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Visions *for sustainable food and nutrition security in Europe*

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How can we improve the food system in the EU, especially from the perspective of social, environmental and economic sustainability? How can we balance and encompass views on how to strengthen food and nutrition security in the EU? These are the core questions of the SUSFANS project. SUSFANS' overall goal is to come to a better food and nutrition system for human health, the environment and corporate enterprises in Europe.

SUSFANS is led by the notion that improvements in the diets of the European consumers must come from, and be supportive of, sustainable food systems.

The research approach is built on a set of metrics, models and foresight tools. They can be used as a navigation for sustainable food and nutrition security. This approach results in a holistic, integrative and coherent vision of what entails sustainable food and nutrition security in the EU and globally. It underpins a perspective on how EU policies on farming, fishing, food and nutrition could contribute to that vision with greater efficacy than today.

> LEAD ARTICLE ON PAGE 2.

> FULL REPORT: [SUSFANS.EU/PORTFOLIO/VISION-SUSFANS-PROJECT](https://susfans.eu/portfolio/vision-susfans-project)

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Visions for sustainable food and nutrition security in Europe

NEED FOR A NEW APPROACH

In the second half of the twentieth century European agricultural and fishery policies – aimed at fostering agricultural productivity, securing fair living standards for farmers and ensuring food availability for its population – resulted in massive productive capacity and a strong knowledge and innovation base in Europe.

But, where is light, there is also shadow. Outbreaks of BSE, salmonella and E.Coli show that food quality and safety have sometimes been compromised. Access to safe and nutritious food is not guaranteed for all of Europe's consumers. Food poverty is still experienced; around 11 per cent of the EU population is unable to afford a meal with meat, chicken, fish or a vegetarian equivalent every second day.

At the same time, a rising proportion of the European population, close to 50 per cent in 2010, is overweight or obese, making them prone to chronic diseases. Adding to this, as a flip side of increased European affluence, food waste reaches over a 100 million tonnes per year, a number which is growing, showing the problematic ethical dimension. Not to forget, there are strong environmental concerns: Climate change is having its impact on agriculture in Northern and Southern Europe, leading to land degradation and putting water quality under pressure.

CHALLENGES FOR THE EU FOOD SECURITY

Maintaining the agri-food sector's beneficial services to society is increasingly challenging in the face of changing economic, social, political and environmental conditions.

Food crises, i.e. due to weather extremes, need to be guarded against, growing pressures on the natural resource base need to be reduced. In the long-term,

the EU agri-food sector needs to be globally competitive and sustainable if it wants to maintain a strong European production base. Next to the production challenges, EU food consumption has to become more healthy, nutritious, environmentally and economically sustainable, whilst remaining affordable and diversified.

EU policy makers increasingly recognize that existing frameworks for food safety control (the General Food Law) and primary production (the Common Agricultural Policy, CAP) provide insufficient direction for the European food system.

The majority of research on FNS has historically been relatively disparate, either focusing on food production by agricultural and fisheries sciences, or on consumption patterns, diets and health by the nutrition sciences.

This has led to the development of a new, transdisciplinary research project, SUSFANS, which develops metrics, identifies and analyses drivers, integrates data and modelling and formulates foresight for EU sustainable FNS. It builds on a common scientific evidence-base which accounts for the perspectives of the various actors and factors that play a role in the food system.

HOW SUSFANS WILL WORK

SUSFANS will advance research in support of policy and practice on sustainable Food and Nutrition Security in the EU. SUSFANS is a joint research effort by partners and stakeholders from academia, public and private sectors. Its work is divided in three pillars, aiming at (1) Assessing sustainable Food and Nutrition Security in the EU, (2) Metrics and tools for measuring, assessing and monitoring sustainable Food and Nutrition Security and (3) Modelling sustainable Food and Nutrition Security: The SUSFANS toolbox.



Metrics, models and foresight for European sustainable food and nutrition security: The Visions of the SUSFANS project

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Read more: sufans.eu/portfolio/vision-sufans-project

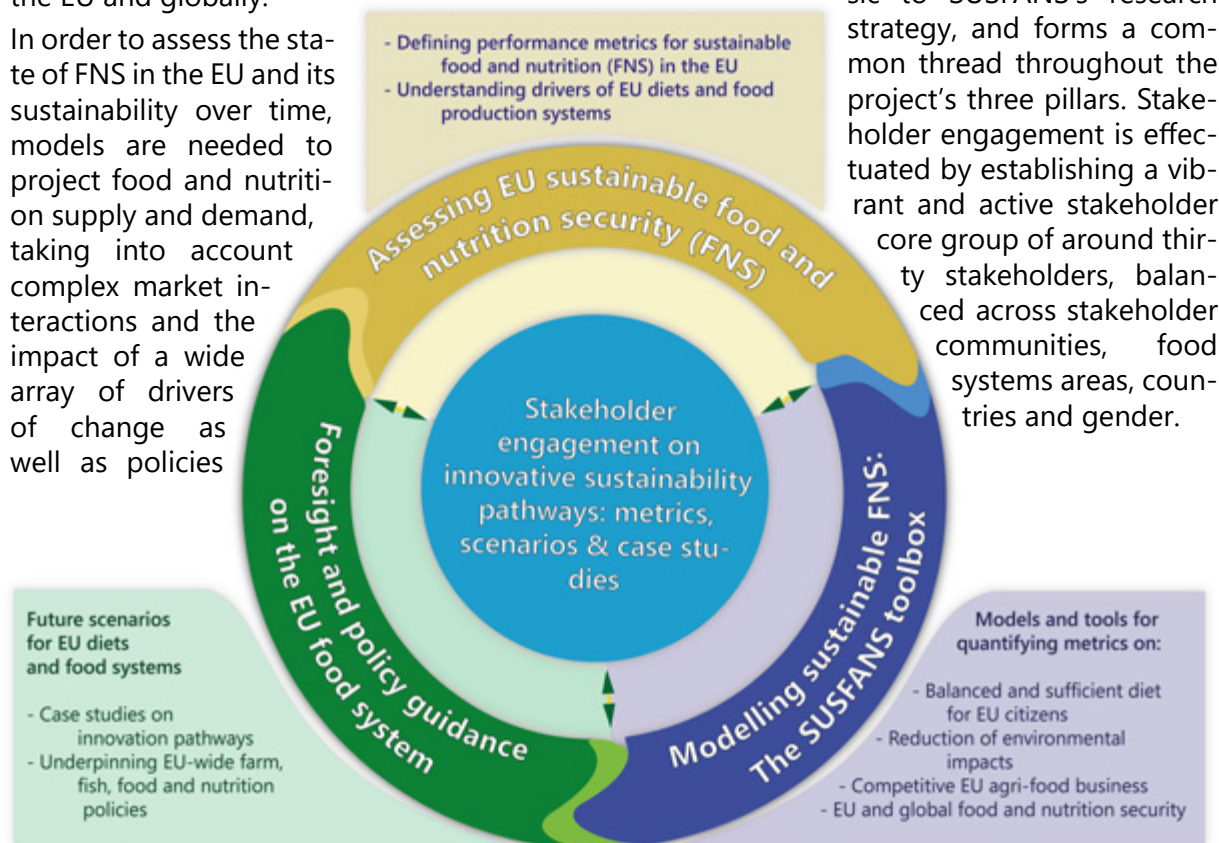
In **Pillar 1**, SUSFANS will define performance metrics for sustainable food and nutrition in the EU, assign values on the relative importance of the various sustainability dimensions, elicited from different stakeholders from the government, private sector, research community and civil society, provides greater clarity on what they consider to be sustainable diets from a health, environmental, economic and global Food and Nutrition perspective. It aims at understanding the drivers of EU diets and food production system.

