SUSFOOD STRATEGIC SCENE

REVIEW REPORT 2018

SUSFOOD2

SUSFOOD STRATEGIC SCENE

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The operational environment of SUSFOOD2

The first review report analysing the strategic scene
2018

Contents

Photo by Nikola Schulz

Abstract

This report describes the current background of research and innovation programming in the field of sustainable food production and consumption in Europe. It complements the SUSFOOD Strategic Research Agenda (SRA) and serves as a tool for its implementation. It summarizes the SRA and the objectives of SUSFOOD2, and gives an overview on the main trends and drivers in the field of SUSFOOD. It also lists other relevant initiatives and takes a look on the first achievements of SUSFOOD funded projects.

1. Introduction

The Strategic Research Agenda (SRA) of the EU FP7 ERA NET project on Sustainable Food Production and Consumption (SUSFOOD) was published in 2014. This first review report of the SRA aims to draft an updated picture of the current state-of-the-art in the field of the research and innovation of sustainable food production and consumption in Europe. The SUSFOOD SRA focuses on food chain beyond the farm gate but it interfaces with primary production on several issues.

SUSFOOD2 will continue the implementation of its SRA. This review of new movements and upcoming research gaps will help to plan the implementation activities and guide the overall impact assessment in the current context. A second review is envisaged in 2020.

This report is based on the SUSFOOD SRA and SUSFOOD2 proposal. In the mapping a number of agendas, strategies and foresights were studied and updates of the context described in the SRA were done. SUSFOOD2 partners were also involved in the process. A web survey was carried out in March-April 2017, where partners were asked to state SUSFOOD related initiatives (26 responders representing 80% of partners). In December 2017, a workshop was organized with the SUSFOOD2 Governing Board (GB) and External Advisory Board (EAB) to get ideas about the current needs of research, some challenges and the expected impact of the network. This review report was also circulated among the partners and EAB members and they had a chance to comment it.

2.   Background

SUSFOOD has the vision: ***All food chain partners contribute to achieving sustainable, secure and resilient food systems which feed the world and make sustainable choices the easy and preferable choices for consumers.***

2.1.   Definition of Sustainability

SUSFOOD defines sustainability in the food area as: "A food system that supports food security, makes optimal use of natural and human resources, and respects biodiversity and ecosystems for present and future generations, and which is culturally accepta-ble and accessible, environmentally sound and eco-nomically fair and viable, and provides the consumer with nutritionally adequate, safe, healthy and affor-dable food." This definition is in accordance with the characteristics set out by FAO (2014).

1.2 SUSFOOD SRA

The SUSFOOD SRA was developed as a result of coo-peration of 25 partners from 16 European countries (building the FP7 SUSFOOD consortium). The process included mapping of foresight studies, workshops, consultations of SUSFOOD governmental bodies and national contributions. The SRA sets out the road map of which research areas need to be addressed to ensure sustainable development of food systems in Europe.

In the SRA, a number of core challenges with high relevance for SUSFOOD, reflecting environmental, technological, socio-demographic, economic, and political dimensions, were identified (Box 1).
Based on the identified challenges for sustainable

food production and consumption the SRA lists and describes eight priority research areas (Box 2) and two cross-cutting issues, namely equity and ethics, and localization of food chain activities. All research funded by SUSFOOD should be considered in res-pect to the SUSFOOD definition of sustainability, the two cross-cutting issues, and a multi-disciplinary and whole food-systems approach. Taking all this into ac-count, SUSFOOD focuses specially on those parts of the food chain beyond the farm gate, i.e. processing, distribution, preparation and consumption of food. An additional focus is on having a positive impact on Small and Medium sized Enterprises (SME) and job creation.

Under FP7 SUSFOOD ERA-NET (2011-2014) two re-search calls were launched based on these priority research areas. SUSFOOD2 launched a co-funded call in 2017. The funded projects are described in chap-ter 5.

BOX 1 - Challenges for sustainable food production and consumption identified in SUSFOOD SRA:
1. Global food and nutrition security
2. Limited energy, water, natural resources
3. Innovation, knowledge transfer, sustainable development in the food system
4. Food and health
5. Change of markets and approaches, resilient and sustainable food economy, employment
6. Food demand (consumer awareness, food system)

2.3.   Objectives of SUSFOOD2

SUSFOOD2 promotes a cross-sectoral and multi-disciplinary approach from biology to food engineering and social sciences. It addresses the following socio-economic and environmental goals:

- To develop sustainable food systems from production to consumption, to increase food production sustainably while reducing waste in food supply chain and limiting environmental impacts;

- To improve the quality of life by improving food quality in a sustainable way and to ensure the resilience of the food supply chain;
- To encourage sustainable consumer behaviors and food choices;
- To improve competitiveness and economic growth in the European food industry with special attention to SMEs.

BOX 2 - Priority research areas defined in SUSFOOD SRA:

1. Public policy coherence
2. Innovation in food processing technologies
3. Redesign input, waste and side flow strategies to increase resource efficiency and provide added value in food products and processing, manufacture etc.
4. Interdisciplinary research approach to develop innovative food products and use of new raw materials for food products
5. Harmonisation of the methods and metrics for integrated assessment of sustainability of food products and food patterns
6. Connection between stakeholders and food systems
7. Understanding of consumer behavior and food choices
8. Integration of information systems for personalized and sustainable choices

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3.   Strategic context of SUSFOOD2

