ERA-HDHL

Knowledge Hub on Food and Nutrition Security

In collaboration with

JPI-OCEANS and FACCE-JPI

Template C Joint Proposal

Submission deadline Proposal:

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PART C: DETAILED PROJECT INFORMATION

An integrated approach to the challenge of sustainable food systems: adaptive and mitigatory strategies to address climate change and malnutrition (SYSTEMIC)

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List of participating research groups

Nr.	KH-ID	Organisation name	Acronym organisation	Name group leader within KH	Country
1		Ghent University	UGent	Carl Lachat	Belgium
2.	1103	National Institute for Agricultural Research - Safety and Quality of Plant Products	INRA-SQPOV	Claire Dufour	France
3	1108	National Institute for Agricultural Research - Science and technology of milk and eggs	INRA-STLO	Didier Dupont	France
4	1109	National Institute for Agricultural Research - Plant and cropping System in Horticulture	INRA-PSH	Helene Gautier	France
5	1124	National Institute for Agricultural Research - Nutrition Physiology and Ingestive Behaviour	INRA-PNCA	Claire Gaudichon	France
6	1126	National Institute for Agricultural Research - Centre for Cardiovascular and Nutrition research / Aix-Marseille University	INRA-C2VN/ AMU	Emmanuelle Reboul	France
7	1127	National Institute for Agricultural Research - Food and Digestive Microbiology to serve Health	INRA-Micalis	Christina Nielsen-LeRoux	France
8	1130	National Institute for Agricultural Research - Food Process Engineering and Microbiology	INRA- GMPA	Pascal Bonnarme	France
9	983	Technical University of Munich, ZIEL Institute for Food and Health Else Kröner-Fresenius - Centre of Nutritional Medicine	TUM	Thomas Skurk	Germany
10	1128	Kiel Ocean Assessment and Solution Centre at Kiel University	CAU	Jörn Schmidt	Germany
11	1131	Leibniz Centre for Tropical Marine Research	ZMT	Holger Kuehnhold	Germany
12	951	University of Florence- Department of Agriculture, Food, Environment and Forestry	DAGRI	Marco Bindi	Italy
13	967	Council for Agricultural Research and Economics - Research Centre for Cereal and	CREA-CI	Giuseppe Mandolino	Italy

		Industrial Crops			
14	1016	University of Palermo - Department of Engineering		Maurizio Cellura	Italy
15	1056	University of Milan, Department of Food, Environmental and Nutritional Sciences	UMIL	Patrizia Riso	Italy
16	1058	Council for Agricultural Research and Economics - Research Centre for Food and Nutrition	CREA-AN	Marika Ferrari	Italy
17	1063	Council for Agricultural Research and Economics - Research Centre for Genomics and Bioinformatics	CREA-GB	Luigi Cattivelli	Italy
18	1064	University of Sassari/Centre for Conservation and Evaluation of Plant Biodiversity		Maurizio Mulas	Italy
19	1093	Ente Nazionale di Ricerca e promozione per la standardizzazione	ENR	Francesco Beltrame	Italy
20	1094	Libera UniversitÃ di Bolzano	UNIBZ	Marco Gobbetti	Italy
21	1097	Alta Scuola in Management ed Economia Agro-alimentare/ Università Cattolica del Sacro Cuore	SMEA	Daniele Moro	Italy
22	1105	University of Florence - Department of Agriculture, Food, Environment and Forestry		Anna Dallamarta	Italy
23	1112	Polytechnic University of Marche - Dep. Life and Environmental Sciences	UNIVPM-DiSVA	Francesca Comitini	Italy
24	1117	Department of Computer, Control and Management Engineering, Sapienza University of Rome	UNIROMA1-DIAG	Alberto De Santis	Italy
25	1120	University of Bari Aldo Moro	UNIBA	Maria De Angelis	Italy
26	1121	University of Bologna, Department of Physics and Astronomy	UNIBO	Daniel Remondini	Italy
27	962	Riga Stradins University- Dpt of Internal Diseases / Nutritionist division	RSU	Laila Meija	Latvia
28	1106	Nodibinajums Baltic Studies Centre		Talis Tisenkopfs	Latvia
29	1051	Norwegian Institute of Bioeconomy Research	NIBIO	Habtamu Alem	Norway
30	1022	Institute of Marine Research	IMR	Lise Madsen	Norway

31	1033	Institute of Marine Research	IMR	Marian Kjellevold	Norway
32	979	Centre of Marine Sciences	CCMAR	Lui-sa Barreira	Portugal
33	1044	Rede de Química e Tecnologia - Laboratório Associado para a Química Verde	REQUIMTE-LAQV	Isabel Mafra	Portugal
34	1047	Rede de Química e Tecnologia - Laboratório Associado para a Química Verde	REQUIMTE-LAQV	Isabel Ferreira	Portugal
35	1107	Rede de Química e Tecnologia - Laboratório Associado para a Química Verde	REQUIMTE-LAQV	Cristina Delerue-Matos	Portugal
36	1122	University of Porto, Institute of Public Health,	ISPUP	Duarte Torres	Portugal
37	1115	University of Porto, Faculty of Pharmacy		Maria Beatriz P P Oliveira	Portugal
38	1118	Institute of Mediterranean Agricultural and Environmental Sciences - University of Evora	ICAAM	Elsa Lamy	Portugal
39	1125	Universidade Católica Portuguesa - Escola Superior de Biotecnologia	UCP	Ana Maria Gomes	Portugal
40	978	University of Vigo	UVigo	Jesus Simal-Gandara	Spain
41	1008	University of Valencia		Carolina Rausell Segarra	Spain

Work package (WP) list

WP	Work package title	Lead partner	Start month	End month	Deliverable no
WP0	Project coordination and management	Alem (Norway), Bindi (Italy) Torres (Portugal)	Jan. 2020	Dec.2022	
WP1	Resource use, current knowledge, and future trends	Remondini (Italy) Ferrise (Italy)	Jan. 2020	Dec.2022	
WP2	Sustainable & value-added food production	Simal-Gandara (Spain) Schmidt (Germany) Habyarimana (Italy)	Jan. 2020	Dec.2022	
WP3	Nutrition	Reboul (France) Ferrari (Italy)	Jan. 2020	Dec.2022	
WP4	Consumer Behaviour	Moro (Italy) D'Addezio (Italy) Simal-Gandara (Spain)	Jan. 2020	Dec.2022	
WP5	Public Health and Environmental impact	Torres (Portugal) Madsen (Norway)	Jan. 2020	Dec.2022	
WP6	Dissemination and capacity building	Alem (Norway), Bindi (Italy) Torres (Portugal)	Jan. 2020	Dec.2022	