To do this, SUSFANS extends the common definition of Food and Nutrition Security, which says that food and nutrition security exists when: *"all people at all times have physical, social and economic access to food, which is safe and consumed in sufficient quantity and quality to meet their dietary needs and food preferences, and is supported by an environment of adequate sanitation, health services and care, allowing for a healthy and active life"* (CFS, 2012).

The first pillar will further develop a framework to lay out in more detail how the drivers influence the different food system actors and their activities and allow to map possible intervention points.

Pillar 2 will concentrate on models and tools for quantifying metrics on balanced and sufficient diets for EU citizens, reducing environmental impacts, competitive EU agri-food businesses and food and nutrition security in the EU and globally.

In order to assess the state of FNS in the EU and its sustainability over time, models are needed to project food and nutrition supply and demand, taking into account complex market interactions and the impact of a wide array of drivers of change as well as policies



A COW WITH BSE, LOSING THE ABILITY TO STAND.

PHOTO: UNITED STATES DEPARTMENT OF AGRICULTURE, PUBLIC DOMAIN

on sustainability. Models are combined in a toolbox for the quantification of future scenarios

Pillar 3 aims at Foresight and policy guidance for sustainable FNS in the EU. The conceptual framework (Pillar 1) and modelling (Pillar 2) of sustainable FNS in the EU can be used to provide foresight on future pathways for EU food production and consumption.

This is done on the basis of two case studies and several EU-wide scenarios, which are determined in close collaboration with stakeholders and consider the impacts of sector, product, trade, consumer, nutrition and health policies and/or innovations. The results are used to formulate recommendations on using the SUSFANS framework to advance evidence-based food policy on sustainable FNS in the EU.

STAKEHOLDER ENGAGEMENT

Engagement with stakeholders is intrinsic to SUSFANS's research strategy, and forms a common thread throughout the project's three pillars. Stakeholder engagement is effectuated by establishing a vibrant and active stakeholder core group of around thirty stakeholders, balanced across stakeholder communities, food systems areas, countries and gender.

Creating a Toolbox for Food and Nutrition Security

The aim of SUSFANS is to show how nutritional health and food production can be better aligned and to strengthen the existing computational models for key specifics of the EU food system. A core output of SUSFANS will thus be a Toolbox, integrating different agricultural, economic and biophysical models. It is developed within the Work package 9.

THE TOOLBOX WILL BE CAPABLE OF

- Tracing nutrients in agriculture, fish, food and feed through the EU system;
- Supporting foresight on EU diets and food production systems;
- Capturing dimensions of sustainability by stage of the food supply chain (primary food production, food processing and consuming);
- Providing entry points for policy and innovation by government, private sector, NGOs and the science community

This ambitious aim will be achieved through input and output data linkages between the various models. The models in the toolbox cover all scale levels, including the global level, EU28, the sub-regional levels of EU4, national level and province level, household types (e.g. rural, urban) and the individual level and capture different time horizons (long-term, medium-term and short-term).

The SUSFANS Toolbox will interlink and enhance long-term models such as MAGNET, CAPRI and GLOBIOM and SHARP and short-term models of consumer behavior and diets. The newly AgriPrice4Cast-model by SUSFANS will help to understand short-term dynamics on EU agricultural markets, in order to support market surveillance and crises management. Other models used are the EPIC and DIET model.

MODEL-LINKING

The general approach to link assessment models within the SUSFANS toolbox is a "soft" one, i.e.

onewhich does not aim at a (software-)technical integration but rather at linkages between the various components of the toolbox. This decision is based on the experience gathered by SUSFANS partners from previous EU research projects with a strong modelling focus (e.g. FoodSecure, AGRICISTRAD, SEAMLESS), out of the following reasons:

1. The long-term models are already very complex modelling systems by themselves. They have been and are currently applied to a multitude of different policy issues related to the future of the global and European agri-food sector. Each system has its own proprietary software infrastructure and is continuously developed. "Hard-linking" these models in a new, overarching software framework would involve efforts far beyond the budget and time horizon of SUSFANS;
2. The long-term models in the SUSFANS toolbox are complex and continuously adapted; Other models are to be developed. The uncertainty and dynamics of models developments prohibits the development of a joint technical infrastructure in parallel without stifling conceptual progress;
3. Beyond scientific soundness and relevance, the sustainability of the toolbox developed in research projects depends on the institutional setting in which the toolbox will be maintained and further developed afterwards. A hard-linked system comprising all the involved disciplines and "sub-model-systems" would not find such an institutional home.

Soft-linking models within a common conceptual framework allows researchers and decision-makers to fully exploit the complementarities and flexibilities in a modelling system while minimizing risks in terms of conceptual disalignment, a large software and ICT burden, and compromised transparency. We distinguish three types of model soft linkages:

1. Harmonization of scenario definitions. This will most often refer to relative chan-



ges of drivers between scenarios as definitions and data sources of model inputs differ.

2. Transfer of output data from one model to be used as input data in another model. This is likely the most important type of model-linkage as it allows exploiting the model complementarities.
3. Alignment of model behavior in overlapping model domains. Here, one either harmonizes structural model parameters that are comparable across models or sequentially calibrates one model based on the response behavior of another model.

HOW TO SOLVE LINKAGE PROBLEMS

The model outputs in the toolbox are mapped to metrics by taking into consideration each model's comparative advantage compared with the other models. The models may nonetheless provide outcomes for variables and indicators which may partially overlap. Where this is the case, the outcomes of the model being strongest in the area under scrutiny are used.

Nevertheless there will be deviations of important outcomes. To clean them out, they will be traced back to the underlying structural or data reasons in discussions across modelling teams, leading to adjustments.

TESTING - IS THE TOOLBOX WORKING?

The possibilities of the Toolbox will be shown in Case studies and scenarios. It will be tested by means of the case studies of innovation pathways in the livestock-fish supply chain and in the fruit-vegetable chain and will subsequently be documented in deliverable D9.5. During this phase of the project, the scenario work will start.