3.1.   Food systems approach

The food systems approach (Figure 1) could help in identifying different aspects of sustainability and their interrelations, like resource efficiency, environmental stability, resilience and the public health agenda. A food system gathers all the elements and activities that relate to the production, processing, distribution, preparation and consumption of food, and the output of these activities, including socio-economic and environmental outcomes (HLPE 2014).
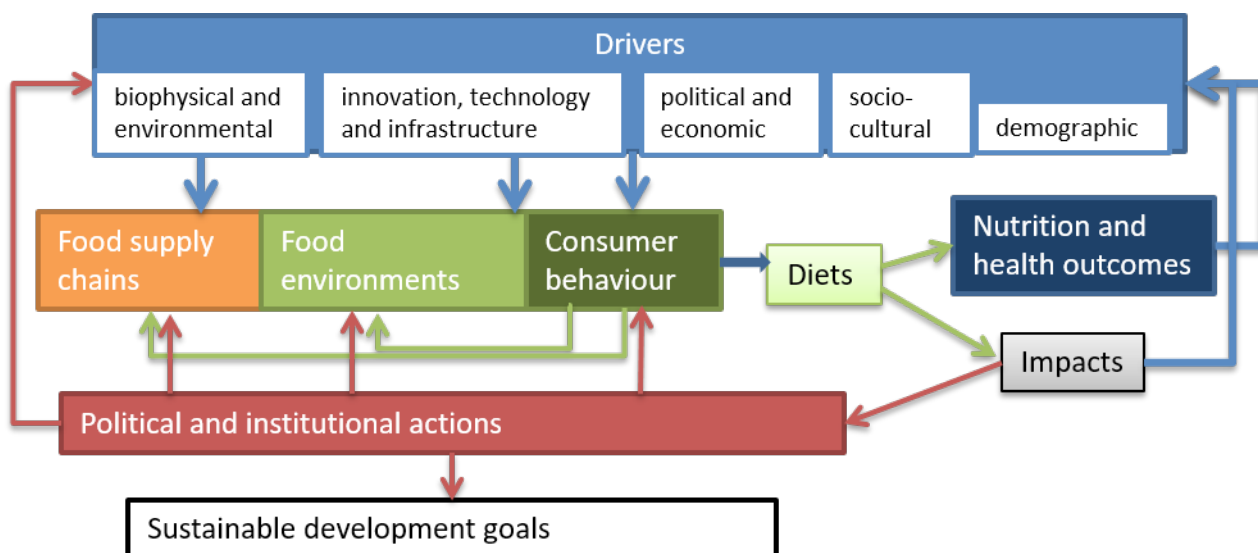
Figure 1. Food system as adapted from HLPE report (2017).

In December 2017, the SUSFOOD2 External Advisory Board (EAB) and Governing Board (GB) had a workshop in Madrid (Figure 2). They mentioned long supply chains as one of the challenges of the current food systems.

The food systems also need more transparency and integrate food safety as a unique selling point. Understanding food environments, e.g. the context in which consumers engage with the food system to make their decisions is important to design effective solutions that would support consumers' lifestyle changes.

Figure 2. Workshop of SUSFOOD2 External Advisory Board and Governing Board in Madrid 2017. Photo K. Broekaert.

The challenges identified in SUSFOOD SRA are listed in Box 1. Three of the challenges, i.e. food security, resource constraints and food waste were taken into deeper examination. The same structure is followed in this report. In general, the overall global context in 2018 has not changed from what was described in the SUSFOOD SRA in 2014. The increasing demand for nutritious food and natural resources are the main challenges for future food systems.

3.2. Global food and nutrition security

The SUSFOOD SRA uses FAO's definition for food security: "Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life".

The expected growth of the world population to 9 billion in 2050 will lead to a near 60 % increase in food demand. Hunger and undernutrition, micronutrient deficiencies on the one hand, and on the other hand overnutrition exist in parallel and are partly connected. In 2016 worldwide 815 million people were chronically undernourished (FAO 2017). At the same time the worldwide obesity has nearly tripled since 1975 (WHO 2017). Socio-economical inequity, ageing and urbanization also have an effect on the way in which the food systems are established.

United Nations (UN) launched the Agenda 2030 for Sustainable Development including Sustainable Development Goals (SDGs) in September 2015. The EU and Member States are committed to implement the Agenda 2030 for Sustainable Development and the SDGs within the EU and in development cooperation with partner countries. SDGs are also well in line with objectives and SRA of SUSFOOD and strengthen the

justification of its targets: SDG2 (end hunger, achieve food security and improved nutrition, and promote sustainable agriculture) is closely connected with SDG1 (poverty alleviation), SDG3 (ensure healthy lives), SDG5 (gender equality), SDG6 (water), SDG7 (energy), SDG8 (economic growth), SDG11 (sustainable cities and communities), SDG 12 (sustainable consumption and production), SDG13 (climate change), and SDG15 (land use and management).

UN Paris agreement (2015) ratified by 173 countries recognizes that sustainable lifestyles and sustainable patterns of consumption and production play an important role in addressing climate change.

The EC announced the Food 2030 initiative (DG Research and Innovation, 2016), a policy framework to better structure, connect and scale up European research and innovation for food and nutrition security and climate issues. Food 2030 is aligned with EU commitment to SDGs. The priorities of Food 2030 are nutrition for sustainable and healthy diets, climate-smart and environmentally sustainable food systems, circular and resource efficient food systems and food systems innovation and empowerment of communities. Food 2030 conference in October 2016 reviewed topics spanning the relationships between agriculture, food and health. These included personalized nutrition, connecting health and nutrition data, the role of precision agriculture, preparedness for climate change, and microbiomes. Additionally, there were more general debates on building better connections between research and practice, and between different policy-making departments at EU level but also with global collaborators.

Food2030 conference in October 2017 served to disseminate successful European research and innovation initiatives and contributed to the ongoing science-policy dialogue in the area of food and nutrition security. Some examples of innovative projects are presented in the report "Future-proofing our food systems through research and innovation" (2017).

FACCE-JPI, JPI HDHL and JPI Oceans (2015, 2017) have joined forces to bring two common priority research areas forward to be tackled together. One area concerns the effects of policies on food and nutrition se

curity and the second is on food production for better nutrition and better resilience to climate change.