Pert chart

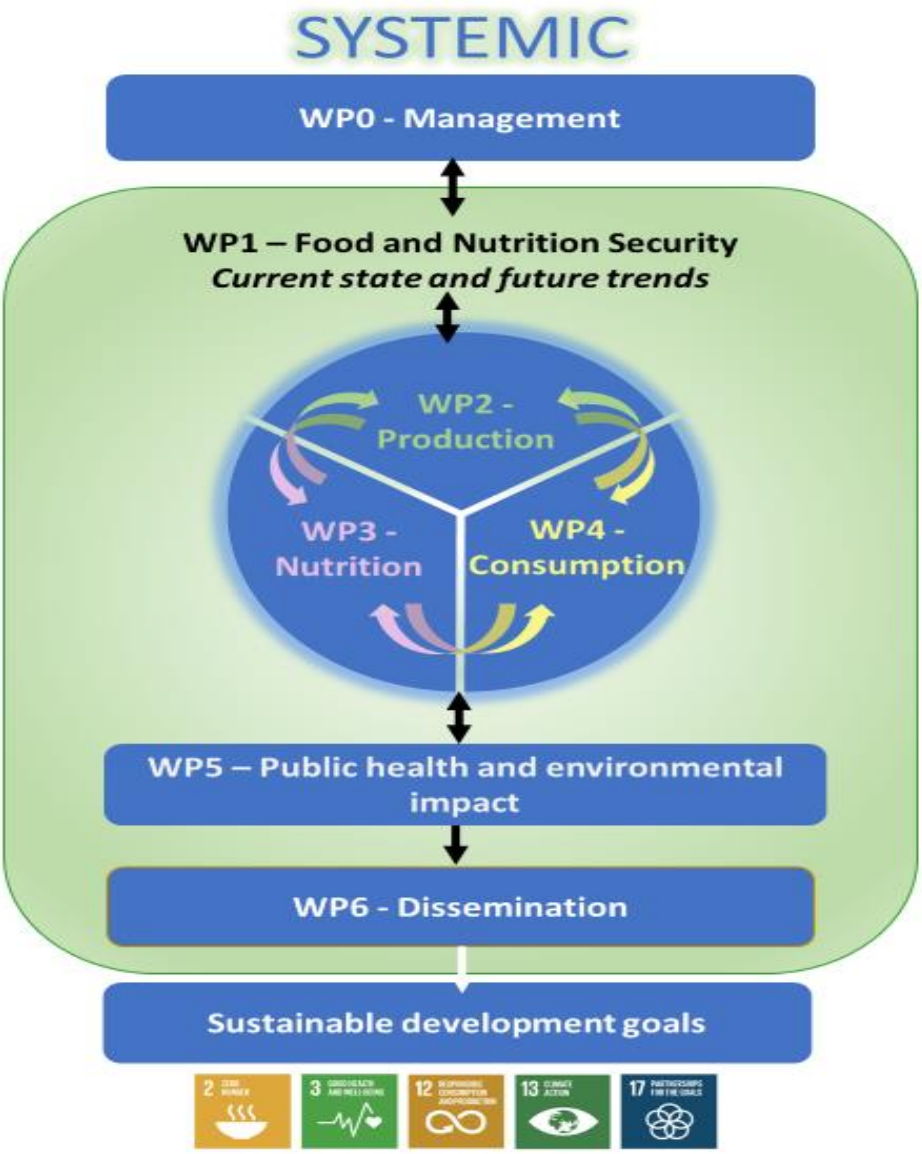

Figure 1. Pert Chart which shows the interdependencies of work packages (WP)

Gantt chart (T= task and D=Deliverables)

WPS/ Task	Description of Task and Working packages (WP)	Quarter during which task completion is expected											
		2020				2021				2022			
WP0.	***Project coordination and management***	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
T0.1	Establish project management team (work plan)	D	D										
T0.2	Financial management and Reporting			D			D			D			D
T0.3	Kick-off meeting and end-of project conference	D	D									D	D
WP1	**Resource use, current knowledge, and future trends**												
T1.1	Climate change scenarios and data needs				D				D				D
T1.2	Impacts on biophysical inputs				D				D				D
T1.3	Impacts on social/economic inputs				D				D				D
WP2	**Sustainable & value-added food production**												
T2.1	Crop production optimization, biodiversity, and plant breeding				D				D				D
T2.2	New developments in aquaculture and agriculture				D				D				D
T2.3	Novel foods (circular economy)				D				D				D
T2.4	Risks and safety assessment				D				D				D
WP3	**Nutrition**												
T3.1	Food composition and new sources				D				D				D
T3.2	Bioavailability				D				D				D
T3.3	Physiological effects of sustainable diets				D				D				D

T3.4	Dietary assessment and balanced nutritious diets						D						D
WP4	**Consumer Behaviour**												
T4.1	How we eat				D				D				
T4.2	Changing food practices						D		D		D		
T4.3	Consumer Food Future Scenarios (C-FFS)								D				D
WP5	**Public Health and Environmental Impact**												
T5.1	Review of food and nutrition policy measures across Europe				D								
T5.2	Identification of future food scenarios						D						
T5.3	Relevant health effects and environmental impacts								D				
T5.4	Risk-benefit characterization of future food scenarios											D	
T5.5	Health effects and environmental impacts: scenarios comparison												D
WP6	**Dissemination & capacity building**												
T6.1	Education of consumers on low environmental impact product			D			D			D			D
T6.2	Data sharing		D			D			D			D	
T6.3	Capacity building and networking		D			D			D			D	
T6.4	Workshops and seminars				D				D				D

Overview on Milestones

No	Milestone name	Work Packages involved	Month
1	Project Management Team (PMT) established	All WPs	1
2	Kick-off meeting	All WPs	2
3.	End of project conference	All WPs	35
4	Definition of tasks roadmap of activities to be carried out	WP1	6
5	Checking activities carried out and defining future steps	WP1	18
6	Checking activities carried out and defining final steps	WP1	30
7	Revision of prototypes to be proposed in different scenarios	WP2	35
8	Capacity building on minimization strategies of climate change on aquaculture	WP2	18
9	Exchange of research info and resources on this kind of cultures	WP2	18
10	Diffusion and transfer conferences and workshops on alternative protein-rich foods	WP2	6
11	Thematic area meeting on novel methodologies to assess food safety risks	WP2	6
11	Practical courses on how traceability solutions work on the total food production chain	WP2	6
12	List of the new food products and ingredients (including alternative protein sources)	WP3	6
13	List of key procedures including food samples preparation, assessment of digestion, bio accessibility and bioavailability of nutrients/ bioactive	WP3	6
14	Identification of sensible target groups of the population.	WP3	6
15	List of food intake dataset and studies that could potentially be conjointly analysed	WP3	6
16	List of knowledge gaps in analytical values for use in food composition tables with special focus on proteins, micronutrients and “new foods”	WP3	18

17	Identification of knowledge gaps and establishment of structure-function relationships to better predict effects of (new) production and processing methods on bioavailability of nutrients/bioactives	WP3	18
18	Identification of knowledge gaps on the potential risk associated with the new sustainable dietary patterns in terms of health	WP3	18
19	Definition of criteria to develop balanced nutritious diet including alternative/novel food and sustainability	WP3	24
20	Definition of integrated procedures within the food system to support high bioavailability of nutrients/bioactive	WP3	30
21	Definition of "nutritional" reference standards to be attended and be pursued within the food system approach to ensure the goal of optimal body function and health	WP3	30
22	Database of available sources and data describing food choices in EU.	WP4	12
23	Database of indicators and targets for healthy and sustainable food choices in EU.	WP4	12
24	Map of key food choice trends and identification of gaps to food system targets completed.	WP4	24
25	Map of determinants with the assessment of their impact.	WP4	24
26	Map on consumers determinants in buying and eating novel and functional foods with special focus on sensory characteristics and consumers acceptability	WP4	30
27	C-FFS for 2030/2050 proposed.	WP4	36
28	Graph database to store the findings of the review on food and nutrition policy measures	WP5	6
29	List of case studies and respective scenarios to be considered	WP5	16
30	Definition of scenarios profile [e.g. level of aggregation (food component, food product, dietary pattern), population groups of interest, risk-benefit question with the description of the scenarios to assess (reference and alternative scenarios)	WP5	18
31	Schematic trees of health effects and environmental effects for each case-study	WP5	20
32	Harmonized datasets of individual food consumption data in national representative samples of at least two countries (North and South of Europe) for health risk-benefit and environmental impact assessment purpose.	WP5	24

33	Harmonized dataset food composition data (nutrients and other dietary components)	WP5	24
34	Harmonized dataset of occurrence/concentration of chemical and microbiological hazards in foods	WP5	24
35	Harmonized dataset of environmental impact factors related to food	WP5	24
36	Education, training, and capacity building measures	WP6	Every 6 months
37	Data Sharing	WP6	Every 6 months
38	Biannual meeting to share and evaluate the project results	WP6	Every 3 months
39	Workshops and seminars	WP6	12, 24, 36

Overview on Deliverables

No.	Deliverable name	Work Package	Month	Nature (e.g. report, manuscript, protocol)	Dissemination level (public, confidential)
1	Financial report	WP0	Every 3 months	report	confidential
2	Internal Report on Task activities during the 1st year	WP1	12	report	confidential
3	Internal Report on Task activities during the 2nd year	WP1	24	report	confidential
4	Internal Report on Task activities during the 3rd year	WP1	36	report	confidential
5	White paper on climate change and main input use	WP1	36	report	public
6	Optimized map of multiple cropping throughout EU	WP2	6	map	Public
7	Database and bio-bank of suitable germplasm with genomic and phenotypic data; capacity building	WP2	6	database	Public
8	Technical newsletter recommending ingredients for aquaculture feeds	WP2	6	manuscript	Public
9	States of art on how to add value to both autochthonous cultivars and food by-products	WP2	6	manuscript	Public
10	Reports with scientific basis proposing healthy diets based on bioactive-rich foods	WP2	6	manuscript	public
11	Papers with authenticity strategies for plant and animal-based foods to detect frauds	WP2	6	manuscript	public
12	Benefits of new processes in terms of (micro) nutrient composition and food labelling report of the new food products	WP3	12	Report	Confidential

13	Report on improved models/ approaches for assessment of the bioavailability of (micro)nutrients and bioactives	WP3	12	Report	Public
14	Detailed list of "at risk" nutrients and non-nutrients with impact on physiological functions in the context of climate change	WP3	12	Report	Confidential
15	Report on actual food sources and nutrients intake in EU population to quantify the impact in terms of nutritional coverage and variety of diets	WP3	18	Report	Confidential
16	Report on strategies to improve food composition (including identifying new sustainable feed/food sources) and mitigate food allergenicity	WP3	24	Report	Confidential
17	Report on main factors impacting digestion, bio accessibility and bioavailability in terms of production and processing	WP3	24	Report	Confidential
18	Report on the potential impact of alternative sustainable food sources on physiological effects	WP3	24	Report	Confidential
19	Report on the effect of climate change and new transformation processes on food composition	WP3	36	Manuscript	Public
20	Report on key strategies to overcome the impact of climate change on bioavailability of nutrients	WP3	36	Manuscript	Public
21	Systematic reviews/meta-analyses on physiological effects of foods/food classes/dietary patterns in view of the identified at risk nutrients/non-nutrients and by considering different target groups of population	WP3	36	Manuscript	Public
22	Report on existing and possible diet models for balanced food and nutrients intake considering novel /alternative food sources	WP3	36	Manuscript	Public