THE IMPORTANCE OF THE TOOLBOX

The Toolbox will improve the evidence-base on SFNS, to the benefit of policy making. Environmental change, diet-related diseases, and globalizing food supply cause major challenges for SFNS of EU citizens. Policies to

face these challenges need to build on past and current evidence and need to account for uncertainties and unforeseen developments in the future. Data and models can deliver such a scientific evidence-base. But if we accept SFNS as a policy ambition, it introduces a multi-dimensional concept into the policy cycle.

Possible innovations that are currently considered as case studies include:

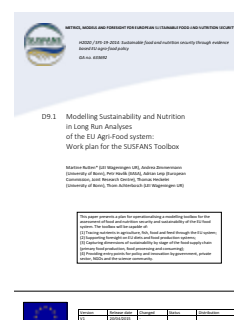
- Encourage human health and reduce the environmental impact by replacing animal-source food products with plant-based products or fish in human diets;
- Avoid feed-food competition by feeding biomass to livestock that does not compete with human food production e.g. food waste, co-products or biomass from marginal land;
- Reduce the environmental impact by increasing consumption of locally produced plant-sourced food;
- Adjust diets to improve human health by reducing consumption of processed food (high level of salt and sugar), increase proportion of digestible fibre, and increase fruit and vegetable intake.

Generally, innovations can be taken up by the toolbox via a supply side / food chain side or a demand side route. In the former, a change in the use of inputs through for example a change in technology, affects supply of, trade and consumption of agri-food products. In the latter, the innovation is sparked by changes in taste of the wider public, which alters dietary choices and so production and trade of agri-food products. The innovations come about because of changing behaviour by producers (for example because of Corporate Social Responsibility considerations) or consumers (for example by being better informed on issues of health and environmental sustainability), and/or may originate from government intervention including changes in regulation or financial policy instruments (taxes, subsidies).

Modelling Sustainability and Nutrition in Long Run Analyses of the EU Agri-Food system: Work plan for the SUSFANS Toolbox

Martine Rutten* (LEI Wageningen, UR), Andrea Zimmermann, (University of Bonn), Petr Havlík (IIASA), Adrian Leip (European Commission, Joint Research Centre), Thomas Heckeles, (University of Bonn), Thom Achterbosch (LEI Wageningen UR)

Read more: sufans.org/portfolio/modelling-sustainability-and-nutrition-long-run-analyses-eu-agri-food-system-work-plan



Firms' strategic reactions to nutritional policies

Understand and derive a set of optimal policies

Cardiovascular diseases and cancer constitute almost two-thirds of diseases in industrial countries. A large number of these (chronic) diseases are due to lifestyle-related risk factors, among them poor dietary habits such as excessive intakes of salt, carbohydrates, and fats, in addition to insufficient intakes of fruits and vegetables. According to the World Health Organization, preventing these diet-related risk factors in combination with actions reducing physical inactivity and tobacco use could lead to an increase in the average life expectancy by three to five years in high-income countries.

INFORMATION CAMPAIGNS LEADING TO HEALTH INEQUALITIES?

Governments and public health agencies have been implementing policies to promote preventive behavior over the past years, such as information campaigns and food product labeling. These policies have not had much positive impact yet. They are even suspected to increase health inequalities as lower-educated individuals respond less to information policy.

Given the modest impacts of information-based policies, public health agencies are

now considering other policies to modify the market environment, ranging from price policies to nutrition-related standards. The overall goal is to facilitate healthier food choices, even among non-health-sensitive consumers.

FOOD INDUSTRY SHOULD CREATE BETTER FOOD ENVIRONMENT

Public health agencies and policy makers urge the food industry to favor a better food environment. This can be done through changes in the quality and variety of foods and in advertising and marketing.

In the design of nutritional policies, it is important to anticipate the reaction of food firms. Companies may amplify or weaken their impact or they affect the health outcomes of food consumption through their decisions about the quality and variety of foods. Generally, firms base their response to nutritional policies on market segmentation and product differentiation. Nutrition and health claims, such as 'rich in fibers', 'light in sugar', 'enriched in vitamins', target health-sensitive consumers who have higher willingness to pay for additional health functions in foods.



WEAK INCENTIVES TO REFORMULATE PRODUCTS

Market shares for those products remain relatively small at approximately 20 percent. The nutritional quality of food in the remaining part of the market is more contrasted. Therefore, public health agencies urge the food industry to commit, in individual or collective agreements, to reduce the level of 'bad' nutrients in food products. Although some brands have moved quite significantly, firms have weak incentives to enter into a product reformulation strategy to improve the nutritional quality of products.

There are several possible reasons for this:

1. Reformulation will likely increase production costs. Changes in ingredients might affect variable costs; new recipes might require development expenditures.
2. Asymmetry of information between producers and consumers: Consumers often do not know about a product's quality, as nutrient fact panels on food packages are difficult to understand. This information problem results in a breakdown in the market for processed foods, leading to the 'McDonald's equilibrium' in which low quality covers the entire market.
3. 'Addiction assumption': If the consumption of added sugars or fat in foods leads to addictive behaviors, companies have strong incentives to continue to market such foods. This assumption is plausible but remains controversial.
4. Consumers' expectations: Although consumers do not always perceive moderate changes in salt or fat content, once they know, many consumers reject the reformulated product because they believe that 'healthier' means 'less tasty'.

HOW TO FORCE QUALITY IMPROVEMENT

To force food quality improvements, policy makers may use various instruments:

- Implementing minimum quality standards. The theoretical literature on minimum quality standards provides mixed insights. In a simple setting, in which differentiation between products relies on a single characteristic, they seem to be quite efficient. For example, the ban upon trans-fatty acid (TFA) in New York State and in Denmark, where a mandatory maximum content of TFA was implemented

in 2004, seems to have had positive effects. In a more complex setting, however, in which products are differentiated along multiple characteristics, setting minimum quality standards might be counterproductive, even if the market underprovides quality.

- Other tools such as food taxes can influence the quality chosen by firms. The regulator might define a quality threshold. Products that have a quality higher than the threshold are not taxed, lower are. Such a policy seems to be efficient, as a firm prefers to reformulate its product to avoid the tax, leading to positive results for health and welfare.



THE SALT EXAMPLE

Elevated dietary salt intake is an established risk factor for high blood pressure and cardiovascular events. The WHO has recognized excess dietary salt intake as a global problem and set a worldwide target of less than 5 g salt per day per person.

However, high salt content generally makes food more palatable. Reducing salt in foods may therefore alter the product's taste and be perceived negatively by consumers. Most consumers are not really aware of the health impacts of high salt intakes, the majority is unaware of health recommendations and one-third is not interested in salt reduction.

Voluntary commitments by firms to improve the nutritional quality of foods remain modest. Firms' reluctance to decrease the salt content in foods echoes consumers' resistance. Moreover, technological solutions that can be used to compensate for taste modification are imperfect, leading many consumers to appreciate the product less or even reject it. Finally, removing salt in foods may induce additional production costs.

