, co-editor of 5 books,
- Co-inventor 6 patents.

### **Selection of papers in peer reviewed journals**

- A.G.J. Voragen and W. Pilnik. Pektindepolymerasen. I. Mitteilung: Einteilung der Pektinsäuredepolymerasen nach ihrer Wirkung auf oligomere Galakturonsäuren. *Z.f.Lebensmittelunters.u.-Forschun*, 142 (5), 1970, 346-359.
- A.G.J. Voragen, F.M. Rombouts, M.J. Hooijdonk and W. Pilnik. Comparison of endgroup methods for the measurement of pectin degradation. *Lebensm.-Wiss.u.-Technol.*, 4 (1), 1971, 7-11.
- A.G.J. Voragen, F.M. Rombouts and W. Pilnik. Influence of the degree of esterification on the activity of pectin- and pectate-lyases. *Lebensm.-Wiss.u.-Technol.*, 4 (4), 1971, 126-128.
- S.B. Tjan, A.G.J. Voragen and W. Pilnik. Analysis of some partly and fully esterified oligogalactopyranuronic acids by P.M.R. spectrometry at 220 MHz. *Carbohydrate Res.*, 34, 1974, 15-32.
- W. Pilnik, A.G.J. Voragen and F.M. Rombouts. Specificity of pectic lyases on pectin- and pectate amides. *Lebensmitt.-Wiss.u.-Technol.*, 7 (6), 1974, 353-355.
- C. Versteeg, L.J.H. Martens, F.M. Rombouts, A.G.J. Voragen and W. Pilnik. Enzymatic hydrolysis of Naringin in grapefruit juice. *Lebensm.-Wiss.u.-Technol.*, 10, 1977, 268-272.
- A.G.J. Voragen, R. Heutink and W. Pilnik. Solubilization of apple cell walls with polysaccharide-degrading enzymes. *J. of Applied Biochemistry*, 2, 1980, 452-468.
- J.A. de Vries, A.G.J. Voragen, F.M. Rombouts and W. Pilnik. Extraction and purification of pectins from alcohol insoluble solids from ripe and unripe apples. *Carbohydrate Polymers*, 1, 1981, 117-127.
- A.G.J. Voragen, H.A.M. de Kok, A.J. Kelholt, H.A. Schols and KO Swan Dijen. Determination of Bongrek acid and toxoflavin by high pressure liquid chromatography. *Food Chemistry*, 9 (3), 1982, 167-174.
- A.G.J. Voragen, H.A. Schols, J.A. de Vries and W. Pilnik. High-performance liquid chromatographic analysis of uronic acids and oligogalacturonic acids. *J. of Chromatogr.*, 244, 1982, 327-336.
- J.A. de Vries, F.M. Rombouts, A.G.J. Voragen and W. Pilnik. Enzymic degradation of apple pectins. *Carbohydrate Polymers*, 2 (1), 1982, 25-33.
- A.G.J. Voragen, J.P.T. Timmers, J.P.H. Linssen, H.A. Schols and W. Pilnik. Methods of analysis for cell-wall polysaccharides of fruit and vegetables. *Z. Lebensm. Unters. Forsch.* 177, 1983, 251-256.
- J.A. de Vries, C.H. den Uijl, A.G.J. Voragen, F.M. Rombouts and W. Pilnik. Structural features of the neutral sugar side chains of apple pectic substances. *Carbohydrate Polymers*, 3, 1983, 193-205.
- J.A. de Vries, F.M. Rombouts, A.G.J. Voragen and W. Pilnik. Distribution of methoxyl groups in apple pectic substances. *Carbohydrate Polymers*, 3, 1983, 245-258.
- J.C. van der Hoeven, W.J. Lagerweij, I.M. Bruggeman, A.G.J. Voragen and J.H. Koeman. Mutagenicity of extracts of some vegetables commonly consumed in The Netherlands. *J. Agric. Food Chem.*, 31, 1983, 1020-1026.
- J.A. de Vries, A.G.J. Voragen, F.M. Rombouts and W. Pilnik. Changes in the structure of apple pectic substances during ripening and storage. *Carbohydrate Polymers*, 4, 1984, 3-13.
- J.A. de Vries, F.M. Rombouts, A.G.J. Voragen and W. Pilnik. Comparison of the structural features of apple and citrus pectic substances. *Carbohydrate Polymers*, 4, 1984, 89-101.
- G. Beldman, M.J.F. Searle-van Leeuwen, F.M. Rombouts and A.G.J. Voragen. The cellulases of *Trichoderma viride*. Purification, characterization and comparison of all detectable endoglucanases, exoglucanases and  $\beta$ -glucosidases. *Eur. J. of Biochemistry* 146, 1985, 301-308.
- A.G.J. Voragen, H.A. Schols and W. Pilnik. Structural features of the hemi-cellulosic polymers of apples. *Z.lebensm.Unters.Forsch.*, 183, 1986, 105-110.
- A.G.J. Voragen, H.A. Schols and W. Pilnik. Determination of the degree of methylation and acetylation of pectins by HPLC. *Food Hydrocolloids* 1, 1986, 65-70.