23	List of information sources and protocols for the compilation, harmonization and internal dissemination of data on food choice.	WP4	12	Report	Public
24	Report summarizing key food choice trends, assessing gaps to targets, evaluating potential impacts on EU food systems and formulating policy implications	WP4	24	Report	Public
25	Report on drivers of individual food choice related to sustainable consumption behaviour.	WP4	24	Report	Public
26	Report on key drivers of consumers' acceptance of novel foods, and related aspects.	WP4	18	Report	Public
27	Report(s) on case-studies	WP4	30	Report	Public
28	Design of C-FFS for 2030/2050	WP4	24	Report	Public
29	Consumer Future Food Scenarios (C-FFS) for 2030 reviewed and disseminated.	WP4	36	Report	Public
30	Final Report on WP4	WP4	36	Report	Public
31	Review graph database of food and nutrition policy measures across countries (main objectives, target, type of intervention, monitoring process, impact)	WP5	12	database	public
32	Report/Review document of food and nutrition policy measures across countries (main objectives, target, type of intervention, monitoring process, impact)	WP5	12	report	public
33	Webinar among partners and different stakeholders to identify the gaps	WP5	12	webinar	confidential

34	Summary document containing measures of association between health effects and exposure	WP5	24	report	confidential
35	Intermediate document containing the results of risk benefit characterization for both quantitative or semi-quantitative approaches	WP5	30	report	confidential
36	Estimation of the change in the burden of disease and the environment impact, for each scenario	WP5	36	manuscript	public
37	Integration of results from all case studies, identification of knowledge gaps and future research priorities	WP5	36	manuscript	public
38	Education and training, capacity building	WP6	Every 6 months	report	public
39	Data sharing	WP6	Every 3 months	Report	confidential
40	Biannual meeting to share and evaluate the project results	WP6	Every 6 months	Report	public
41	Workshops and seminars	WP6	3 times in 36 months	manuscript	public

An integrated approach to the challenge of sustainable food systems: adaptive and mitigatory strategies to address climate change and malnutrition (SYSTEMIC)

1. General information

1.1 Summary

Securing sufficient and healthy food for all, while minimizing environmental impact is the great challenge we face already today. Local production limits and global trade challenge equal access to food. With climate change increasingly affecting food production in areas, which are already disadvantaged, unprecedented population (especially in urban and coastal areas) and income growth and deterioration of usable land, these challenges will intensify. We need a holistic approach to transform the global food production system with the ability to adapt to regional necessities. The **SYSTEMIC** network (an integrated approach to the challenge of sustainable food systems: adaptive and mitigatory strategies to address climate change and malnutrition) will bring together scientists and practitioners from different disciplines and expertise on different parts of the food system to explore cross-cutting solutions, identify knowledge gaps and develop pathways for a food system transformation, which is climate-resilient and able to cope with societal challenges.

While the information on policies and technologies that would enhance productivity and sustainability of individual agricultural sectors is available to some extent, literature is practically devoid of information and experiences for countries and communities considering a comprehensive approach (cross-sectoral policies, strategies, and technologies) to sustainable food and agriculture. This project is the first effort to fill this gap, providing information on proven options and opportunities that provides sustainable, resilient, and nutritional food from both land and sea. The SYSTEMIC project idea is based on researchers from 41 research groups working in eight countries by creating a network for a better understanding of food and nutrition security in a changing environment. National and transnational collaboration in R&D projects together with the transfer of knowledge and technology are the major aim of the research teams working in this project. SYSTEMIC is a three years project working on seven interrelated working packages and case studies.

SYSTEMIC will develop a joint vision for the development of an integrated food system for continuous improvement in sustainability at production, consumption, and public health. The project involves contributing towards the following Sustainable Development Goals (SDGs): (2) zero hunger, (3) good health and well-being, (12) responsible consumption and production, (13) climate action, and (17) partnerships to achieve the goals.

Key Features

SYSTEMIC will

- Assess current technologies on their feasibility to address the food challenges
- Develop methods to assess trade-offs in support of decision and policy making
- Identify knowledge gaps and research needs to funding agencies and governments
- Disseminate knowledge to industry, society, and policy, and develop and collate education and training tools

1.2 Keywords

Food security, climate change, food production, consumption, nutrition, and public health

1.3. Description of the Knowledge Hub in general

The overall aim of the Knowledge Hub on Food and Nutrition Security is to foster transnational and interdisciplinary collaboration and networking to catalyse and accelerate research that integrates the different facets of the food system to address climate and global change challenges. SYSTEMIC will work through a series of workshops on cross-cutting themes, building on and connecting existing initiatives, projects and programs.

1.3.1. State of the art and objectives

a. State of the art

The production of food and feed faces important challenges: by 2050 horizon, the world in general and the European Union in particular, will face an important food crisis as a direct consequence of climate change, and this crisis seems irreversible. The advance of desertification can be dramatic in the countries of the Mediterranean basin (Spain, Portugal, Italy, Greece, southern France, and the Balkans), as shown in the forecast for the Iberian Peninsula on the horizon of the year 2100 (Figure 2). Moreover, the loss of arable land associated with the increase in sea level and soil salinization will have a very important impact especially in the North Sea (Denmark, Germany, Holland, Belgium) and in certain areas of France, Spain, and Italy, as depicted in Figure 3 according to medium-term forecasts.

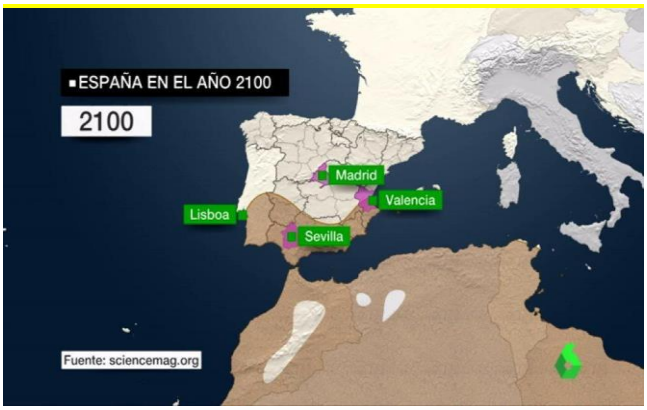

Figure 2: Advance of the Sahara Desert in 2100

Figure 3: Forecast of sea-level rise in Europe in the year 2100

Food production from agriculture and fisheries are highly dependent on the climate. Moderate warming and more carbon dioxide in the atmosphere may help some plants to grow faster. However, more severe warming, floods, and drought may reduce crop productivity that could have a consequence for food availability. Moreover, warmer water temperatures are likely to cause the habitat ranges of many fish and shellfish species to shift, which could disrupt the food system and ecosystems. Variations in the rainfall and the advance of desertification in the south of Europe will cause important losses of arable lands and their productivity. Under such a scenario of loss of arable lands and crop yields, the exponentially increasing world population would mean an uncertain world's future.

The modification of climate, together with changes in agriculture practices and food transformation, will induce a change in food nutritional quality and in the accessibility of nutritious diet that should be considered to ensure the nutritional security of the populations. The design of new nutritious diet requires for collaboration between nutritional and environmental sciences, and diet modelling is the preferred approach for operationalizing on the health aspect since it captures the complexity of diet as a whole (Mertens et al, 2017). Besides, food choice will be the key wild card variable defining how climate change will ultimately affect human diet, nutrition, and health. Whether, how and to what extent consumers are willing and able to adjust their choices to modifications in the composition and nutritional quality of products, the transformation of production and supply chains, and the fast evolution of markets will shape the future of European food systems. Importantly, the dynamics of food choice

will also determine the success of any adaptive strategies and policy initiatives envisaged to ensure food and nutrition security in the face of climate change. Moreover, the crucial role played by the manufacturing and distribution sectors in mediating food system adaptation, whether supply-demand- or policy-driven, should also be considered.