BETTER UNDERSTAND FIRMS' STRATEGIC REACTIONS TO NUTRITIONAL POLICIES

Confronted with the limitations of information campaigns targeting consumers and the modest impact of voluntary commitments by firms, the WHO and some governments are considering more coercive interventions based on quality regulation and fiscal policies.

But how do companies react to market impacts under these conditions? Vincent Réquillart; "The main contribution of our analysis is to evaluate market impacts of alternative policies. We integrate strategic reactions of firms both in terms of prices and product characteristics. Thus, we consider linkages between the nutritional quality of food products and their taste characteristics. This complex relationship between the taste and health characteristics of a product is a key point in analyzing firms' strategy. In addition, we estimate social welfare impacts."

In this context, SUSFANS researchers developed a model of product differentiation. They looked into two mono-product firms competing on price and product characteristics. Products are differentiated along a one-dimensional characteristic, e.g., more or less salty. The position of a product on this axis may affect consumers' utility in two ways: through its health impact, and through its taste due to the content in salt.

IMPORTANT CONSUMER INFORMATION POLICIES

Using this framework, the researchers compare the impact of three policies - imposing a minimum quality standard; setting an excise tax based on the nutrient content of the two products; and setting an excise tax based on the nutrient content of the 'bad' product - on consumer demand, prices, product characteristics, a health indicator, and welfare.

"We show that firms respond differently to the three instruments, leading to different

impacts on market and public health outcomes. Of the three policies we analyzed, we found that only the minimum quality standards policy and the linear excise tax on the low-quality product are effective in a general sense", tells Réquillart. "The choice, however, between the two depends on the priorities of the regulator and on the consumers' resistance to move away from their initial taste preferences. Finally, we show that policies intended to change the food market environment allow for greater health benefits and welfare than policies based solely on information campaigns."

"Overall, our results have two important consequences for nutritional policy design. Whereas some policy makers are sometimes reluctant to go beyond consumer information and education interventions, our analysis suggests that policies targeting changes in food quality must always complement information policies."

STANDARD-BASED POLICIES MIGHT BE PREFERABLE TO FISCAL POLICIES

"A large part of the public debates related to nutrition and health policies has focused on fiscal interventions like fat tax, taxes on soft beverages. Our analysis does not suggest prioritizing such instruments in most cases", tells Réquillart. "In fact, the tax policy is regressive, thus lowering the surplus of the less-health-conscious consumers while increasing the surplus of the more-health-conscious consumers. Moreover, we also show that if the tax rate is too high, firms' strategic reactions may lead to unintended consequences". Thus, an excessively high tax rate leads the low-quality firm to degrade the quality of its product, which leads to a strong negative impact on the health outcome of the policy.

It should be stressed that in most cases, standard-based policies should be prioritized. Practical difficulties of such policies that could however limit their implementation would have to be analyzed in greater detail.



Quality standards versus nutritional taxes: Health welfare impacts with strategic firms

Vincent Réquillart, Louis Georges Soler, Yu Zang

Read more: sufans.org/portfolio/quality-standards-versus-nutritional-taxes-health-welfare-impacts-strategic-firms

Work package 3 news flash

Within the WP3 of SUSFANS project, the following publications have been completed:

An assessment of the potential health impacts of food reformulation



Leroy, P., Réquillart, V., Soler, L.-G., & Enderli, G. (2015). *An assessment of the potential health impacts of food reformulation*. European Journal of Clinical Nutrition (2016) 70, 694–699; doi:10.1038/ejcn.2015.201; published online 16 December 2015

nature.com/ejcn/journal/vaop/ncurrent/full/ejcn2015201a.html

Background/Objectives:

Policies focused on food quality are intended to facilitate healthy choices by consumers, even those who are not fully informed about the links between food consumption and health. The goal of this paper is to evaluate the potential impact of such a food reformulation scenario on health outcomes.

Subjects/Methods:

We first created reformulation scenarios adapted to the French characteristics of foods. After computing the changes in the nutrient intakes of representative consumers, we determined the health effects of these changes. To do so, we used the DIETRON health assessment model, which calculates the number of deaths avoided by changes in food and nutrient intakes. *Results*: Depending on the reformulation scenario, the total impact of reformulation varies between 2408 and 3597 avoided deaths per year, which amounts to a 3.7–5.5% reduction in mortality linked to diseases considered in the DIETRON model.

The impacts are much higher for men than for women and much higher for low-income categories than for high-income categories. These differences result from the differences in consumption patterns and initial disease prevalence among the various income categories.

Conclusions:

Even without any changes in consumers' behaviors, realistic food reformulation may have significant health outcomes.

,QUALITY STANDARDS VERSUS NUTRITIONAL TAXES: HEALTH AND WELFARE IMPACTS WITH STRATEGIC FIRMS'

Vincent Réquillart, Louis-Georges Soler and Yu Zang. Available *,Quality standards versus nutritional taxes: Health and welfare impacts with strategic firms'*. working paper. susfans.org/portfolio/quality-standards-versus-nutritional-taxes-health-welfare-impacts-strategic-firms (see left page)



SUSFANS ACTIVITIES

In terms of SUSFANS activities, WP3 partners have contributed to the implementation of the SUSFANS Conceptual framework and FNS sustainability metrics under WP1.

At the same time, WP3 partners are continuing working on several research topics, namely: private food standards, market dynamics in food chains, post-farm food chain for environmental sustainability, and firms' strategies in food innovation and nutritional policies.

The role of seafood in healthy and sustainable diets

Sara Hornborg, Friederike Ziegler and Kristina Bergman (SP)



The role of seafood in healthy and sustainable diets is complex. It is the most traded food commodity, has vastly different environmental sustainability, is essential in countries with undernourishment but being exported to developed countries where it is being promoted as a healthy and environmentally sound choice. In a public report due in September we intend to illustrate this complexity for defining optimized diets for EU citizens.

The purpose of the study is to make an in-depth analysis of current drivers of EU seafood production (aquaculture and fisheries) and how Food and Nutrition Security (FNS) related to seafood could be strengthened. Through literature review and data compilation, a general overview and understanding of the sector as it looks like today is provided, identifying variables and metrics for assessing seafood FNS for the EU and discussing needs for improved seafood FNS of the EU.

SOME BASIC FACTS RELATED TO SEAFOOD IN THE EU:

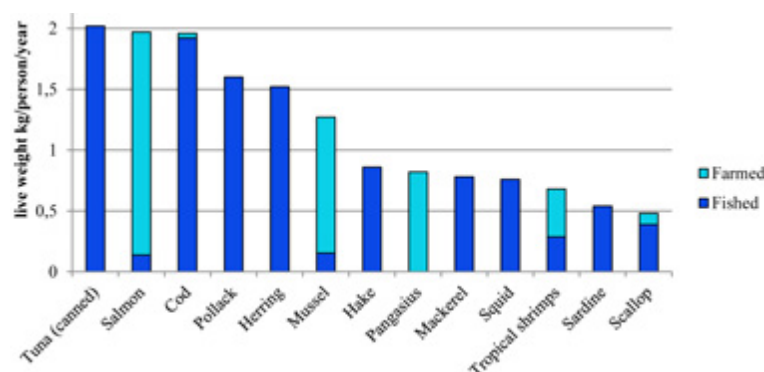
- EU seafood production (farmed and wild-caught) contributes to 3% of the world supply. Globally, half of the production volume is farmed, whereas in

the EU, only 20% comes from aquaculture.