3.3.   Resource constraints and food industry

Many of food systems are currently unsustainable from a natural resources perspective such as land degradation, depletion of fish stocks, nutrient losses, impacts on biodiversity, air, soil and water quality, and greenhouse gas emissions (UNEP 2016). An overarching issue is climate change which will affect what can grow and where. Food system activities beyond the farm gate contribute to environmental degradation through water use, pollution and energy use.

The SUSFOOD SRA emphasizes the need to improve the water and energy efficiency throughout the food supply chain. Food industry is the largest manufacturing sector in terms of turnover, added value and employment in Europe (FoodDrinkEurope Data and Trends, 2017). The carbon, energy and water consumption of food industry is also remarkable, and thus research is needed to improve the sustainability in the use of resources. The development of innovative technologies, approaches and business models is a crucial factor for boosting the competitiveness of the European industry.

FoodDrinkEurope launched an online platform "More than Food" in June 2017 which brings together the key initiatives of the food and drink sector to promote its core values all along the manufacturing process and showcase the industry's work on nutrition, sustainability, innovation and entrepreneurship.

3.4.   Food waste

Food waste was the third global challenge in closer examination in SUSFOOD SRA. In this field progress has taken place in research and policy commitment. The problem is, however, not yet solved. More research, development and innovation are needed. One of the targets of Agenda 2030 is to halve per capita food waste at the retail and consumer level by 2030, and reduce food losses along the food production and supply chains.

At EU level, a website provides information on EU actions to tackle food waste, a repository of good practices in food waste prevention, communications materials to help raise awareness and a food waste resources library. FUSIONS EU project (FP7, 2012-2016) resulted in estimates of European food waste levels and recommendations and guidelines for a common European food waste policy framework. The REFRESH EU project continues the work started in FUSIONS. Other initiatives communicating about food waste are e.g. Love Food Hate Waste, Saving-Food, Say No To Food Waste, and The Food Box. Also FoodDrinkEurope and EUFIC have campaigns against food waste.

3.5.   Other trends and drivers

FoodNavigator is an online news source for the food industry providing view of the food and beverage market. FoodNavigator names some trends for coming years. As an example, local producers and small companies will have a bigger role in the coming years. Further, there is increasing awareness of the link be-

SUSFOOD2 EAB & GB workshop (2017) noted that ICT technology and use of big data connected to food systems are helpful to ensure resource sustainability and more efficient use of resources. EAB & GB workshop also raised the impression that industry is driven by profits and price is still one of the main drivers in global food consumption (FAO 2015). Food industry has been going through a massive concentration process over the last decades and the investments of big companies can affect which trends expand. However, the food industry is still mainly SME based (99.1% of the total of EU food and drink companies, FoodDrinkEurope Data and Trends, 2017). The SMEs thus also have an important role but there is an insufficient transfer of research results and knowledge. Research can improve the technological production, but only consumer perception will change the behavior. Other things like sustainability and ethical issues are becoming more important to some consumers.

tween health, ageing and diet. Also reducing salt, fat and sugar remain important trends. Consumers like if food or a company has a story to tell.

In SUSFOOD2 EAB & GB workshop (2017) it was stated that trends change all the time. The trends as mentioned by FoodNavigator (see above) were also indicated by EAB & GB members.

During the last years there has been an increase in plant based products and alternative protein sources like insects and products from aquaculture. An example of artificial food is presented in Box 3. Consumers show interest in food with less ingredients and cleaner labels as also examined in the Strategic Research and Innovation Agenda (SRIA) of the ETP Food for Life (2016). Globally, meat consumption is rising but it seems at the same time that in Europe the number of people reducing meat consumption is increasing. The food sector has an important role in achieving more sustainable patterns of consumption by providing alternative products.

Technological innovations change the production systems all the time. E.g. a non-invasive food scanner, capable of delivering real-time results to help people accurately manage their food intake, recently won an EC Horizon Prize. Pioneering projects such as PERFORMANCE funded by FP7 framework or CIBUS-FOOD funded by SUSFOOD have used 3D printing technology for food innovations and personalized nutrition. Technological innovations can improve the traceability and sustainability of food supply chains.

New technology and the use of new raw materials often face the challenges of legislation. Food legislation is extremely complex, designed for big industry, and not addressing the structures of SME. Research could help to design more practical yet effective food legislation.

There has been a significant increase in the use and potential of smart phones and social media in food sector over the last years. Technology enables new ways of interaction and data collection between consumers and producers, as also examined in the SRIA of the ETP Food for Life (2016). Digital information can be used for participatory food systems. Applications for smart phones can guide personalized food choices. Social media also empowers consumers to communicate with each other in a fast and efficient way regardless of the time and location, with all input having an equal status. An example of positive utilization of social media communication is presented in Box 4. This example also shows how marketing activities and advertisement can influence consumption patterns. In SUSFOOD2 co-funded call 2017 a project aiming to study how food practices are affected by socio-technical innovations in food provisioning platforms was selected to be funded (see Box 6).

On the other hand, social media can amplify critical opinions, such as prejudices against industrially-processed food. Furthermore, social media can disseminate disinformation extremely efficiently. The amount of information is huge and the responsibility to filter science- or evidence-based information from disinformation is on the consumer.