The stability of whole food systems may be at risk under climate change because of short-term variability in the supply of food from the land and sea. Mitigation and adaptive strategies to climate change are thus urgently required. To achieve food and nutrition security, there is a need for a holistic and integrated approach to mitigate the impact of climate change on food and nutrition security and secure sufficient and healthy food for all. The concept of the food system includes several dimensions (economic, environmental, social and health) and a variety of activities (agriculture, industry, trade, etc.) that relate to the processing of raw materials into food for consumption. Thus, the conceptual model for this project is based on an integrated approach to face the challenge of sustainable food systems as the set of operations and processes involved in transforming raw materials into food and transforming nutrients into health outcomes, all which functions as a system within biophysical and socio-cultural contexts (Figure 4).

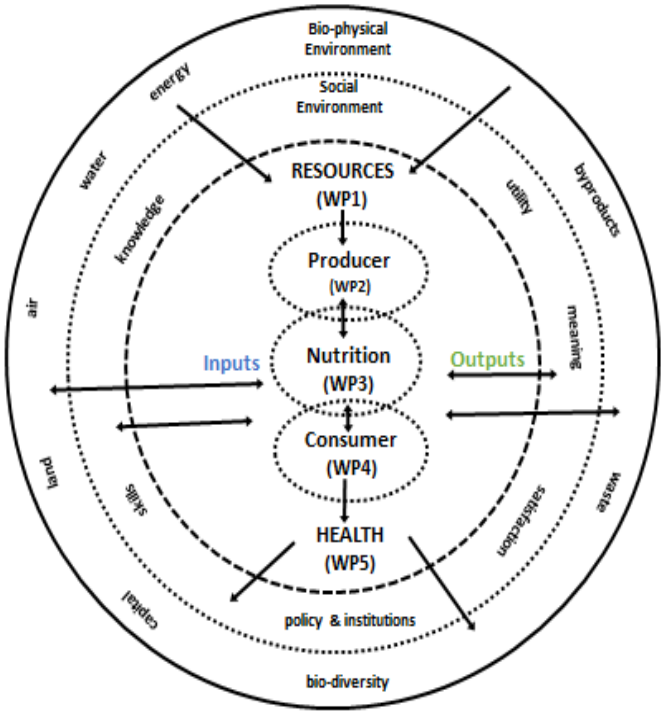

Figure 4. A conceptual model of the food and nutritional system based on (Sobal J. et al., 1998)
WP= Working packages focus

While the information on policies and technologies that would enhance productivity and sustainability of individual agricultural sectors is available to some extent, literature is practically devoid of information and experiences for countries and communities considering an integrated approach (cross-sectoral policies, strategies, and technologies) for food and nutrition security. This project is the first effort to fill this gap, providing information on proven options and opportunities that provides sustainable, resilient, and nutritional food from both land and sea. The project follows the integration of centre the food chain, starting from the resources used to the primary production to finish in food products containing a nutritive value, consumption, and its health effects. The project looking an alternative strategy associated with the reduction of environmental impacts and looking for patterns of circular economy which represent the best option that can help the European Union to overcome the challenging scenarios predicted in the next 30 years.

b. Vision and overall aims and objectives

The overall aim of the SYSTEMIC project is to implement adaptive strategies for sustainable food production, consumption, and public health by addressing the diverse impact of climate change on nutrition quality and composition of food and defining standards to achieve food and nutrition security. The project aims to address the challenges of impacts of climate change on food systems and encourage healthy, environmentally sustainable diets.

1.3.2. Network concept

The SYSTEMIC project idea is based on researchers from 42 research groups working in eight countries by creating a network for a better understanding of food and nutrition security in a changing environment. National and transnational collaboration in R&D projects together with the transfer of knowledge and technology is the major aim of the research teams working in this project. SYSTEMIC uses an integrated approach and the research group shares research data based on FAIR data management principles to make data findable, accessible, interoperable, and reusable. SYSTEMIC is a three years project working on seven interrelated working packages and case studies. We will focus on specific test cases including cereals, legumes, and olive oil for terrestrial, and fish, molluscs and algae for aquatic systems. To start with, a case study on olive oil chain represents a new model in the production in terms of sustainability and in the light of the recent climate changes.

1.3.3. Network structure and management

The project network structure is divided into three levels of management and organization. Level 1 is the decision-making body coordinated by the General Assembly (GA). The GA is composed of one representative from each partner and is chaired by the project coordinator. The GA will make decisions on financial, administrative, scientific, knowledge, and innovation aspects. Project level 2 is the Project Management Team (PMT), which comprises the project coordinator and the WP leaders. The PMT works under the GA and assists in drawing up proposals and reporting to the GA. The PMT is more involved in the technical parts of the project, such as the coordination of activities, analysis and design of objectives and events, planning the work according to the objectives, risk management, the allocation and control of resources, assigning tasks, controlling project execution, tracking and reporting progress, and analysing the results based on the facts uncovered. Level 3 of the project structure comprises the WP leaders' team which are composed of the WP leader and the task leader which are concerned more with the technical aspects of the project.

1.3.4. Quality of the transnational collaboration and scientific exchange

The SYSTEMIC project connects transnational and multidisciplinary research groups working on terrestrial and aquatic food production systems to gather a holistic understanding of the innovation potential of the food system. It also assesses current gaps in knowledge and technology to provide recommendations for research and educational programs and policy development to achieve the objectives of the Knowledge Hub. The project follows an integrated approach where it aims to bring together expertise, knowledge, facilities and sharing databases to achieve food and nutrition security and to propose adaptive strategies to mitigate global climate change and malnutrition.

The SYSTEMIC project will deliver a prospective state-of-art analysis of food choice in Europe, which culminates with the foresight of demand-level response to climate change and related mitigating strategies, i.e., the design of Consumer Future Food Scenarios (C-FFS). This analysis will be supported by project partners' who have a solid background and combined expertise in social, food, environmental and health sciences, thereby strengthening the KH's multidisciplinary approach. Adopting a consumer- and market-oriented perspective which will also promote a strong engagement of key stakeholders from the food processing and distribution industries, thereby facilitating a broad and sustainable uptake of KH findings by relevant food system actors.

1.3.5. The potential impact of the expected results

The **potential impact** of the SYSTEMIC project involves contributing towards the following Sustainable Development Goals (SDGs): (2) zero hunger, (3) good health and well-being, (12) responsible consumption and production, (13) climate action, and (17) partnerships to achieve the goals.

1.3.6. The overall strategy of the work plan

SYSTEMIC project is a three years project designed with seven working packages. The detail of the working plan is discussed in the GANTT chart.

1.3.7. Dissemination and exploitation strategy

The SYSTEMIC project gives emphasis on the importance of dissemination and exploitation which make up one of the WP of the project. WP6 discusses in detail strategies to transfer knowledge, workshops and other deliverables to communicate and transfer research results to other related initiatives as well as the public sector and discuss their implementation with appropriate stakeholders.

1.3.8. Risk & risk Management

The project expected the following risks and designed the following precautionary measures.

Risks and contingencies	WPs	Precautionary measures
Single WPs and tasks may not progress as planned.	All	The project is monitored by the General Assembly (GA) committee to identify the progress, bottlenecks, and decisive action required in each of the WPs. A regular Skype meeting will be held at least every month.
Initial research outcomes may suggest the adjusting of the individual task and WP budgets to prioritize the most promising strategies.	All	Re-allocation of budgets and sample sizes is permitted but must be approved by the project steering committee.
Risk of the insufficient extent of dissemination that project information does not reach the intended target audience.	WP6	A wide variety of communication channels, including online technical publications, public events, workshops, articles, social media, and videos will be used.
Not all crops/aquaculture species can be mapped, or all germplasm can be databased.	WP2	Specific crops types/aquaculture species and relevant germplasms will be selected.
Not all food safety risks and authenticity strategies can be considered.	WP2	The most relevant food safety/authenticity will be selected for different food types.
Not all nutritional modifications in food can be considered.	WP3	A focus will be done on selected relevant food products.
Not widespread coverage of EU countries and dataset.	WP4	At least relevant countries, datasets, and information related to Partners.
Not all healthy diets based on bioactive-rich foods can be considered.	All	Only the most relevant, mainly affecting health issues of the EU citizens, will be selected.

2. Work package description

The SYSTEMIC project focused on working on 7 Working Packages (WP) and cross-cutting case studies. The WPs are discussed in detail as follows:

2.1. WP0: project organization and management

1. Partners involved

Leaders: Alem (Norway), Bindi (Italy) and Torres (Portugal). All project partners will be involved in this WP.

Name	Affiliation	Country
Habtamu Alem	NIBIO	Norway
Marco Bindi	UNIFI	Italy
Duarte Torres	ISPUP	Portugal

2. Aim of the WP

The aim of WP0 is ensuring the successful implementation of the project according to the plan, focusing on 1) activity management in the WPs, 2) financial management and reporting, 3) internal and external communication, 4), organizing annual project plenary meetings, 5) the dissemination progress, and 6) addressing project issues.