- The dominating type of wild-caught seafood is small pelagics (mainly herring, sprat and mackerel). Farmed species mainly comprises of bivalves (predominantly mussels) and salmonids.
- Spain is the largest producer in both volume and value of wild-caught and farmed seafood. Other large fishing producers (in volume) are Denmark, France and the UK; in terms of value, France, Italy and the UK are important.
- Tuna, salmon and cod are the most consumed seafood items (Figure 1). The EU citizen prefers to eat wild-caught seafood, with only 25% coming from aquaculture.
- Many EU countries show high seafood consumption, on average 25 kg per year. This places the EU citizen as having the fifth highest seafood consumption in the world. With limited availability of wild fish stocks, the EU is therefore highly dependent on seafood imports.

The self-sufficiency rate (ratio between own production and consumption) has been stable around 45% in the latest estimates (2008-2012).

The research is part of WP4 deliverable D4.2 (drivers of fisheries and aquaculture production in the EU)



Developing a fish module for an economic agricultural sector model

Chiaoya Chang, Andrea Zimmermann, Peter Witzke, Thomas Heckeley (UBO)

Being the fastest growing food producing sector, aquaculture has the potential to provide high quality protein sources and meet increasing future food demand.

However, the raising concerns over competition for land - direct and through feed competition - and sustainability as well as restrictive regulations may limit the expansion of aquaculture. We are working on a thorough literature review of the complex interlinkages across aquaculture, land use and sustainability.

The literature review is of an explorative character and touches and combines various topics in and around aquaculture (e.g. environmental sustainability, political regulation). We combine existing literature from various disciplines (e.g. aquaculture, agricultural economics, land use) for a thorough description of the relationships and give an overview of quantitative models for economic and environmental impact assessment.

THE MOST IMPORTANT FINDINGS ARE:

- The rapidly growing aquaculture is considered as a sustainable solution in terms of compensating the leveling-off of marine fish resources and to ensure food and nutrition security. Although the impacts of the expansion of aquaculture on ecosystems is still controversial (e.g. carnivores culture is the biggest consumer of reduction fisheries), aquaculture still contributes to sustainability economically and socially.
- The competition for resources including water, land, and feed between aquaculture and agriculture, the environmental damages resulting from the intensification of farming and the overuse of antibiotic and pesticides indicate the importance of adequate legislations to safeguard seafood safety, consumers' health and the growing aquaculture industry.

- Feed matters: Fishfeed accounts for roughly 50% of the total rearing cost and plays a vital role of linking aquaculture with agriculture through feed production. Along with the advancements in feed technology and the steady growth of herbivores culture, the percentage of plant ingredients in fish feed is projected to reach 90% in 2020. As a result further land use changes through an increasing demand of crops for aquafeed as well as mangrove deforestation and crop farm transformation for aquaculture are expected.
- Aquaculture is often absent in the existing economic agricultural models, and most of the aquaculture models are focused on environmental impacts. IMPACT and AgLink-CoSiMo (FAO-OECD) models are currently the only two global economic agricultural models that feature a relatively completely structured fisheries sector. To enable the analysis of aquaculture-agriculture interactions, there is a need for further developing these and other models.

Based on the knowledge gained from the literature review, we have started developing a fish module for the global economic agricultural sector model CAPRI (capri-model.org).

In exchange with other SUSFANS groups (SP, IIASA, LEI-WUR), we have agreed on a basic strategy for classifying fish species. For the CAPRI model, we introduced a preliminary set of six species plus fish meal and fish oil. Data from FAO were mapped to these groups and we are now working on dividing them into fish from capture and aquaculture fishery.

The next step will be to establish the land use connection. Final aim will be to be able to assess questions like (1) how does aquaculture contribute to food and nutrition security, (2) how sustainable is aquaculture, (3) how does aquaculture connect with land use and (3) what is the impact of the Common Fishery Policy on aquaculture in the EU?



Analysis of crop production in the European Union

Andrea Zimmermann (UBO)



Crop production is the most crucial primary agricultural production activity for both food and nutrition security. Besides its importance for the direct human consumption, crop production is also crucial for producing feed for livestock and increasingly also for aquaculture.

Most generally, crop production is primarily determined by the interaction of land use and crop yields. Both land use and crop yields are affected by various drivers. The deliverable on drivers of crop production consists of two main parts.

The first part of the paper is strongly aligned with the SUSFANS conceptual framework in terms of deepening the driver section in the conceptual framework with respect to crop production. T

he second part of the paper is based on empirical work. It first shows a yield trend analysis followed by the analysis of yield gaps, i.e. the gap between biological potential and actually realised yields, across the EU.

Yield trends can be decomposed into productivity growth due to technical progress (e.g. breeding) and decreasing yield gaps, often achieved through different management. Both descriptive and empirical analysis focus on the most important crops in Europe and, if possible, vegetables and fruits as important crops for nutrition security and the respective SUSFANS case study.

FIRST RESULTS ON CROP PRODUCTION IN THE EU SHOW THAT:

- Wheat makes up for around 45% of the total cereals production in the EU28. It is followed by maize (23%) and barley production (18%). Most wheat is produced in France, Germany, United Kingdom and Poland. Together these countries account for more than 60% of wheat production in the EU28.
- Among the vegetables and fruits with the highest production quantities in the EU28 are tomatoes, carrots, onions, apples, peaches and citrus fruits. Additionally, the EU is the largest producer of olive oil worldwide.
- The empirical analysis is planned to be based on farm data from the Farm Accountancy Data Network (FADN). FADN provides European-wide data of about 80,000 sample farms. The sample farms are selected in order to best represent the total population of about 5,000,000 farms in the EU. A request for FADN data was sent to the European Commission.
- Preliminary results on yield trends of cereals in the EU suggest that yield growth rates are declining in the old member states (EU15), whereas increasing growth rates can be found in many of the new member states. The trend estimates are very sensitive to the length of the time



series.

- The literature on yield gap analyses has been searched and is discussed in the paper. If data become available on time, a yield gap case study will be shown for the preliminary deliverable version due in September.

SUSFANS

Facts

How is SUSFANS Project organized? And what are its objectives? Starting in 2015, SUSFANS is creating a conceptual framework, an evidence base, and analytical tools for underpinning EU-wide food policies.

This will be done with respect to their impact on consumers' diets, on nutrition and public health, on the environment, on the competitiveness of the EU agricultural-food sector, as well as on global food and nutrition security.