BOX 3 - Case: Grow your own food
Growing meat or berries in laboratory is already possible. The price is still high but going down. People still value the "real" food higher but what if artificial food is more sustainable? On the other hand does it contain the same diversity of secondary metabolites or profitable microbes as the traditional food?
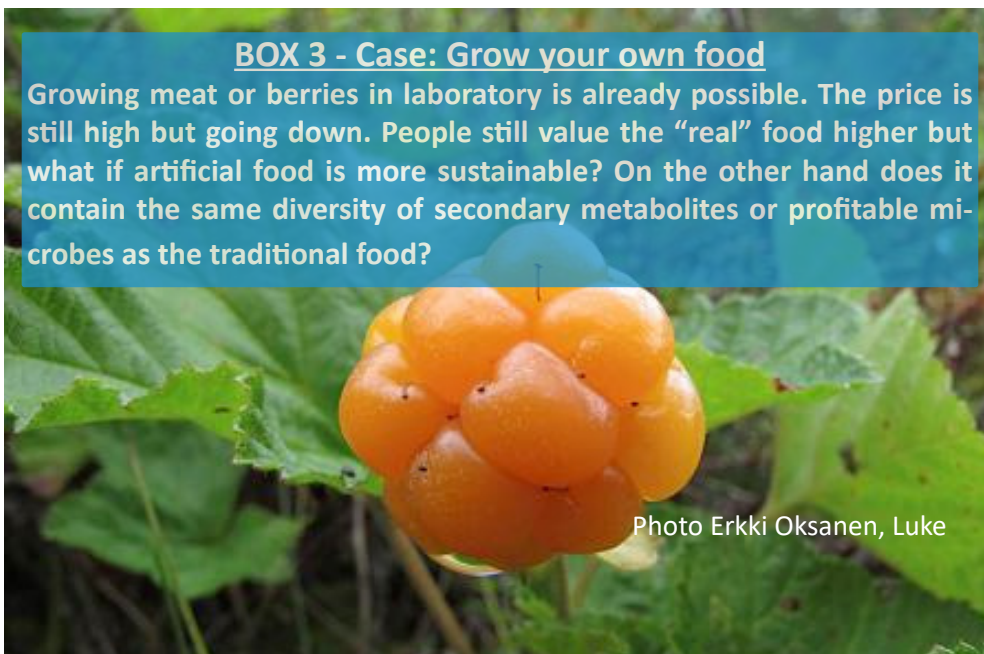
Photo Erkki Oksanen, Luke

BOX 4 - Case: Food waste and social media

A cauliflower campaign started from a small newspaper article in August 2017. Due to cold summer in Finland the cauliflower harvest time was short and there was oversupply of cauliflowers. A farmer told that he has to leave the crops on the field because there is no demand. This was a start for a massive social media campaign to avoid food waste. People shared cauliflower tips and recipes. The main retailers joined the campaign by advertising and putting cauliflowers on best places in the shops. This all caused the demand to increase and potential food waste to be avoided.

Photo Elina Nurmi, Luke

EAB & GB (workshop, 2017) stated that food has a high cultural value but consumers have prejudices towards new technologies and might fear to loose food as a real thing. Advanced technology also changes the way food comes to table.

Food consumption will need to change to improve consumer health. It is obvious that clear information concerning sustainable and healthy diets towards consumers and industry is needed and knowledge transfer should be improved. However, changing the behavior of consumers is very difficult. It requires multidisciplinary research on upstream determinants of food behaviors. Furthermore, the ways of eating are changing. The increasing trend to eat out-of-home, canteens, catering and restaurants play a crucial role in making food systems more sustainable.

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4. SUSFOOD2 and related initiatives

The SUSFOOD SRA lists examples of EU initiatives in connection to SUSFOOD. This list includes ERA-Nets, Joint Programming initiatives (JPIs), European Technology Platforms (ETPs), and some FP7 projects and other initiatives. In order to update the list of initiatives surrounding SUSFOOD, the SUSFOOD2 partners were asked in spring 2017 to add relevant initiatives. This updated list is given in Table 1. A grouping of these initiatives according to their field was mapped and is presented in Figure 4.

FOOD QUALITY AND SAFETY
AMR Transmission dynamics JPI
TP Organics
*CORE Organic Plus Cofund
Plants for the Future
EATiP
CSA Authent-Net
Global Food Security Programme
ETP Food for Life
SCAR SWG on Food Systems
AuthentNet

INDUSTRY
*ETB Pro
*Euro Trans Bio
ETP Food for Life
ManuFuture
TP Organics
Plants for the Future
SusChem
EATiP
Enterprise Europe Network
PPP- Bio-based Industries Joint Undertaking
FoodNexus

CLIMATE CHANGE, FOOD WASTE
FACCE-JPI
• *ERAGAS
Climate JPI
Belmont Forum
Global Research Alliance on Agriculture and Greenhouse Gases (GRA)
REFRESH
EU Platform on Food Losses and Food Waste
ETP Food for Life

CONSUMERS, HEALTH, SOCIETY
HDHL JPI
• *ERA-HDHL
• *HDHL-INTIMIC
ETP Food for Life
Plants for the Future
EU Platform on Diet, Physical Activity and Health
Global Food Security Programme
JPI Urban Europe
JPI Cultural Heritage
JPI Demographic
EATiP
EIT Food
FoodForce
SCAR SWG on Food Systems
FReSH

INNOVATION, RESEARCH
European Regions Research and Innovation Network
4PRIMA CSA
PLATFORM
European Commission Joint Research Centre (JRC)
Coordination of nationally-funded research (COST)
European Innovation Partnerships (EIP)
National contact points
European Association of Development Agencies (EURADA)
European Food Alliance
FoodForce
FIT4FOOD 2030
SCAR SWG on Food Systems
ETP Food for Life

NATURAL RESOURCES, TECHNOLOGY
WATERS JPI
• IC4WATER CSA
• *WaterWorks2014
• *WaterWorks2015
• *WaterWorks2017
European Water Platform
4PRIMA CSA
ManuFuture
SusChem
PLATFORM
S3 Platform

AGRICULTURE
FACCE-JPI
• *ERAGAS
• *FACCE-SURPLUS
• *SusCrop
*CORE Organic Plus/Cofund
*SusAN
European Innovation Partnerships (EIP)
SWG AKIS
4PRIMA CSA
*LEAP-Agri
*ICT-AGRI 2
TP Organics
SCAR SWG on Food Systems
SCAR SWG AKIS
Biohorizon network
Euphresco network