- A.G.J. Voragen, H.A. Schols, M.J.F. Searle-van Leeuwen, G. Beldman and F.M. Rombouts. HPLC analysis of oligomeric and monomeric saccharides from enzymatically degraded polysaccharides. *J. Chromatogr.* 370, 1986, 113-120.
- A.G.J. Voragen, F.M. Rombouts, M.F. Searle-van Leeuwen, H.A. Schols and W. Pilnik. The degradation of arabinans by endo-arabinanase and arabinofuranosidases purified from *Aspergillus niger*. *Food Hydrocolloids* 1 (5/6) (1987) 423-437.
- G. Beldman, A.G.J. Voragen, F.M. Rombouts, M.F. Searle-van Leeuwen and W. Pilnik. Adsorption and kinetic behaviour of purified endoglucanases from *Trichoderma viride*. *Biotechnology and Bioengineering*, 30, 1987, 251-257.
- G. Beldman, J. Hennekam and A.G.J. Voragen. Enzymatic hydrolysis of beer brewers' spent grain and the influence of pretreatments. *Biotechnology and Bioengineering*, Vol. XXX, 5 (1987) 668-671.
- G. Beldman, A.G.J. Voragen, F.M. Rombouts, M.F. Searle-van Leeuwen and W. Pilnik. Specific and nonspecific glucanases from *Trichoderma viride*. *Biotechnology and Bioengineering* 31 (1988) 160-167.
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- F.M. Rombouts, A.G.J. Voragen, M.F. Searle-van Leeuwen, C.C.J.M. Geraeds, H.A. Schols and W. Pilnik. The arabinanases of *Aspergillus niger* - purification and characterization of two  $\alpha$ -L-arabinofuranosidases and an endo-1,5- $\alpha$ -L-arabinanase. *Carbohydrate Polymers* 9 (1988) 25-47.
- A.G.J. Voragen, H.A. Schols and W. Pilnik. Non-enzymatic browning of oligogalacturonides in apple juice models. *Zeitung für Lebensmitteluntersuchung und -Forschung* 187 (1988) 315-320.
- E. Leclercq, A.G.J. Voragen, L.M. Brugging and W. Pilnik. Effect of light, solvents and commercial enzymes on the solubility and stability of sesquiterpene lactones from chicory roots. *Zeitung für Lebensmitteluntersuchung und -Forschung* 187 (1988) 440-443.
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- H. Gruppen, J.P. Marseille, A.G.J. Voragen, R.J. Hamer and W. Pilnik. Mild isolation of water-insoluble cell-wall material from wheat flour: Composition of fractions obtained with emphasis on non-starch polysaccharides. *Journal of Cereal Science* 9 (1989) 247-260.
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- A.G.J. Voragen Food enzymes prospects. *International Food Ingredients* 1 (1990) 18-31.
- T.A. van Beek, P. Maas, B.M. King, E. Leclercq, A.G.J. Voragen and A. de Groot. Bitter sesquiterpene lactones from chicory roots. *Journal of Agricultural and Food Chemistry* 38 (1990) 1035-1038.
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- C.M.G.C. Renard, H.A. Schols, A.G.J. Voragen, J.-F. Thibault and W. Pilnik. Studies on apple protopectin. III: Characterization of the material extracted by pure polysaccharidases from apple cell walls. *Carbohydrate Polymers* 15 (1991) 13-32.
- R. Pasculli, C. Geraeds, F. Voragen and W. Pilnik. Characterization of polygalacturonases from yeast and fungi. *Lebensmittelwissenschaft und -Technologie*, 24 (1991) 63-70.
- L.H.D. Jenniskens, A.G.J. Voragen, W. Pilnik and M.A. Posthumus. Effects of the treatment of apple pulp with liquefying enzymes on the aroma of apple juice. *Lebensmittelwissenschaft und -Technologie*, 24 (1991) 69-92.
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- F.J.M. Kormelink, M.J.F. Searle-van Leeuwen, T.M. Wood and A.G.J. Voragen. (1,4)- $\beta$ -D-Arabinoxylan arabinofuranohydrolase: a novel enzyme in the bioconversion of arabinoxylan. *Applied Microbiology and Biotechnology* 35 (1991) 231-232.
- H. Gruppen, R.J. Hamer and A.G.J. Voragen. Barium hydroxide as a tool to extract pure arabinoxylans from water-insoluble cell wall material of wheat flour. *Journal of Cereal Science* 13 (1991) 275-290.
- J.W. van de Vis, M.J.F. Searle-van Leeuwen, H.A. Siliha, F.J.M. Kormelink and A.G.J. Voragen. Purification and characterization of *endo*-1,4- $\beta$ -D-galactanase from *Aspergillus niger* and *Aspergillus aculeatus*: Use in combination with arabinanases from *Aspergillus niger* in enzymic conversion of potato arabinogalactan. *Carbohydrates Polymers* 16 (1991) 167-187.
- R.J. Viëtor, A.G.J. Voragen, S.A.G.F. Angelino and W. Pilnik. Non-starch polysaccharides in barley and malt: a mass balance of flour fractionation. *Journal of Cereal Science* 14 (1991) 73-83.
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- E.M. Düsterhöft, A.G.J. Voragen and F.M. Engels. Non-starch polysaccharides from sunflower (*Helianthus annuus*) meal and palm kernel (*Elaeis guineensis*) meal - preparation of cell wall material and extraction of polysaccharide fractions. *J Sci Food Agric* 55 (1991) 411-422.
- F.J.M. Kormelink, M.J.F. Searle-van Leeuwen, T.M. Wood, and A.G.J. Voragen. Purification and characterization of a (1,4)- $\beta$ -D-arabinoxylan arabinofuranohydrolase from *Aspergillus awamori*. *Applied Microbiology and Biotechnology* 35 (1991) 753-758.
- G.A. de Ruiter, A.W. van der Lugt, A.G.J. Voragen, F.M. Rombouts and H.W. Notermans. High-performance size-exclusion chromatography and ELISA detection of extracellular polysaccharides from *Mucorales*. *Carbohydrate Research* 215 (1991) 47-57.
- P. van de Veen, M.J.A. Flipphi, A.G.J. Voragen, J. Visser. Induction, purification and characterisation of arabinases produced by *Aspergillus niger*. *Arch. Microbiol.* 157 (1991) 23-28.