FOUR YEARS, THREE PILLARS, TWELVE WORK PACKAGES

The 4-year project is organized in three pillars, which jointly comprise 12 Work Packages, with research institutions from all over Europe. SUSFANS will integrate metrics, models and foresight, aiming to set a scientific standard for assessing sustainable food and nutrition security in the EU.

The project will inform policy reforms and innovations that contribute to better calibration of healthy consumption and food production in the EU.

The exchange with stakeholders is considered essential for the research agenda and its impact towards a European food system. The research design is based on three, inter-related pillars.

SUSFANS FRAMEWORK

The framework aims to

- Provide a 'concise' picture of all Wfood system components and their interactions relevant for analysis
- Provide a checklist for all the metrics we would ideally like to have to assess the EU food system (and show gaps in data etc.)
- Provide a roadmap for a coherent analysis across all participating disciplines and project partners

The Stakeholder Core Group

A new approach for a better food and nutrition system in the EU



Achieving food and nutrition security through simple science output can be discouraging on the long run. Promising research output may not trickle down to policy makers or players in the food system areas, falling flat before being integrated. A key feature of SUSFANS approach to achieve food and nutrition security in Europe is the building of a dynamic Core stakeholder group.

The Stakeholder Core Group (short: SCG) integrates 30 to 40 organisations, connecting players from different communities, food system areas, countries and gender, engaging across policy domains and the full food chain. Here, a perfect balance of interests is capital. „There is no fixation on a special group of stakeholders“, explains Coordinator Thom Achterbosch. „The composition of the SCG will probably vary during the lifetime of the project as a result of the dynamics in the multi-actor process of SUSFANS and the various phases in the scientific agenda“.

John Ingram: „The SUSFANS approach makes use of an interaction between stakeholder and science community. The analysis and foresight on food systems and diets can be build on the evidence base, to explore the scope for future gains in sustainability all along the food chain. But a cooperative engagement with stakeholders is central to our research strategy. „ The cooperation will jointly determine a balanced set of metrics for a sustainable Food and Nutrition Security throughout the EU.

This will be done within Work package 6,

maintained by Oxford University. They will ensure SUSFANS outputs are of optimal value to a balanced range of end users.

INTERACTION WITH A BROAD STAKEHOLDER COMMUNITY

For this, a solid and effective interaction with a broad stakeholder community throughout the life of the project will be built and maintained.

„It is of major importance to build and maintain a relation with the stakeholders throughout the project by involving them in a proactive manner. This provides added value to SUSFANS work, particularly when considering the range of the disciplines that will be engaged“, tells Ingram.

Also stakeholders, which are already engaged in projects with similar agendas, will be fit into the project. „This collaboration with other projects' stakeholder groups is important so as to avoid "stakeholder fatigue and confusion; it is crucial to present a coherent and well-coordinated approach to stakeholder engagement so as to ensure long-lasting relationships to mutual benefit, explains Ingram.

SUSFANS is addressing a wide range of issues connected to diets and European food systems, i.e. public health, stability and resilience, resource scarcity and the sustainability in terms of environmental, social and economic considerations. This opens opportunities for engagement with a wide range of stakeholders

The concept for narrowing down the potential list of stakeholders is threefold

- Critical stakeholders are to be found among key agents of change, i.e. organisations with the ability to help shape a transformation of the food systems or inform the process with leading opinions. Such agents are found in business, government, civil society and academia.
- The agent's roles of interest to SUSFANS include all food system actors; nutrition and health specialists; government at EU and lower levels; and intergovernmental bodies; experts from various disciplines.
- SUSFANS is focused on developing knowledge 'tools', i.e. metrics, models and foresight. A leading criterion is which key stakeholder organizations will be using the tools

In the end, the stakeholders can be divided in three groups: i) food system activities; (ii) food system policy; and (iii) food system influences

THE NEW SUSFANS APPROACH: INTERACTION AND SCENARIOS

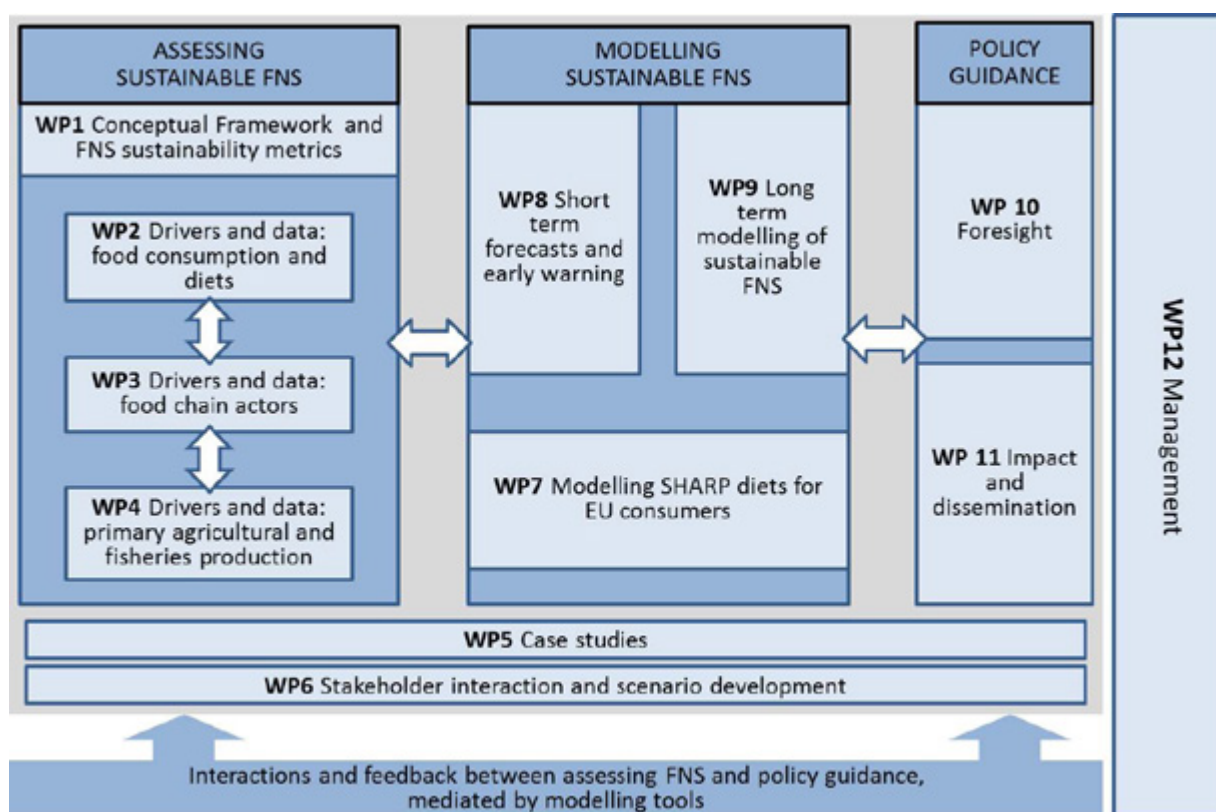
This deep interaction between actors comes within a new scenario approach. In the science community, scenario approaches are increasingly used as a means of exploring uncertainties about the complex interactions

establishing Food and Nutrition Security. Explorative storylines are quite common within many foresight analysis methods, to show alternative plausible futures.