AQUACULTURE
OCEANS JPI
EATiP
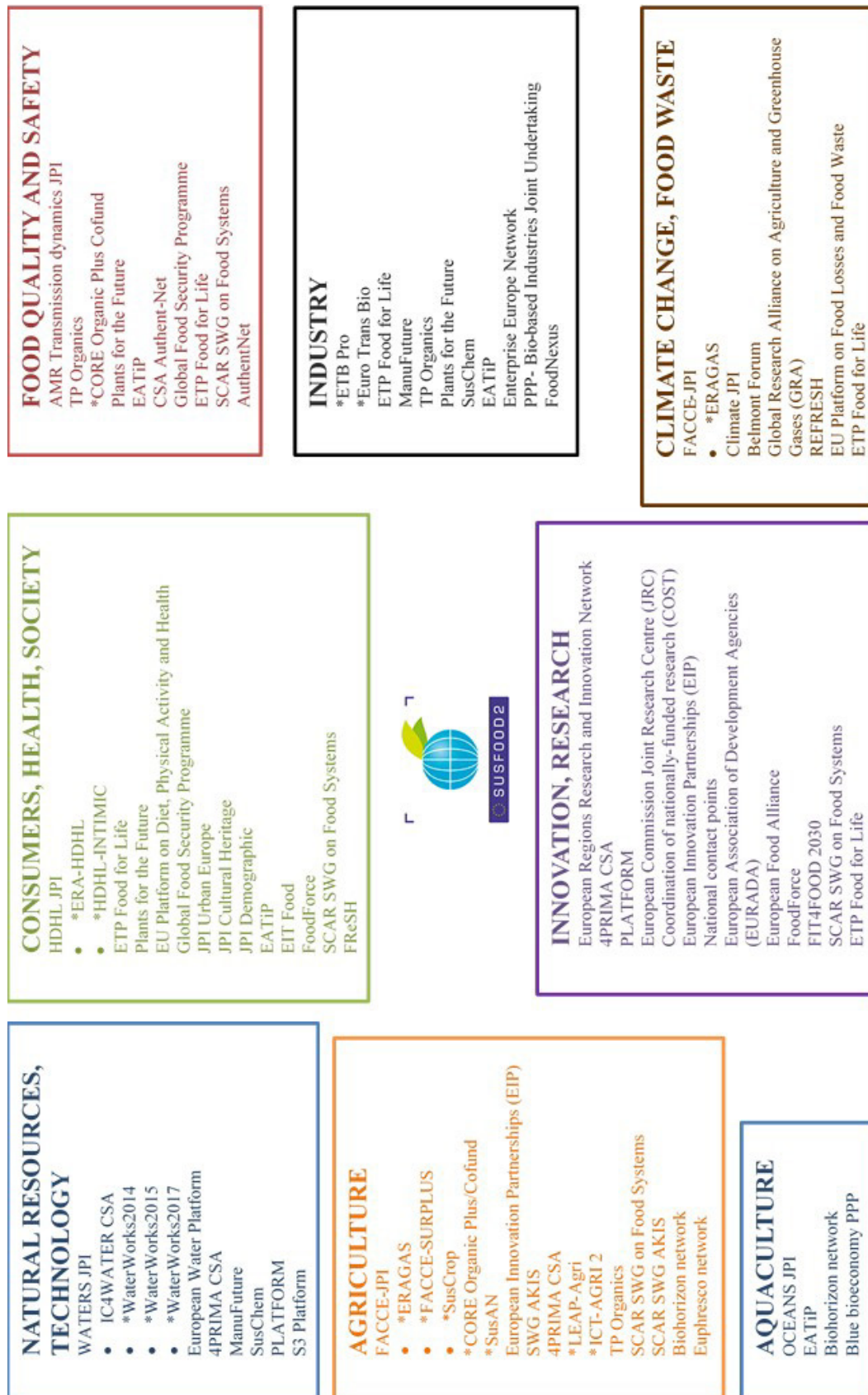Biohorizon network
Blue bioeconomy PPP

Figure 4 Some initiatives in the fields related to SUSFOOD2. ERA-Nets are marked with *.

In addition to these identified initiatives and projects there are hundreds of food related projects funded by H2020. According to CORDIS there are nearly 900 European projects funded by H2020 Societal Challenges 2 (Food) program (SC2).

SUSFOOD2 is especially interested in cooperating with other initiatives like ERA-Nets and JPIs. For instance the JPIs FACCE and HDHL mention SUSFOOD or SUSFOOD2 in their SRA or implementation plan. Additional calls could be organized together with other ERA-Nets, like CORE Organic.

To have a clear picture of how much public R&I funding at national level has been allocated to food systems, a pilot study was conducted in 2017 in three countries (Finland, Hungary and Belgium) within the framework of the SCAR Food Systems SWG. This mapping of research funded 2012 to 2016 was then also performed by more countries in 2018. This study, which is supposed to be published in June 2018, shows that a sustainable and resource efficient food system demands conscious approach in research financing. Consumer demand plays a central role in the food sector but at present, a minority of funding is given towards consumer studies. It was also stated very clearly, that in the past the focus of the financing has been on primary production and food processing, and that there are knowledge gaps to be filled in the research of connections between food and health and food sustainability. There are gaps also in the research of consumer driven processes including distribution.

In 2017 UK decided to leave the EU. UK is a strong player in the food area both in industry and research. It will remain to be seen how Brexit will affect the European food area.