3. Description of the work and role of partners

Tasks: 1) Establish the PMT 2) Financial management and reporting. 3) Kick-off meeting and end-of-project conference. All partners involved in these tasks but lead by the project coordinators.

4. Description of the activities

A project management team (PMT) representing all WP leaders and the project coordinator will be established to facilitate effective and efficient collaboration and communication among project partners and with reference/user groups. The PMT will control project activities, tasks, and deliverables. A kick-off meeting for all participants in the consortium will be held at the start of the project. At the end of the project, a scientific conference will be organized.

5. **Deliverables and Milestone**

Each task and deliverables will be completed in a close collaboration of all partners and WPs. The work plan and milestones for each task is clearly stated in the GANTT chart.

Task	Deliverables and Milestone	Timing
1.1	Project Management Team (PMT) established	1st month
1.2	Kick-off meeting	2nd month
1.3	End of project conference	Month 35
1.4	Financial management and reporting	Every 3 months

6. Risk & risk Management

Refer to the table which shows the expected risk and proposed risk management for the whole project

2.2. Resource use, current knowledge, and future trends (WP1)

1. Partners involved

WP1 Leaders: Daniel Remondini (Italy) and Roberto Ferrise (Italy)

Name	Affiliation	Country
Marco Bindi, Roberto Ferrise, and Gloria Padovan	UNIFI (951)	Italy
Gabriele Dono, Raffaele Cortigiani, Nicola Lacetera, and Andrea Vitali	UNITUS (951)	Italy
Domenico Ventrella	CREA (951)	Italy
Pier Paolo Roggero, Laura Mula, Antonio Pulina, Giovanna Seddaiu	UNISS (951)	Italy
Massimiliano Pasqui and Marco Moriondo	CNR-IBE (951)	Italy
Jesus Simal-Gandara	UVigo (978)	Spain
Habtamu Alem	NIBIO (1051)	Norway
Ephrem Habyarimana	CREA-CI (967)	Italy
Anna Dalla Marta, Marco Napoli, Simone Orlandini	UNIFI (1105)	Italy
Maurizio Cellura, Sonia Longo, Francesco Guarino	UNIPA (1016)	Italy
Maurizio Mulas	CBV/UNISS (1064)	Italy
Francesco Beltrame, Tiziano Caruso,and Angela Zinnai	ENR - UNIPA - UNIPI (1093)	Italy
Daniel Remondini, Nicolas Greggio, Diego Marazza	UNIBO (1121)	Italy
Filiberto Altobelli	CREA-PB (1058)	Italy
Talis Tisenkopfs	Nodibinajums Baltic Studies Centre (1106)	Latvia
Marta Vasconcelos, Ana Gomes, Elisabete Pinto	UCP (1125)	Portugal

2. Aim of the WP1

The aim of WP1 is to describe the input resources to the food system as affected by the prospective climate changes, and to identify the most relevant trends (e.g. on rain levels, use/unused soil, changes in food habits) affecting future scenario on food and nutrition. Two main categories of inputs (factors) will be considered: biophysical and social/economic factors. Aspects related to the relationships between climate and inputs to the food and nutrition system will be considered in a general way, to provide a broad description of how climate change may affect the system. Such information will represent the basis for specific analysis that will take place in the other WPs.

3. Description of the work and role of partners

WP1 involves the following main tasks

Task 1.1: Climate change scenarios and data needs

Task leaders: M.Bindi/R. Ferrise UNIFI (IT); Partners: UNIFI (IT), UNISS (IT), CNR-IBE (IT), UNIBO (IT), CREA-CI (IT), UNIPA (IT), CREA-PB (IT) all partners for helping defining needs)

Aim: Gathering information on the current state of knowledge regarding current and expected climatic conditions. Aspects such as quantity and type of existing data, Spatio-temporal resolution, downscaling and upscaling methodologies, etc. will be sought. In collaboration with the project partners, specific needs will be identified in terms of the type and format of the data for the analysis of the system. This information may be used (or useful) to carry out the activities envisaged in the subsequent WPs.

Method: The work will be based on existing projects, activities, initiatives and programs. People from the different sectors and background, particularly to assist in defining needs for food and system analysis; Climate can be described at different scales, from global to local, the investigation of different climate change scenarios, either based on Regional climate or Global circulation models approaches with different downscaling techniques and different geographical sites

Source: all partners involved in collecting information about climate change effects on the food and nutrition system.

Task 1.2: Climate change impacts on biophysical inputs

Task leader: M. Vasconcelos UCP (PT); partners UNIFI (IT), UNIBO (IT), CREA (IT), UNISS (IT), UNITUS (IT), CREA-CI (IT), CREA-PB (IT), all by providing information, reviews, knowledge, etc on main biophysical inputs)

Aim: Overall, this task is aimed at consolidating the current state of knowledge about the effect of climate and its changes on the biophysical environment of the food and nutrition systems.

Method: The work will be based on existing projects, activities and initiatives and programs. Based on literature reviews and partners' knowledge and experiences, the main biophysical inputs (e.g. crops, land, water, energy, germplasm, etc.) to the production, consumption and nutrition components of the food system will be identified, and the role of climate and prospected changes on them will be explored.

Source: Potentially, all the KH partners may contribute with data, information, knowledge, stakeholder experiences, etc. to the task**.**

Task 1.3: Climate change impacts on social and economic inputs use

Task leader: A. Habtamu NIBIO (NO); partners: UNIFI (IT), UNISS (IT), CNR-IBE (IT), UNITUS (IT), CREA-PB (IT) and, all by providing information, reviews, knowledge, etc on main social/economic inputs)

Aim: This task focused on measuring productivity and efficiency of resource use in a changing environment. Moreover, we will identify socio-economic factors which affect the better performance of resource use.

Method: The work will be based on existing projects, activities, initiatives, and programs. Literature reviews will be conducted. We will apply qualitative and quantitative performance measurement methods.

Sources: We will use Farm Accountancy Data Network (FADN) which is a European system of sample surveys conducted every year to collect accountancy data from farms.

4. Description of the activities

Regular meetings (either physical or via internet, teleconferences) among partners will be held to identify the main aspects and topics to be explored and to define how to address them. Starting from existing reports (e.g. IPCC, FAO, EU, etc.), a literature review will be carried out to gather information about climate change and its effects on food system input resources. Existing scientific literature will be collected with the aim to identify the main topics, summarize current knowledge, gaps, and research needs. Attention will be devoted to answering questions such as, for instance, what are the specific effects on regional food production, which crops/livestock/aquatic plants and animals will be most affected and what is the impact on the economy and food and nutrition security.

5. Deliverables and Milestone

- Three end-of-year internal reports on activities carried out and progress of the tasks (Months 12, 24, 36; Responsible: WP and task leaders)
- White paper on climate change and main input resources of food and nutrition system delivered (Month 36; Responsible: WP leaders)

Task	Milestone	Timing
all	Definition of tasks roadmap of activities to be carried out	6
all	Checking activities carried out and defining future steps	18
all	Checking activities carried out and defining final steps	30

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6. Risk & risk Management

Refer to the table which shows the expected risk and proposed risk management for the whole project

2.3. Sustainable and Value-Added Food Production (WP2)

1. **Partners involved**

WP2 Leaders: Simal-Gandara (Spain), Schmidt (Germany), and Habyarimana (Italy)

Name KH member	**Organization**	**Country**
Pascal Bonnarme; Eric Dugat-Bony; Sophie Landaud; and Anne Saint-Eve	INRA-GMPA (1130)	France
Giuseppe Mandolino; Laura Bassolino; Donatella B.M. Ficco; Pasquale De Vita; Ephrem Habyarimana; Roberta Paris; and Daniela Pacifico	CREA-CI (967)	Italy
Andrea Carboni	CREA-CI (1058)	Italy
Giulia Bianchi, Marina Buccheri	CREA-IT (967)	Italy
Holger Kuehnhold	ZMT (1131)	Germany
Nicolas Greggio; Diego Marazza; Daniel Remondini; Daniele Torreggiani; Alberto Barbaresi, and Patrizia Tassinari	UNIBO (1121)	Italy
Maria Beatriz P.P. Oliveira; Thelma de Barros Machado; Leonardo Ricciardi	REQUIMTE/FF/UP (1115)	Portugal
Marco Gobbetti; Raffaella Di Cagno	UNIBZ (1094)	Italy
Maria De Angelis; Annalisa De Boni; Fabio Minervini; Carlo Giuseppe Rizzello	UNIBA (1120)	Italy
Gian Attilio Sacchi; Carlo Massimo Pozzi	UMIL- DISAA (1056)	Italy
Jesus Simal-Gandara	UVigo (978)	Spain
Carolina Rausell; M. Dolores Real and Inmaculada García-Robles	University of Valencia (1008)	Spain
Isabel C.F.R. Ferreira	IPB-CIMO (1047)	Portugal
Ana Maria Gomes; Marta Vasconcelos; and Elisabete Pinto	UCP-CBQF (1125)	Portugal
Maurizio Cellura, Sonia Longo, Francesco Guarino	UNIPA - Department of Engineering (1016)	Italy
Maurizio Mulas	UNISS - Centre for Conservation and Evaluation of Plant Biodiversity (1064)	Italy