SUSFANS makes use of those existing storylines, instead of just developing a new one on its own. SUSFANS researchers and stakeholders will review a set of scenario exercises, including the OECD long term futures, FOODSECURE or Transmango. The combination and reviewing will lead to the creation of alternative storylines, including the development of policy and innovation strategies in government, farming and the food chain to redress undesirable future paths.

They will be quantified with the SUSFANS model toolbox, and published in a SUSFANS Foresight report.

„The strength of this analysis is that it will take into account the heterogeneity and explicit interaction of production systems and consumer behaviour in the EU, within a global and changing environment“, explains John Ingram. „Synergies and trade-offs across the sustainability dimensions of the whole Food and nutrition system will be evident at EU, subregional and sectoral levels. This makes it possible not only to elaborate targeted policies. But also to identify the interests around sustainable FNS for a range of EU agro-fish-food sectors and chains.“



The reactions of land use to price and policy signals



Recent food price spikes and their potential link to an increased demand of biofuels and food, ongoing land use changes, such as conversion of tropical forest to agricultural land, and their relation to Green House Gas Emissions as well as discussions about the so called bio-economy – all these factors have renewed societal and scientific interest in better understanding how agricultural land use reacts to price and policy signals.

For scientists, especially economists, it is crucial to integrate these issues into models.

The core question is how to represent land use and management by farms and firms in models. SUSFANS researchers at the University of Bonn have now classified and compared key mechanisms with regard to land use in various model applications, in a way which was not conducted before. The outcomes are published in the SUSFANS working paper "Spatial heterogeneity of the agricultural sector in economic models".

LAND HETEROGENEITY

The SUSFANS researchers have been focusing on spatial heterogeneity. The paper is the first to provide a comprehensive and theory-based discussion of approaches to better represent spatial and land heterogeneity in economic models. Most economic models take land by its input, size and output relation, thus assuming a land homogeneity that mostly does not exist in real-life conditions at farm level.

Plots play a key role in assessing spatial heterogeneity. Plots are typically distinguished by biophysical conditions, like soil properties, local climate, or if they are flat or hilly. Fur-

thermore, size, shape, distance to markets (transport costs), the use of a plot in previous management seasons, for example rotational effects, are all factors contributing to land heterogeneity.

FIRM HETEROGENEITY

If moving to a higher aggregation level as for example a group of farms (firms) situated in the same region differences in production functions will increase with higher variability in biophysical conditions and other aspects. Whereas the production factor land is immobile, firms clearly have varying production factors such as labor, knowledge and capital. Consequently, even identical plots from a bio-physical perspective might deliver a different output at given input quantities, since the technology of the firms and/or the utility function of the managers operating these plots usually differ.

SPATIAL HETEROGENEITY

All these factors contribute to spatial heterogeneity. Spatial heterogeneity can be understood as the combination and interaction of land and firm heterogeneity, while taking additionally into account spatial differences in market and policy signals.

Whereas market signals for commodities like grains or oilseeds might be quite similar within a country, other markets like fruits and vegetables might receive market signals that differ spatially. Consumers may prefer regional food for example, willing to pay higher prices.

Policy signals also differ in space: Political interventions affecting agricultural land use

Access to input and outputs markets, transport cost differences and policy interventions such as border protection also clearly differentiate prices in space and lead to spatial specialization in agriculture.

The challenge for economic modeling is that only some of the spatially heterogeneous drivers can be observed directly, whereas other drivers, related to the behavioral model and production functions, can only be assumed. Accordingly, a clear separation of land from other spatial heterogeneity factors is hardly possible in empirical applications.

- Are attributes of spatial heterogeneity such as soil or climate considered explicitly in the production function or only indirectly by calibrating observed input/output relations?
- Is there a clear separation between land heterogeneity and other factors which are (potentially) spatially differentiated (other production factors, behavioral model, market and policy signals)?

The researchers based their overview on an analysis of global (agro-)economic models comparing the representation of land heterogeneity, like GTAP-AEZ or the OECD's and FAO's Aglink-Cosimo, CAPRI or IMPACT-WATER model.

For an empirical determination of a production function based taking potential yields potential yields and their relation to land heterogeneity into account, statistical-econometric pre-work is required.

Spatial heterogeneity of the agricultural sector in economic models

Marcel Adenäuer, Wolfgang Britz, Andrea Zimmermann

Read more: susfans.org/portfolio/spatial-heterogeneity-agricultural-sector-economic-models

REGIONAL AGGREGATED MODEL FOR GERMANY AS AN EXAMPLE

FIRST COMPREHENSIVE AND THEORY-BASED DISCUSSION OF APPROACHES

„We limit the review of different modeling approaches of land heterogeneity to a few selected models for illustrating their implications. Based on a test case we conducted with crop yields in Germany, we demonstrate that the error rate associated with assuming that average regional potential yields are independent of the ‘real’ spatial land allocation is quite low we assume that crops will not move freely across a country“, explains leading author Marcel Adenäuer.

A full verification of this at European or global scale is left for future model applications. „Also, we just show a basic illustration of how economic yield functions that take biophysical aspects into account could potentially be parameterized based on transferring applications in the literature to our approach. The refinement of the parameterization and its adaptation to our purposes is beyond the scope of this paper and will be discussed in future research“, tells Adenäuer.



WP1: Deliverable D1.1 submitted in August

DELIVERABLE IS ON THE SUSFANS CONCEPTUAL FRAMEWORK

This deliverable reports on Task D1.1., the development of a conceptual framework for the SUSFANS project.

Drawing on a literature review and feedback from the SUSFANS stakeholder core group, the conceptual framework describes the actors of the EU food system, their activities, the food system outcomes and the factors directly and indirectly driving actor behaviour.

The framework also shows the relationships between the food system and the key policy goals the EU has formulated for the system. The report highlights the benefits of adopting a food systems approach to analysing EU sustainable food and nutrition security and ends with describing the use of the conceptual framework within the project and externally.

The deliverable report will be featured in the second SUSFANS newsletter.

A Conceptual Framework for Assessing and Devising Policy for Sustainable Food and Nutrition Security in the EU: the SUSFANS conceptual framework

Monika Zurek, John Ingram, Andrea Zimmermann, Maria Garrone, Martine Rutten, Inge Tetens, Adrian Leip, Pieter van't Veer, Muriel Verain, Emily Bouwman, Stephan Marette, Chiaoya Chang, Catharina Latka, Sara Hornborg, Friederike Seville Ziegler, Joost Vervoort, Thom Achterbosch, Ida Terluin, Petr Havlik, Andre Deppermann

Read more: sufans.eu/portfolio/framework-assessing-and-devising-policy-sustainable-food-and-nutrition-security-eu-sufans



General Project update

PLENARY PROJECT MEETING: “ASSESSING EU SUSTAINABLE FOOD AND NUTRITION SECURITY”

This 1.5 day meeting will be held in Brussels, starting on October 26 in the morning. This meeting consists of (at least) one duly representative of each beneficiary.