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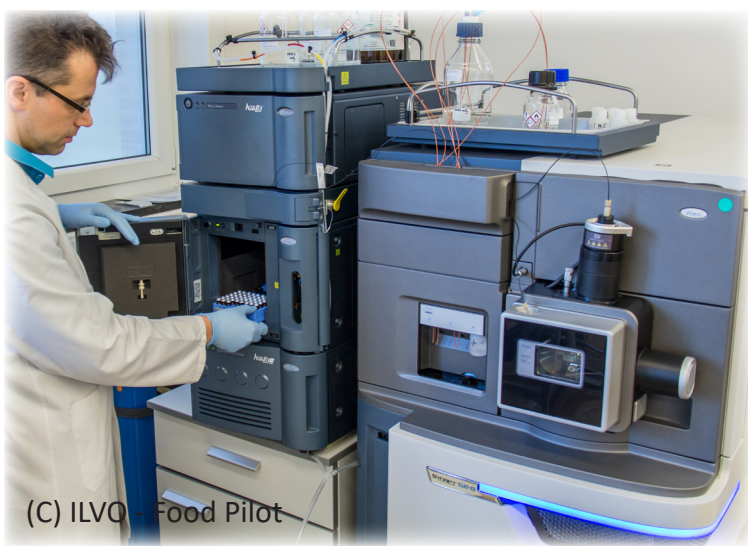
(C) ILVO - Food Pilot

(C) INRA, Christophe Maitre

Table 1. List of initiatives related to SUSFOOD2

EU level initiatives and networks	
	European Commission (DG DEVCO, DG AGRI and DG RTD)
JRC	European Commission Joint Research Centre *Commission's science and knowledge service*
SCAR SWG on Food Systems SCAR SWG AKIS	Strategic Working Group of the Standing Committee of Agricultural Research Agriculture Knowledge and Innovation Systems
EIT Food (KIC)	European Institute of Innovation and Technology *Education/entrepreneurship/innovation within Food*
EIP	European Innovation Partnerships to stimulate interactive innovation
Enterprise Europe Network	Helps businesses innovate and grow on an international scale
EU Platform on Food Losses and Food Waste	A Platform dedicated to food waste prevention
EU Platform for action on Diet, Physical Activity and Health	Forum for European-level organisations, ranging from the food industry to consumer protection NGOs, willing to commit to tackling current trends in diet and physical activity
National contact points	Provide guidance, practical information and assistance on all aspects of participation in Horizon 2020
Joint Programming Initiatives (JPI)	
FACCE	Food Security, Agriculture and Climate Change *Sustainable food security under climate change, environmentally sustainable intensification of agricultural systems, developing synergies and reducing trade-offs between food supply, biodiversity and ecosystem services*
HDHL	A Healthy Diet for a Healthy Life *Determinants of food consumption and physical activity, diet and food production, prevention of diet-related chronic diseases*
OCEANS	Healthy and productive seas and oceans *Enable a knowledge-based maritime economy, optimise its value in a sustainable way, ensure Good Environmental Status of the seas and optimise planning of activities in the marine space, optimise the response to climate change and mitigate human impacts on the marine environment*
WATER	Achieving sustainable water systems for a sustainable economy
Climate	Connecting Climate Knowledge for Europe
AMR	Antimicrobial resistance
Urban Europe	Global urban challenges of today
ERA-NETs	
CORE Organic Plus / Cofund	Coordination of European Transnational Research in Organic Food and Farming Systems *Sustainable production of high quality food, reduction of dependency on high energy and resource inputs, improvement of environment and nature conservation, climate change adaptation*
FACCE-SURPLUS Cofund	Sustainable and resilient agriculture for food and non-food-systems
SusAn Cofund	Sustainable livestock production
SusCrop Cofund	Sustainable crop production
ERA-HDHL Cofund	Biomarkers for Nutrition and Health under the umbrella of JPI HDHL
HDHL-INTIMIC Cofund	INtesTInal MICrobiomics under the umbrella of JPI HDHL
Euro Trans Bio ETB Pro	European programme for transnational research, development and innovation cooperations of biotech SMEs
LEAP-Agri	EU-AU food and nutrition security and sustainable agriculture
FACCE ERA-GAS	Monitoring & mitigation of Greenhouse gases from agri- and silvi-culture
WaterWorks2014 WaterWorks2015 WaterWorks2017	ERA-Net Cofunds under JPI Water

European Technology Platforms	
Food for Life	Consumer science customized food supply, sustainable food production, innovative technologies
ManuFuture	New high-added-value products, new manufacturing engineering, emerging manufacturing science and technologies
TP Organics	Organic food and farming sector (including organic food quality, organic food processing, biomarkers)
Plants for the Future	Healthy, safe and sufficient food, bio-energy production, consumer choice
SusChem	Industrial biotechnology, new materials with tailored properties, reaction and process design
EATiP	European Aquaculture: sustainable aquaculture sector, relationship with consumer, importance and role in society
European Water Platform	Water Supply and Sanitation Technology Platform
Horizon 2020 projects, CSAs etc	
REFRESH	Resource Efficient Food and Drink for the Entire Supply Chain Follow-up of FUSIONS: reduction of food waste
PRIMA Article 185	partnership for research and innovation on food systems and water resources, between countries of both shores of the Mediterranean basin
IC4WATER CSA	Development of international cooperation in the Water area (JPI WATER)
CSA Authent-Net	Food Authenticity Research Network
Biohorizon	Network of specialised National Contact Points for H2020, within the scope of Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy.
PLATFORM	Bio-economic Network and central platform for exchange of best practice and cooperation with other ERA-Nets in the Bio-economy
PPP- Bio-based Industries Joint Undertaking	Public-Private Partnership between the EU and the Bio-based Industries Consortium, Smart Specialisation Strategy
S3 Platform	provides advice to EU countries and regions for the design and implementation of their Smart Specialisation Strategy
COST	Coordination of nationally-funded research provide funds for organising conferences, meetings, training schools, short scientific exchanges or other networking activities
Fit4Food2030	Towards FOOD 2030 – future-proofing the European food systems through Research & Innovation
Other initiatives and networks	
FoodForce	Network of leading European research provider organisations active in the areas of food, nutrition and health.
Euphresco	Network of organisations funding research projects and coordinating national research in the phytosanitary area.
ERRIN	European Regions Research and Innovation Network supporting regions in developing their collaborative and open regional innovation ecosystems
Belmont Forum	An international partnership that mobilizes funding of environmental change research and accelerates its delivery to remove critical barriers to sustainability
EURADA	European Association of Development Agencies *gathers people working on economic development*
European Food Alliance	Food and agricultural clusters in Europe working towards providing agrifood companies the service and network contacts
GRA	Global Research Alliance on Agriculture and Greenhouse Gases
Global Food Security Programme	UK's main public funders programme of providing the world's growing population with access to safe, affordable and nutritious food
EFFoST	The European Federation of Food Science and Technology *pushes the production of sustainable and healthy food by facilitating knowledge exchange.*
FoodDrinkEurope	Organization of Europe's food and drink industry