Jörn Schmidt; Eva Theismann; Karin Schwarz; Christian Henning, Wiebke Müller-Lupp	CAU (1128)	Germany
Anna Dalla Marta, Marco Napoli, Simone Orlandini	UNIFI - DAGRI (1105)	Italy
Francesca Comitini; Maurizio Ciani	UNIVPM-DiSVA (1112)	Italy
Filiberto Altobelli	CREA-PB (1058)	Italy
Luigi Cattivelli, Agostino Fricano, Raffaella Battaglia, Alessandro Tondelli, Elisabetta Mazzucotelli	CREA-GB (1063)	Italy
Bruno Campion, Alessia Losa	CREA-GB (1058)	Italy
Isabel M.P.L.V.O. Ferreira, Miguel Faria, Susana Casal	REQUIMTE/LAQV (1047)	Portugal
Cristina Delerue-Matos, Francisca Rodrigues, Elsa F. Vieira	REQUIMTE/LAQV (1107)	Portugal
Isabel Mafra, Joana Costa	REQUIMTE/LAQV (1044)	Portugal
Leonardo Mata, Luísa Barreira, João Varela, Rui Santos	CCMAR (979)	Portugal
Francesco Beltrame; Tiziano Caruso; Angela Zinnai	ENR (1093)	Italy
Nadia Bertin, Daniele Bevacqua, Anne-Laure Fanciullino, Hélène Gautier, Michel Génard, Gilles Vercambre	INRA-PSH (1109)	France
Thomas Skurk, Beate Brandl	TUM (983)	Germany
Marco Bindi, Roberto Ferrise, Gloria Padovan, Camilla Dibari, Giuliana Parisi, Stefano Benedettelli	UNIFI (951)	Italy
Gabriele Dono, Raffaele Cortignani, Nicola Lacetera, and Andrea Vitali	UNITUS (951)	Italy
Pier Paolo Roggero, Laura Mula, Antonio Pulina, Giovanna Seddaiu, Ignazio Floris, Alberto Satta, Roberto Mannu, Arturo Cocco	UNISS (951)	Italy
Massimiliano Pasqui, Marco Moriondo	CNR-IBE (951)	Italy
Habtamu Alem	NIBIO (1051)	Norway

2. Aim of the WP

WP2 aims to assess the innovations and transformations needed for future terrestrial and aquatic food production. Challenges for the food system are 1) Climate change (rainfall, heatwaves, land scarcity, extreme winds); 2) Environmental effects (chemical additives, water, energy, land, waste and by-products); and 3) Harmful substances (bio-toxins, bacteria, parasites, nanoparticles, antimicrobials, per-fluorinated compounds). Challenges are addressed by specific measures exploring innovations.

Measures: 1) Climate-resilient food production; 2) Reduce inputs; 3) Reduce harmful outputs; 4) Disease resilient food production; 5) Reduce transport; and 6) Increase traceability

Innovations:

- Crop production optimization (heat and drought resistant)
- Resilient crop and livestock (terrestrial and aquatic)
- Promoting biodiversity in production systems (connected to WP5)
- Integrated food systems (including aquaponics)
- Novel foods (connected to WP3 and WP4)
- Novel means of processing including fermentation (connected toWP3 and WP4)
- Closing production cycles (re-using waste and by-products) (connected to WP5 and WP1)

3. Description of work and role of partners:

The work will be based on existing projects, activities and initiatives and programs for a holistic understanding of the whole food system. We will start focussing on specific test cases including cereals, legumes, and olive oil for terrestrial, and fish, molluscs and algae for aquatic systems. The WP focuses on the following four main tasks.

Task 2.1) Crop production optimization, biodiversity, and plant breeding

Task Leaders: Remondini (UNIBO), Italy, and Rausell, Spain
Partners: UNIFI (IT), UNISS (IT), CNR-IBE (IT), UNITUS (IT), UNIBO (IT), CREA-GB (IT)

Aims: Crop production optimization; gathering and screening advanced germplasms for suitability to healthy food production requirements under climate change scenarios (heat and drought); and large-scale characterization, protection, bio-fortification, and production of healthy food-producing crops under climate change scenarios.

Methods: Remote Sensing data (e.g., Earth Observation derived data) will be used to identify portions of agricultural land not cultivated (bare soil) through the year; dataset of genomic sequences, genes and microRNAs which are candidates for controlling yield and nutritional and health-promoting quality compounds under stress conditions, and disease resistance in plants will be used in the process of implementing the relevant innovations and measures listed above under the aim of the work package 2 (WP2); a key issue would be to gather quality integrated data, information, knowledge and analytical tools for improved models and scenarios in time frames and at scales relevant for decision-making; etc.

Sources: FAO reports and case studies, peer-reviewed literature, and database (Copernicus, EMODNET).

Task 2.2) New developments in integrated food production systems
Task Leaders: Kuehnhold, Germany, and Costa, Portugal),
Partners: UNIFI (IT), UNISS(IT), UNIBO (IT), CAU (GE), CREA-CI (IT)

Aims: The task special focus on agriculture, livestock, and aquaculture. Biotechnology and gene technology, safety, quality and the ethical challenges associated with its use and products; integrated multi-trophic aquaculture, aquaponics, and permaculture; new sustainable ingredients for animal feeds, especially in aquaculture.

Methods: Gene biotechnology approaches; constructed wetlands (CWs); recirculating aquaculture systems (RAS); integrated multi-trophic aquaculture (IMTA); utilizing biomass from lower trophic levels (e.g. jellyfish and sea cucumbers); hydroponics; saltwater aquaponics; search for alternative ingredients, such as those from plants (algae Inc.), microorganisms, insects; smart, efficient and sustainable livestock production; etc.

Sources: FOOD2030EU-proofing the European food systems through research & innovation, and CORDIS EU research results, peer-reviewed literature.

Task 2.3) Novel foods based on new ingredients, materials, and processes

Task Leaders: Ferreira, IPB (PT); Bonnarme, INRA-GMPA (FR)]
Partners: INRA-C2VN/ AMU (FR), UNIMI-DeFENS (IT), CCMAR (PT), UNIMI-Bio (IT), UCP (PT), REQUIMTE (PT), UNIBA (IT), UNIBZ (IT), RSU (Latvia), UNIVPM-DiSVA (IT), NIBIO (NO), UNIPA (IT), TUM (GER)

Aims: possible replacement of meat production (especially ruminants for the high level of GHGs emissions) by alternative protein-rich foods (e.g., legumes) and alternative sources for vitamins and micronutrients (e.g. seafood), associated low environmental life cycle impacts transformation processes; adding functional and sensorial value to indigenous or local species and recovering functional and bioactive ingredients from food by-products; and developing bioactive rich food products (connected to WP3.2 bioavailability, WP3.3 physiological effects).

Methods: Controlled bioprocesses, such as fermentation; metabolomics; metagenomics; *in-vitro*, *ex-vivo*, and *in-vivo* tests; etc.

Sources: Discussion fora, databases, and research revisions surveys, mainly.

Task 2.4) Food production new risks and safety assessment

Task Leaders Oliveira, Portugal. Partners: CAU, Germany, NIBIO (Norway); REQUIMTE/LAQV (1044, 1047, 1107) (Portugal)

Aims: Emerging food safety risk assessment; addressing food authenticity challenges (ingredients, origin, quality, etc.); and development of food traceability solutions (Blockchain, Radio Frequency Identification or RFID, sensors, DNA barcoding, etc.).

Methods: Exchange experience, methods, data and to assess emerging issues; food fingerprinting and profiling analytical methods; disruptive technologies (Blockchain, Radio Frequency Identification or RFID, sensors, DNA barcoding, etc.); etc.

Sources: EFSA reports and databases; info on easily adulterated foods (liquid, pasty, grounded, and non-homogeneous solid foods, for example); and big-data, mainly.

4. Description of the activities

WP2 will assess current gaps in knowledge and technology, and provide recommendations for research and educational programs, and policy development.

5. Deliverables and Milestones

Main reports including milestones are: 1) Initial definition report for the four thematic areas (1st year); 2) Intermediate report for the four thematic areas (2nd year); & 3) Final report for the four thematic areas (3rd year).