The main objective of the meeting will be to review and discuss scientific progress in the first 18 months of the project, and to ensure further collaboration and cross-fertilization across teams and tasks. While discussions will be centered around the deliverables that examine drivers and data for European sustainable FNS, other components will also be addressed.

We would like to emphasize that junior researchers are very welcome to participate in the meeting and discussions. With regards to room and/or catering reservations, we strongly advise all participants to register via the following link (before the 1st of October): https://www.eventure-online.com/eventure/externalLogin.form?congress=144_SCG16&cat=1&username=create&password=create

SECOND MEETING OF THE STAKEHOLDER CORE GROUP

This second SCG Workshop will introduce the latest scientific developments of the SUSFANS project. The updated Conceptual Framework, and the most recent progress on metrics selection and representation, will be presented. Results will also be presented of (i) consumer behaviour analysis; (ii) metrics for dietary adequacy and environmental sustainability; (iii) reviews of existing food system scenarios; and (iv) case studies on (a) proteins from livestock-fish supply chains and (b) micronutrients from fruits and vegetables supply chains.

Parallel working groups will actively review and provide feedback on these preliminary results. The entire SUSFANS community will be invited to PPM, including three private sector parties in an advisory role. The SCG meeting will be about performance metrics for assessing sustainable food and nutrition security (FNS) in Europe; a review of FNS scenarios and foreseen case studies on sustainable nutrition and a first glance at the modelling of drivers.

AMENDMENT #1

The first Amendment to the Grant Agreement for

the SUSFANS project has been signed by the Coordinator and submitted to the Commission on August 9, 2016. We are waiting for the approval of the Project Officer and will inform you a.s.a.p. when we have received her conclusions. Meanwhile, if you have any questions with regards to this amendment, please contact Denise Helmes via susfans@wur.nl

OPERATIONAL MANAGEMENT

A (revised) document with all rules, regulations and guidelines concerning the SUSFANS project, including the new format for deliverables, will be distributed after acceptance of the amendment. In case of any changes within your organisation and/or team, please inform Denise Helmes via susfans@wur.nl

PERSONNEL CHANGES IN THE SUSFANS TEAM

Martine Rutten has left LEI to take up a senior position at the Netherlands Ministry of Foreign Affairs. We acknowledge the hard thinking and good work that Martine has done for SUSFANS and wish her all the best in her new position.

Marijke Kuiper (marijke.kuiper@wur.nl; +31703358240) is the leader of Work Package 9 (SUSFANS Modelling Toolbox). Marijke is an economist, seasoned modeller, co-developer of the nutrition & household modules in the MAGNET model...and part-time architect.

Having giving wonderful management support to the SUSFANS project since its early phases, **Denise Helmes** will be resigning from her duties in the project at the end of October, to take up other opportunities. Many thanks to Denise for keeping good spirit and steady course! **Ms Khadija Naïri** will assume the role of Project Assistant in the SUSFANS coordination team, in time for the upcoming consortium meeting. You can continue to reach the coordination team via email susfans@wur.nl.

At Wageningen University there are now three PhD students in place for the basic underpinning of the SHARP diet model. They are **Ollie van Hal** (ollie.vanhal@wur.nl) in the group Animal Production Systems (with prof Imke de Boer); **Ante Ivancic** (ante.ivancic@wur.nl) in the group Operational Research & Logistics (with prof Jacqueline Bloemhof); and **Elly Mertens** (elly.mertens@wur.nl) in the group Human Nutrition (with prof Marianne Geleijnse). Best of luck to all!

Publications

DELIVERABLES

Monika Zurek, John Ingram, Andrea Zimmermann, Maria Garrone, Martine Rutten, Inge Tetens, Adrian Leip, Pieter van't Veer, Muriel Verain, Emily Bouwman, Stephan Marette, Chiaoya Chang, Catharina Latka, Sara Hornborg, Friederike Seville Ziegler, Joost Vervoort, Thom Achterbosch, Ida Terluin, Petr Havlik, Andre Deppermann. **A Conceptual Framework for Assessing and Devising Policy for Sustainable Food and Nutrition Security in the EU: the SUSFANS conceptual framework.** SUSFANS Deliverable D1.1

susfans.eu/portfolio/framework-assessing-and-devising-policy-sustainable-food-and-nutrition-security-eu-susfans

John Ingram, Pierre Dussort, Thom Achterbosch. **The SUSFANS Stakeholder Core Group, drawn across different sectors and roles in European FNS.** SUSFANS Deliverable D 6.1.

susfans.eu/portfolio/d-61-susfans-stakeholder-core-group-drawn-across-different-sectors-and-roles-european-fns

Martine Rutten* (LEI Wageningen, UR), Andrea Zimmermann, (University of Bonn), Petr Havlik (IIASA), Adrian Leip (European Commission, Joint Research Centre), Thomas Heckeley, (University of Bonn), Thom Achterbosch (LEI Wageningen UR): **D 9.1 Modelling Sustainability and Nutrition in Long Run Analyses of the EU Agri-Food system: Work plan for the SUSFANS Toolbox.** SUSFANS Deliverable D 9.1.

susfans.eu/portfolio/modelling-sustainability-and-nutrition-long-run-analyses-eu-agri-food-system-work-plan

PAPERS AND PROCEEDINGS

Vincent Réquillart, Louis Georges Soler, Yu Zang: **Quality standards versus nutritional taxes: Health welfare impacts with strategic firms.** SUSFANS Working paper. 2016. susfans.eu/portfolio/quality-standards-versus-nutritional-taxes-health-welfare-impacts-strategic-firms

Marcel Adenäuer, Wolfgang Britz, Andrea Zimmermann: **Spatial heterogeneity of the agricultural sector in economic models.** SUSFANS Working paper. 2016. susfans.eu/portfolio/spatial-heterogeneity-agricultural-sector-economic-models

SUSFANS WP1 "Conceptual framework and FNS sustainability metrics" Second Workshop. SUSFANS Proceedings. 2016. [susfans.eu/portfolio/susfans-wp1-"conceptual-framework-and-fns-sustainability-metrics"second-workshop](https://susfans.eu/portfolio/susfans-wp1-)

The vision of the SUSFANS project. SUSFANS Working Paper. 2016. susfans.eu/portfolio/vision-susfans-project

Report of the 1st Stakeholder Core Group Workshop. SUSFANS Proceedings. 2015. <http://susfans.eu/portfolio/report-1st-stakeholder-core-group-workshop>