- T.P. Kravtchenko, A.G.J. Voragen and W. Pilnik. Analytical comparison of three industrial pectin preparations. *Carbohydrate Polymers* 18 (1992) 17-25.
- G.A. de Ruiter, S.L. Josso, I.J. Colquhoun, A.G.J. Voragen and F.M. Rombouts. Isolation and characterisation of  $\beta$ -(1,4)-D-glucuronans from extracellular polysaccharides of moulds belonging to Mucorales. *Carbohydrate Polymers* 18 (1992) 1-7.
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- W.M.A. Niessen, R.A.M. van der Hoeven, J. van der Greef, H.A. Schols and A.G.J. Voragen. On-line liquid chromatography/thermospray mass spectrometry in the analysis of oligosaccharides. *Rapid Communications in Mass Spectrometry* 6 (1992) 197-202.
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- W.M.A. Niessen, R.A.M. van der Hoeven, J. van der Greef, H.A. Schols, G. Lucas-Lokhorst, A.G.J. Voragen and C. Bruggink High-performance anion-exchange chromatography/thermospray mass spectrometry in the analysis of oligosaccharides *Rapid Communications in Mass Spectrometry* 6 (1992) 474-478
- E.-M. Düsterhöft, M.A. Posthumus and A.G.J. Voragen Non-starch polysaccharides from sunflower (*Helianthus annuus*) meal and palm-kernel (*Elaeis guineensis*) meal - Investigation of the structure of major polysaccharides *J. Sci. Food Agric.* 59 (1992) 151-160
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### **Group represented**