Task	Milestone	Timing
1	Optimized map of multiple cropping throughout the EU	1st report
	Database and bio-bank of suitable germplasm with genomic, phenomic, and phenotypic data; capacity building on the importance of plant resources and their sustainable exploitation	2nd report
	Revision of prototypes to be proposed in different scenarios	3rd report
2	Capacity building on minimization strategies of climate change on aquaculture	1st report
	Exchange of research info and resources (researchers' mobility)	2nd report
	Technical newsletter recommending ingredients for aquaculture feeds	3rd report
3	Diffusion and transfer conferences and workshops on alternative protein-rich foods	1st report
	States of art on how to add value to both autochthonous cultivars and food by-products	2nd report
	Reports with scientific basis proposing healthy diets based on bioactive-rich foods	3rd report
4	Thematic area meeting on novel methodologies to assess food safety risks	1st report
	Papers with authenticity strategies for plant and animal-based foods to detect frauds	2nd report
	Practical courses on how traceability solutions work on the total food production chain	3rd report

6. Risk & risk Management

Refer to the table which shows the expected risk and proposed risk management for the whole project

2.4. Nutrition (WP3)

1. Partners involved

WP3 Leaders: Emmanuelle Reboul (INRA-C2VN/ AMU, France) and Marika Ferrari (CREA, Italy)

WP members	Affiliation	Country
Claire Dufour, Sylvie Bureau, Carine Le Bourvellec, David Page, Agnes Sabaté	INRA-SQPOV (1103)	France
Didier Dupont	INRA-STLO (1108)	France
Anne Laure Fanciullino, Nadia Bertin, Hélène Gautier	INRA-PSH (1109)	France
François Blachier, Claire Gaudichon	INRA-PNCA (1124)	France
Emmanuelle Reboul, Patrick Borel	INRA (C2VN)/ AMU (1126)	France
Christina Nielsen-Leroux	INRA-Micalis (1127)	France
Thomas Skurk, Beate Brandl	TUM (983)	Germany
Daniel Remondini, Alessio Bonaldo, Anna Zaghini, Nicolas Greggio	UNIBO (1121)	Italy
Marco Gobbetti, Raffaella Di Cagno	UNIBZ (1094)	Italy
Maria De Angelis, Fabio Minervini, Carlo Giuseppe Rizzello, Piero Portincasa	UNIBA (1120)	Italy
Patrizia Riso, Cristian Del Bo’	UMIL-DeFENS (1056)	Italy
Katia Petroni, Chiara Tonelli	UMIL-BIO (967)	Italy
Marika Ferrari, Angela Polito, Marina Carbonaro, Lorenza Mistura, Laura D'Addezio, Laura Censi	CREA-Research Centre of Food and Nutrition (1058 and 967)	Italy
Alberto De Santis	UNIROMA1-DIAG (1117)	Italy
Raffaello Prugger	Tecnoalimenti (1056)	Italy
Francesco Beltrame, Tiziano Caruso, Angela Zinnai	ENR - UNIPA- UNIPI (1093)	Italy
Francesca Comitini; Maurizio Ciani	UNIVPM- DiSVA (1112)	Italy
Laila Meija	RSU (962)	Latvia
Lise Madsen,	IMR (1022)	Norway
Marian Kjellevold, Anita Alvheim	IMR (1033)	Norway
Luísa Barreira, Leonardo Mata, João Varela, Rui Santos	CCMAR (979)	Portugal
Duarte Torres, Carla Lopes, Andreia Oliveira, Catarina Carvalho, Daniela Correia	ISPUP (1122)	Portugal
Ana Maria Gomes; Marta Vasconcelos and Elisabete Pinto	UCP (1125)	Portugal
Isabel M.P.L.V.O. Ferreira, Miguel Faria, Susana Casal	REQUIMTE/LAQV (1047)	Portugal
Cristina Delerue-Matos, Francisca Rodrigues, Elsa F. Vieira	REQUIMTE/LAQV (1107)	Portugal
Isabel C.F.R. Ferreira	IPB-CIMO (1047)	Portugal
Jesus Simal-Gandara	UVigo (978)	Spain

2. Aims of the WP

The main objectives of the Nutrition workgroup are to characterize and to manage the impact of climate change on nutritional properties of food and to propose adaptive strategies/measures, ensure nutrition security of populations, achieving a more inclusive, sustainable, healthy and safe future for all.
To this aim, 4 different interconnected tasks have been identified:

- **Food composition and new food sources**: The aim of this task will be to appreciate the evolution of food composition due to climate change and to the use of sustainable food processing (in terms of nutrients, bioactive, anti-nutrient/ allergen, natural ingredient and contaminant contents) and to identify new universally accessible, healthy and sustainable food and feed sources (*in relation with WP1 and WP2*).
- **Bioavailability**: The aim of this task will be to understand the digestion, the bioaccessibility, and bioavailability of (micro and macro) nutrients from the above foods and from sustainable diets in general, including the characterization of the impact of sustainable food production and processing (*in relation with WP2*).
- **Physiological effects**: The aim of this task will be to determine the health effects related to the consumption of sustainable and balanced diets (*in relation with nutrient/ bioactive bioavailability and content, i.e. WP2, as well as in relation with WP4 and WP5).*
- **Dietary assessment and nutritious balanced diet:** Finally, the aim of this task will be to propose sustainable and nutritious diet to tackle poor nutrition and climate change, considering national food consumption databases, greenhouse gas emissions (GHGE) (*in relation with WP1*), nutritional recommendations and dietary guidelines) (*in relation with WP5*).

3. Description of work and role of partners

Task 3.1. Food composition and new sources

Task Leaders: Cristina Delerue-Matos, REQUIMTE/LAQV & Luisa Barreira, CCMAR (PT)

Partners: INRA-SQPOV, INRA-PSH, INRA-STLO, INRA-PNCA, INRA-Micalis, INRA-C2VN/ AMU (FR), TUM (GER), UNIMI-DeFENS (IT), CREA (IT), UNIBA (IT), UNIBO (IT), UNIBZ (IT), UNIVPM (IT),IMR (NO), UCP (PT), Tecnoalimenti (IT), CCMAR (PT), REQUIMTE (PT), IPB-CIMO (PT), UVigo (ES)

Aim: This task intends to validate chemical/biological analyses and laboratory assays from the different partners and to evaluate the nutrition quality and food safety of the sustainable products developed in WP2. New sustainable food and/or feed sources should be understood as those produced using economic, social and environmentally sustainable practices. Additionally, strategies to improve food composition (e.g. feed supplementation, manipulation of production /cultivation conditions), which can increase food/feed content in specific nutrients, will be sought. This task will also identify constraints to the implementation of new foods (e.g. the necessity of Novel Food Certificate in Europe for microorganism's consumption, public knowledge on the nutritional benefits of new foods, public acceptance). The challenge will be to ensure novel eco-innovative and sustainable solutions to the European food products enabling consumers to move to healthier eating habits.
Impacted stakeholders will be consumers and the food industry.

Methods: The assessment of the nutritional value and bioactive compound composition of the different matrices will be based on different parameters such as water/moisture; ash; total nitrogen (for protein), amino acids; total fat and individual fatty acids, triacylglycerols and sterols; dietary fibre, starch and total sugars; minerals and trace elements; vitamins, carotenoids, phenolic compounds and organic acids. The presence of chemical contaminants (originating from environmental contamination or from transformation/storage processes) in the raw material will be evaluated: insecticides, herbicides, fungicides PAHs and heavy metals. Finally, allergens will be considered since food allergies are a worldwide public health problem that affects up to 17 million Europeans. Methods to assess (micro)nutrients, bioactives, contaminants, and allergens will, therefore, be discussed and SPOs will be established. The nutritional quality of specific sustainable foods will then be estimated, and food composition databases will be updated in relation with WP1.

Sources: Literature and past projects including COST Action CA15136 EUROCAROTEN, SUSFOOD1, SUSFOOD2.

Task 3.2. Bioavailability (food digestion and transport)

Task Leader Ana Gomes, UCP & Luisa Barreira, CCMAR (PT).

Partners: INRA-SQPOV, INRA-PNCA, INRA-STLO, INRA-C2VN/ AMU (FR); TUM (GER); UMIL-Bio, CREA (IT), UMIL-DeFENS, UNIBA, UNIBZ, UNIVPM, Tecnoalimenti (IT); UCP, IPB-CIMO, REQUIMTE (PT); UVigo (ES).

Aim: Besides high-quality nutrient and bioactive profiles and low levels of anti-nutrients, an effective digestion process coupled to efficient nutrient uptake/absorption is required to have the desired health effects. Thus, it is mandatory to assess how climate change may affect the nutritional quality of food and food safety within food systems approach in terms of food digestion, bioaccessibility, and bioavailability and to propose adaptive strategies to ensure global/European food and nutrition security and sustainability. Bioavailability is affected across the whole food chain from the nutritional quality of production, through processing and transformation (food structure) to human digestion efficacy and interaction food-human gut microbiota. The challenge will be to underpin mechanisms influencing bioavailability of (micro and macro) nutrients and bioactives in different contexts and sources including the characterization of sustainable food production and processing and impact on food nutritional value and bioactivity throughout the lifespan. The task will likely impact all the stakeholders involved in the food system approach. A constant dialogue with agri-industry producers and manufacturers will ensure uptake of research outcomes toward more sustainable production and differentiated food products promoting healthy foods and diets. Knowledge of these questions will help inform policies regarding production and transformation.