FoodNexus | European business-led Consortium of multinational companies and SMEs, together with the world's best knowledge institutes in the area of food

FReSH | Food Reform for Sustainability and Health

5.   SUSFOOD and SUSFOOD2 funded research projects

SUSFOOD SRA indicated and described eight priority research areas (Box 2). These research areas should be seen in a holistic manner, as outcome of each research area may challenge other research areas. To stress the importance of a holistic approach, the SRA points at the cross-cutting issues i) localisation of activities and ii) equity and ethics, which both need to be addressed as an integral part of each research area.

The priority research areas have served as a basis for SUSFOOD calls. Fifteen projects were funded under the FP7 ERA-Net SUSFOOD calls in 2013 and 2014 (Table 2). The first results from the funded projects under FP7 show that they have been successful in achieving their objectives and the goals

that were identified in the priority areas. Innovative processes were developed and resource efficiency was improved as the inputs in the processes were optimized and waste reduced. The potential of side fractions was evaluated. Food products with added value containing enhanced levels of health beneficial compounds were developed. The quality of the products was improved and the shelf-life increased (see examples in Figures 5 and 6). Also the understanding of consumer behavior and their preferences was increased. An example from the summary of results of the COSUS project (COnsumers in a SUStainable food supply chain: understanding barriers and facilitators for acceptance of visually suboptimal foods) is presented in Box 5.

Table 2 The research projects funded by SUSFOOD (2013 and 2014)

Topic: Innovation in food processing technologies and food products to support a sustainable food chain

Computational-design and Innovative Building of Uniquely Structured Food (CIBUS-Food)

Development of sustainable processing technologies for converting by-products into healthy, added value ingredients and food products (Sustainable&Healthy)

Novel multifunctional plant protein ingredients with bioprocessing (BIOPROT)

Innovative and low energy microwave assisted freezing process for high quality foods (FREEZEWAVE)

Rapid industrial scale cooking of boiled ham using radio frequency electric fields (RFcooking of Ham)

Gentle and resource-efficient refining of vegetable oils for preservation of valuable components and simplified reprocessing of by-products (ProRef)

Topic: Redesign input, waste and side flow strategies to increase resource efficiency and provide added value in food products and processing, manufacture etc.

Improved and resource efficiency throughout the post-harvest chain of fresh-cut fruits and vegetables (CEREAL)

Sustainable food production through quality optimized raw material production and processing technologies for premium quality vegetable products and generated by-products (SUNNIVA)

Decision support system on optimized waste collection by vacuum technology with simultaneous production of bioenergy from wastes (BIOSUCK)

Adding value to fruit processing waste: innovative ways to incorporate fibres from berry pomace in baked and extruded cereal-based foods (BERRYPOM)

Topic: Interdisciplinary research approach to innovative food products and use of new raw materials for food products

Sustainable plant ingredients for healthier meat products - proof of concepts (SUSMEATPRO)

Engineering of oat proteins: Consumer driven sustainable food development process (OATPRO)

Topic: Understanding consumer behaviour and food choices

Food, Convenience and Sustainability (FOCAS)

Consumers in a sustainable food supply chain: understanding barriers and facilitators for acceptance of visually suboptimal foods (COSUS)

Implementing sustainable diets in Europe (SUSDIET)

Figure 5. In SUSMEATPRO project plant material was used for healthier meat products. Photos Piret Raudsepp and Mati Roasto.

BOX 5 - Results from co-funded projects

Example : COSUS-project

The results indicate that, like food waste in general, the acceptance of suboptimal foods is a complex issue. The decision of a consumer to accept or discard suboptimal foods is influenced by personal characteristics such as attitudes, food-waste related lifestyle and involvement, environmental commitment, sociodemographic variables. In addition, external factors such as daily routines, food availability, planning, product or suboptimality type and the situations in which food decisions are made (home versus store). Communication had some effects on consumer attitudes to suboptimal foods, as did changing sensory perception and attractive pricing strategies. Barriers to selling suboptimal foods exist throughout the chain, due to limited profitability but also logistics, personal standards and beliefs, including that consumers will not buy suboptimal products. The results explain why, despite positive attitudes to suboptimal foods, not all foods that are suboptimal at some point in the chain are currently sold or consumed. (COSUS final report)
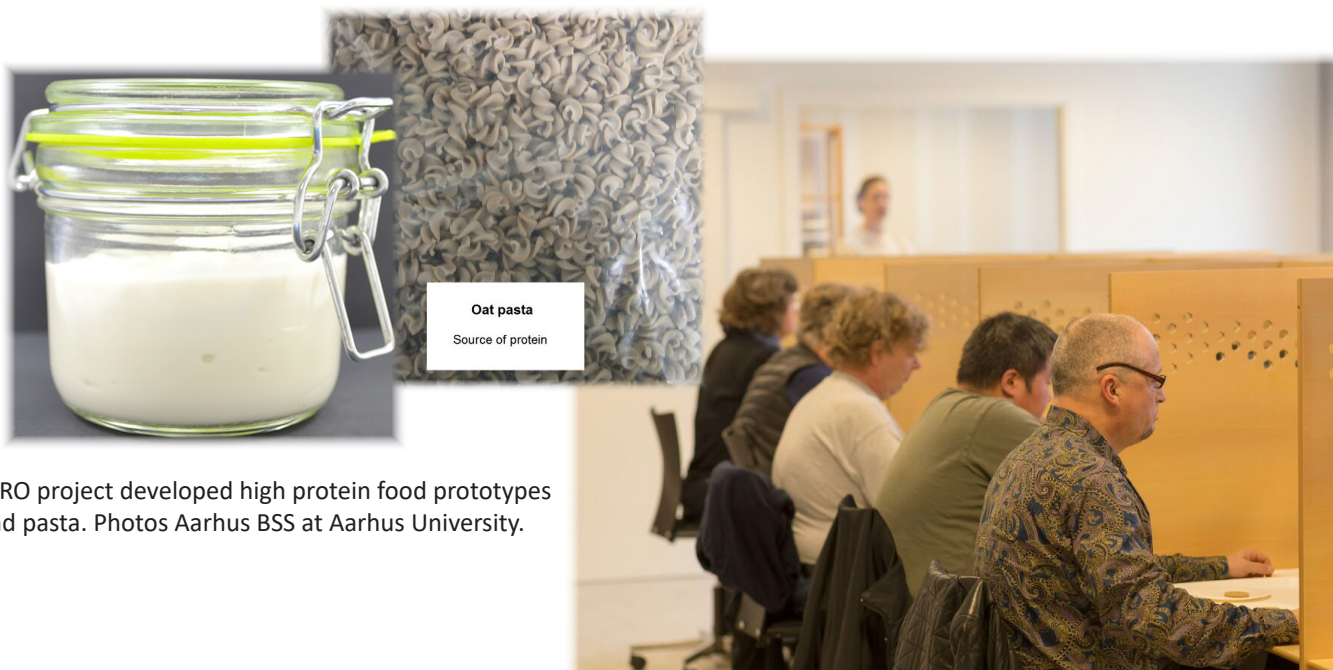
Figure 6. OATPRO project developed high protein food prototypes like yoghurt and pasta. Photos Aarhus BSS at Aarhus University.