From **Wageningen University** the following groups belonging to the department of Agrotechnology and Food Sciences will participate in the ICES-KIS “Voedsel en Voedsel Integriteit” program:

### **Food Chemistry**

Head: Prof. dr. ir. A.G.J. Voragen

Summary of research area:

The research within the Food Chemistry group is on one hand focused on identifying key components that determine the quality of food raw materials and their processing to ingredients or food products and on chemical changes occurring within these components during storage and processing. On the other hand, research is focused on controlling enzymatic processes that are used during processing of raw materials to ingredients or food products.

By a solid knowledge in this area, the quality aspects of food products can be explained and moreover predicted. Besides this, with knowledge on chemical and biochemical conversions, processes can be controlled to have a more complete use of agricultural raw material (less by-products), and new and high-grade final products or ingredients can be manufactured. In general, the attention towards health regulating components is increasing.

Currently about 50 people are affiliated with the laboratory of food chemistry.

### **Food Physics**

Head: Prof.dr. E. van der Linden

Summary of research area:

"To construct physical models that relate molecular properties of ingredients with macroscopic functional properties of food materials and to apply these models to manipulate functional properties of food materials and develop novel functional structures".

The ingredients considered are mainly proteins, (poly) saccharides, oils and fats. Molecular properties that are considered are conformation, charge distribution etc. The macroscopic functional properties that are considered comprise gelation, stability, release, texture, sensory perception, etc.

In order to bridge the gap between molecular and macroscopic length-scales, mesoscopic issues are essential. Hence we focus on molecular assembly (with and without external fields), structure and domain formation, phase behaviour and effects of shear on the former.

Currently about 15 people are affiliated with the laboratory of food physics.

### **Product Design and Quality Management**

Head: Prof.dr.ir. M.A.J.S. van Boekel

Summary of research area:

The research is of fundamental as well as of applied character and is aimed at optimization of existing and the design of new products and processes. Central in this approach is product quality from the consumer perspective. The most important research themes are: (1) Quality optimization from a chain perspective, the development of instruments to regulate quality, (2) Mathematical modelling of changes in quality attributes of foodstuffs during storage and processing, (3) Quantitative measurement of health effects of foodstuffs, health as quality parameter and the effect of processing on these aspects, (4) Packaging in relation to product quality: interactions between product and packaging, ways to influence product quality and shelf life by packaging concepts, (5) Sensory aspects of foodstuffs, the translation of consumer wishes in relation to sensor properties in product characteristics, effects

of processing on sensor properties, importance of sensor properties for product design, (6) Sustainability of production systems for foods, system analysis of food systems, (7) Chemical and physical aspects of milk and dairy products, fermentation processes

Currently about 30 people are affiliated with the group of Product Design and Quality Management.

### **Food & BioProcess Engineering**

Head: Prof.dr.ir. Remco Boom and Prof.dr.ir. Johannes Tramper

The section focuses on a number of research themes which are grouped under Food Process Engineering and Bio-process Engineering. The themes are: Membranes, Structuring and Preservation, Enzyme Bio-catalysis, Marine Biotechnology, Bio-catalytic Reactors, Animal Cell Technology, Solid State Fermentation

Research themes above all share a number of general Process Engineering topics such as (bio) kinetics, transport processes, reactor design, separations, scale-up, biocatalyst technology, and mathematical modelling.

Application areas include the food and feed industry, agro-industry, and the fine-chemicals and pharmaceutical industries.

Food & Bio-Process Engineering consists of some 50 people.

### **Section Human Nutrition and Epidemiology**

Head: Prof.dr.ir. Frans.J. Kok, Prof.dr.ir. Pieter van het Veer and Prof.dr. Michael Müller

The research of the Section Human Nutrition and Epidemiology is aimed at studying of the role of nutrition and life style on the health and well being of man. To this also belongs insight in underlying mechanisms from a biological and behaviour science point of view. The research is aimed at problems in western and non-western countries, in the research various research methods are used ranging from experiments on molecular level via feeding intervention studies with humans to observational population research.

Currently about 105 people are affiliated with the section Human Nutrition and Epidemiology.

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**Degrees**

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 1985 – 1990 Master of Science in Physics, University of Nijmegen, Nijmegen  
 1990 – 1994 PhD in Experimental Physics, Molecule and Laser Physics, Nijmegen  
 Completion of thesis (promoter Prof. Dr. J. Reuss) 13-12-1994

**Positions held**

1989-1994 University assistant-teacher in physics and chemistry, supervisor of six students for master degree  
 1990 - 1990 Research fellow, Orsted institute, Copenhagen, Denmark  
 1995 – 1995 Research fellow, Gadjah Mada University of Yogyakarta, Indonesia  
 1995 – 1995 Research fellow, Centro de Investigacion y de Estudios Avanzados del IPN, Mexico D.F.  
 1995 – 1996 STW-NWO Post-doc, University of Nijmegen  
 1996 – 1999 Project leader & deputy department head, ATO-DLO, Wageningen  
 1999 – present Director strategy & commercial affairs, ATO BV, Wageningen

**Membership and/of activities in professional bodies**

- Board member of Dutch Physics Society
- Member of Advisory Board of Food Valley
- Board member of European Food Management Group 'Foodforce'

**Primary research interests (appr. 100 scientists involved in BU-related research)***Preservation technologies and food safety*

applied microbiology, new mild preservation techniques, drying and EME technologies, hygiene engineering

*Food structure and technology*

food physics, extrusion technology, proteins for food applications, (minimal) processing of potatoes, fruit and vegetables

### *Functional ingredients*

immuno-technology and bio-active peptides, separation technologies, food and health

### *Marketing research and sensory science*

trade innovations, sensory research, food perception

### *Postharvest physiology of fruit & vegetables*

storage, packaging, logistics, tracing & tracking

### *Molecular spectroscopy and trace detection of bio-active molecules in the gas phase*

Laser photothermal-based detection systems, Physiological research on complex plant systems, Atmospheric air pollution research)

### **Research grants and awards**

- NWO-STW grant 'Laser photoacoustics applications'
- LSF-photoacoustics grant (ERB-4062 PL97-0089)
- Dutch EET grant 'The development of a sustainable energy-driven agrocontainer'

### **Publications**

- Photoacoustic measurements of Lorentz Broadening in CO<sub>2</sub> between 25°C and 450°C  
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- The photothermal deflection technique: Fast trace gas detection in the atmosphere  
H.S.M. de Vries, F.J.M. Harren, J. Reuss In: Eurotrac/Cost 611 Annual Report part 4: Biatex, Fraunhofer Institute, Garmisch Partenkirchen, 55-58 (1991)
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### Group represented

Within **Wageningen University and Research Center, ATO BV, Institute for Agrotechnological Research**, is an organisation for strategic and applied-scientific research for the industries manufacturing food and non-food products on the basis of vegetable and animal raw materials, and for chain managing companies and organisations. The target of the institute's multidisciplinary research and development activities is to enhance the added value of agro-products and to develop new technologies, new applications and new markets for agro-raw materials. ATO's key activities are:

- Agro and Industrial Production Chains
- Food and Food Processing
- Renewable Resources

The first two contribute to this ICES-KIS business plan. The scope of the business unit Agro and Industrial Production Chains (Ir. A. Simons, ir. A. Timmermans) is to develop innovations for the agro-production chain in order to improve product quality and chain performance for both food and non food products. A unique selling point of the division is the integrated approach, looking at the entire production chain (storage, packaging, processing, etc.), realizing improvements by combining detailed product knowledge, advanced technologies and information systems. Research is divided into post-harvest quality Fresh Products (dr. H. Peppelenbos), Packaging & Transport & Logistics (dr. H. Luitjes) and Production and Control Systems (ir. H. Maas). The scope of the Business Unit Food and Food Processing (dr. H. de Vries and dr. J. Oosterhaven) is to design and develop new food concepts together with our customers. Key issues include system innovations, market-driven product development,

functionality and matrix-ingredient interactions. Research is divided into four groups: food preservation and safety (dr. R. van den Berg), structure and technology (dr. F. Beekmans), functional ingredients (dr. C. Zondervan) and marketing research and sensory science (drs. A. Koster).