An impact analysis is ongoing for the SUSFOOD FP-7 funded projects by ERA-Learn in 2017/2018. The results are limited since only 5 projects out of 15 were already finished at the point of survey but they give some idea of the impact of the co-funded projects for the partners. According to the analysis the most motivating opportunities to participate in SUSFOOD funded projects were developing new knowledge in the subject area and building scientific relationships with organizations in other countries. The responders agreed that the transnational project provided access to higher-quality additional expertise or facilities than would have been possible with a national project (quality). The consortium leadership and management were of high-quality and effective. Major outcome was enhanced research network to compete for future European project funding.

In December 2017, another 12 projects were decided to be funded under SUSFOOD2 (Table 3). An example of projects starting in 2018 is presented in Box 6.

Table 3 The projects funded in SUSFOOD2 (2017)

Topic: Innovation in food processing technologies and products
BIOCARB-4-FOOD - Extraction and characterization of BIOactives and CARBohydrates from seaweeds and seagrasses FOR FOOD-related applications
InProVe - Innovative Processing of Vegetables and Potato
FUNBREW - Biotransformation of brewers´ spent grain: increased functionality for novel food applications
MEFPROC - Improving Sustainability in Food Processing using Moderate Electric Fields (MEF) for Process Intensification and Smart Processing
DISCOVERY - Disaggregation of conventional vegetable press cakes by novel techniques to receive new products and to increase the yield
ProSeaFood - Innovative processing of seaweed for novel, healthy food products and ingredients
Topic: Providing added value, increased resource efficiency and reduction of waste in sustainable food systems
AVARE - Adding value in resource effective food systems
SPAREC - Sustainable Processing of Agrofood Residues to Elicitors and Chemicals
ImPrOVE - Innovative (pre)POmace Valorization process
SUSPUFA - Sustainable production of health-promoting n-3 LCPUFA using agro food industry by-products through microalgae
Topic: Understanding consumer behaviour and food choices
SUSCHOICE - Towards Sustainable Food and Drink Choices among European Young Adults: Drivers, Barriers and Strategical Implications
PLATEFORMS - Sustainable Food Platforms: Enabling sustainable food practices through socio-technical innovation

BOX 6 - An example of SUSFOOD2 co-funded projects

PLATEFORMS - Sustainable Food Platforms: Enabling sustainable food practices through socio-technical innovation

In recent years, we have seen an increase in the range of food provisioning platforms available to consumers. Each platform presents consumers with a unique choice architecture. These emerge from both e-commerce development and consumer-driven food provisioning. Little is known about the impact of these new platforms on food choices, or to what degree they represent new opportunities to promote sustainable food practices. PLATEFORMS aims to produce in-depth knowledge on how food practices are affected by socio-technical innovations in food provisioning platforms, and communicate success stories of sustainability to platform owners and policy makers. This project takes a socio-technical practice approach, seeing consumption in all its phases of planning, provisioning, storing, cooking, eating and disposing – driven by practices more than by individual choices.

The topic "Harmonisation of the methods and metrics for integrated assessment of sustainability of food products and food patterns" was included in the call 2017 but did not get funded. This theme is, however, important as there seems to be a need for more knowledge and information of the subject. In December 2017, the SUSFOOD2 Governing Board discussed this and came to conclusion that other forms of supportive actions like knowledge hubs or a more focused funding activity could be more appropriate in this case (GB & EAB workshop, 2017).

6.   Conclusions

As a conclusion, the priority areas defined in SUS-FOOD SRA are still valid. New initiatives have emerged on the field of sustainable food production and consumption, the most remarkable being Agenda 2030 from UN.

Different technologies and the use of new raw materials are developing fast and provide new potential in the field. There seems to be knowledge gaps in health and sustainability, as well as consumer studies. Also the transfer of information between different stakeholders needs some more efforts.

Collaboration with related EU-initiatives will be a new approach of SUSFOOD2 compared with SUSFOOD. The updated list (see Table 1) show that the actors in the field of food research are numerous and that there are a number of possibilities for co-operation and win-win activities.

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