Except for the above mentioned group leaders, the following programme coordinators (and senior scientists) will be involved under supervision of Prof. Dr. A. Voragen and dr. H. de Vries (together with Wageningen university staff members, e.g. Prof. T. van Boekel, Prof. E. van der Linden, Prof. R. Boom, dr. H. Gruppen): Prof dr. J. Top and drs F. Verdenius (production chains), dr M. van Wordragen (fresh quality), dr H. Schepers (design), dr. G. Dijksterhuis and ir. J. Mojet (sensory science and perception), dr. J. Vereijken and ir. J. van Gijssel (texture snacks), dr. H. Wichers and dr. A. van Amerongen (allergy and functionality), dr. P. Bartels and ir. A. Matser (convenience).



# Appendix C: Link to European Research Programmes

The research and policy issues addressed in the Knowledge Project Food & Food Integrity are also relevant at a European scale. This is evidenced by the close links that exist between the EU Framework 6 Research priorities and the three principal objectives of this Knowledge Project.

Particularly relevant is the EU Framework 6 thematic priority number 5 “Food Quality and Safety”, but links also exist with priority areas 7 (Citizens and Governance in a knowledge based society) and 1 (Life sciences, genomics and biotechnology for health).

Below, we will elaborate in more detail on the embedding of the principal objective of the Knowledge Project Food & Food Integrity with the topics and research areas identified within EU priority area 5.

The primary objective of Priority Area 5 “Food Quality and Safety” is “to improve the health and wellbeing of European citizens through a higher quality of their food, improved control of food production and of related environmental factors ..... Taking the farm-to-fork approach provides the primary driver for developing new and safer food production chains and foods. ...”. The research areas within this Thematic Priority thus address key aspects of food quality, safety and consumer concerns along the food chain”. Within this theme of Food Quality and safety, eight research areas have been identified (see below) each consisting of a number of specific topics (T1 to T47) on which project proposals are invited:

#### *Area 1: Total food chain (EU research topics T1 to T4)*

The objective is “to develop foods with higher quality and safety together with higher quality and safety together with clear health benefits for consumers”.

#### *Area 2: Epidemiology of food-related diseases and allergies (EU research topics T5 to T9)*

The objective is “to examine the complex interactions between food intake and metabolism, immune system, genetic background and socio-economic factors to identify key risk factors and develop common European databases”

#### *Areas 3: Impact of food on health (EU research topics T10 to T16)*

The objective is “to provide the scientific basis for improving health through diet”

#### *Area 4: Traceability processes along the production chain (EU research topic T17)*

The objective is “to increase consumer confidence in the food supply by strengthening the scientific and technological basis for ensuring complete traceability along the entire food chain, including animal feed”.

#### *Area 5” Methods of analysis, detection and control (EU research topics T18 to T23)*

The objective is “to contribute to the development, improvement, validation and harmonisation of reliable and cost-effective sampling and measurement strategies for chemical contaminants and existing and emerging pathogenic micro-organisms so as to control the safety of the food and feed supply and ensure accurate data for risk analysis”.

*Area 6: Safer and environmentally friendly production methods and technologies and healthier foodstuffs (EU research topics T24 to T38)*

The objective is “to develop lower input farming systems based on systems such as integrated production, and organic agriculture”.

*Area 7: Impact of animal feed on human health (EU research topics T39 to T40)*

The objective is “to improve understanding of the role of animal feed, including products containing genetically modified organisms and the use of sub-products of different origin for that feed, in food safety”

*Area 8: Environmental health risks (EU research topics T41 to T47)*

The objectives are “to identify the environmental factors that are detrimental to health, understand the mechanisms involved and determine how to prevent or minimise these effects and risks”.

The table below illustrates how the specific research topics (T1 to T47) within these sub-areas directly relate to the three principal objectives within the Knowledge Project Food and Food Integrity

	Food & Food Integrity principal objectives		
	1. <i>Involvement, trust and confidence</i>	2 <i>Enhancing healthy food choices</i>	3 <i>Socially responsible without sacrifice</i>
EU FW6: Food Quality and Safety			
1. Total food chain		T2	T3, T4
2. Epidemiology	T5	T8, T9	T7
3. Impact food on Health	T13	T10, T16	
4. Traceability processes	T17		
5. Methods	T21		
6. Safe & environmental		T34	T25, T35
7. Animal feed-> Health			
8. Environmental			T42