Methods: A first step will be to standardize/harmonize methodologies for assessment of digestion, bioaccessibility, and bioavailability of nutrients by bringing together already existing harmonized models (e.g. harmonized static *in vitro* digestion method developed within Cost Action INFOGEST) and other different in-house research methodologies. SOPs for food samples preparation, *in vitro* digestion and absorption conditions, data quantification (dependent on nutrient/bioactive), collection, analysis, and formatting for comparison purposes will be developed. Then, existing knowledge on the factors impacting digestion, bioaccessibility, and bioavailability in terms of sustainable production and processing will be studied. Structure matrix effects, encapsulation and/ or synergistic effects on nutrient functionality will be reviewed. This will generate structure-function relationships allowing reliable prediction and design of matrix effects on the digestion of micronutrients. Finally, we will try to demonstrate how climate changes, by affecting food/diet composition, may indirectly impact on (macro and micro) nutrient, bioactive, and anti-nutrient bioavailability. Also, knowledge will be gathered on how i) biofortification strategies, soil fertility initiatives among other sustainable production strategies; ii) alternative dietary sources; iii) food matrix and structure manipulation, bioactives enhancement and processing applications (minimize nutrient loss and increase product shelf-life) may support high bioavailability of nutrients/bioactives in order to fulfill nutritional requirements across the life-span or contribute to reducing the risk of certain chronic diseases.

Sources: INFOGEST - Improving health properties of food by sharing our knowledge on the digestive process Cost Action FA1005; FIBREPRO - Promoting Whole Grain consumption through innovation (ERA AFRICA network); PLANTFOODS – Development of non-dairy plant-based foods and beverages. (National Innovation Agency 034036); HDHL-INTIMIC - Knowledge Platform on Food, Diet, Intestinal Microbiomes and Human Health.

Task 3.3. Physiological effects of sustainable diets

Task Leader: Patrizia Riso, UNIMI-DeFENS (IT).

Partners:INRA-Micalis, INRA-PNCA, INRA-C2VN/ AMU (FR); CREA (IT), UNIBA, UNIBZ, UMIL-DeFENS, UMIL-Bio (IT); RSU (LV); CCMAR, UCP, REQUIMTE, IPB-CIMO (PT); UVigo (ES)

Aim: The aim of this task will be to provide proof of concept of the physiological/functional effects of a sustainable diet and give further support to the optimization of a food system approach with enhanced impact on human nutrition regarding metabolic features, optimal function, and related health and well-being. It is also considered that both poor and overnutrition cause impairment of metabolic and physiological functions. Thus, all the possible dietary scenarios must be addressed. The challenge will be to guarantee nutrient needs at different life stages to reach adequate nutrition and optimal physiological function through sustainable food sources and dietary patterns. The task will have an impact on all the stakeholders involved in the food system approach, including nutritionists and health professionals and policy makers.

Methods: The analysis will originate from data on the impact of climate change on food composition and, as well as on the individual needs in a shifting/evolving scenario. In addition, the most recent research on biological activities of dietary compounds in relation to the chemical/molecular structure doses and related bioavailability will be specifically considered. We will identify nutritional factors (macro or micronutrients, phytochemicals, microorganisms, antinutrients), potentially at risk of over or underexposure in the context of climate change and define the needs to exert biological functions in different target groups of population taking into consideration food sources (in relation with WP2 and WP4 task 1), processing and bioavailability (task 2). Then we will evaluate the physiological impact of different dietary patterns. The specific aim of this activity is to define the relevant knowledge on the physiological and metabolic effect of nutrients and non-nutrient compounds introduced through different dietary patterns (e.g. western-type diets, vegetarian/vegan, pescatarian, flexitarian...) in relation to the most updated recommendations (in collaboration with task 4) and in view of the impact of climate change. The actual available nutrients for target functions will be examined by considering different groups of the population for each critical nutrient which are determinants for health outputs (in connection to activities in WP5). Finally, we will assess the contribution of alternative sustainable food sources on physiological effects. The goal is to provide an estimation of the potential physiological impact of improved (e.g. through the implementation of food system) or novel foods when used as substitutes for other unsustainable or nutrient-poor products.

Sources: HDHL-INTIMIC-Knowledge Platform on Food, Diet, Intestinal Microbiomics and Human Health; COST Action CA16112 : Personalized Nutrition in an aging society: redox control of major age-related diseases; COST Action CA15136 EUROCAROTEN; ENPADASI: JINN-DAT - Joint Italian Network for a Nutritional phenotype data sharing infrastructure in support of nutrigenomics studies: integration of in vivo/in vitro mechanistic studies on dietary needs and health maintenance; Microorganisms in foods and humans: microbiota and metabolome as affected by vegan, vegetarian and omnivore diets (PRIN 2010-2011); MITAMED - Microbiome-tailored food products based on typical Mediterranean Diet components (PRIN 2017).

Task 3.4. Dietary assessment and nutritious balanced diet

Task Leader: Carla Lopes, ISPUP (PT).

Partners: TUM (GER); RSU (LV); CREA (IT), UMIL-Bio, UMIL-DeFENS, UNIBA, UNIBZ, UNIROMA1-DIAG (IT); ESBUCP (PT), ISPUP (PT), IPB-CIMO (PT), REQUIMTE (PT); UVigo (ES)

Aim: To improve diets for sustainable food systems in terms of balanced healthy foods and macro and micronutrients intake to overcome the challenges of unhealthy and unsustainable diets. The task will have an impact for producers and consumers, and all data and indicators will be available for knowledge transfer to food system managers, policy makers, and dissemination of information and practical tips to the public.

Methods: The task activities include acquiring and sharing national databases of food intake among EU countries for analyses of actual dietary intake in Europe (in relation with WP1); establishing the composition of current observed diet in terms of nutrients and food groups intake among population groups to identify the contribution of different food sources (plant and animal) to total macro and micronutrients intake; harmonizing available individual food intake databases using common classification (FoodEx2) (in relation to WP5) merged to the GHGE and water source dataset (in relation to WP1 and WP5) for modelling diet (balanced and sustainable) and identifying main food sources from actual dietary intake responsible to high environmental impact in terms of GHGE and water source starting from literature review (in relation to WP2); analysing models for balanced diet

taking into account macro and micronutrients requirements for the different population subgroups using indicators of climate change (GHGE and water) to evaluate healthy and sustainable food consumption (in relation to WP5). A possible replacement with novel food sources (in relation WP2 and cross-cutting activities) will be investigated to contribute to food and nutrition security according to the objective of FOOD 2030.

Sources: We will use concepts and data from past related projects: EU Menu framework project (support to national dietary surveys in compliance with the EU-Menu methodology - by EFSA); DeDIPAC (Determinants of Diet and Physical Activity; Knowledge Hub to integrate and develop infrastructure for research across Europe), action of the European Joint Programming Initiative (JPI) "A Healthy Diet for a Healthy Life" 2013-2016. TERRAVITA (Biodiversità, Territorio Nutrizione: la sostenibilità dell'agro-alimentare italiano) (2011-2017). SUSDIET (Towards Sustainable Diets in Europe) funded in the framework of the ERANET SUSFOOD 2014-2017. SUSFANS (Metrics, Models, and Foresight for European Sustainable Food and Nutrition Security) funded by H2020, 2014-2019.

4. Description of the activities (networking and scientific)

The Nutrition workgroup is willing to provide evidence-based results, as well as to share data and databases that can be used across Europe. A special effort will be made to provide SOPs and write systematic reviews and/ or position papers to i) implement new values in relevant food composition tables, ii) understand from available data how climate change will impact on all aspects of nutrition (from food composition to dietary guidelines), and iii) provide recommendations for future research and innovations in the food industry (new and adapted food products economically viable, healthy and sustainable)**.**

5. Deliverables & Milestones

Task	Deliverables	Milestones
3.1 Food composition and new sources	- Report on benefits of new processes in terms of (micro)nutrient composition and food labelling report of the new food products M12. - Report on strategies to improve food composition and mitigate food allergenicity M24. - Report on the effect of climate change on food composition M36.	- List of the new food products and ingredients (including alternative protein sources) M6. - List of knowledge gaps in analytical values for use in food composition tables with special focus on proteins, micronutrients and "new foods" M18.
3.2 Bioavailability	- Report on improved models/ approaches for assessment of the bioavailability of (micro)nutrients and bioactives M12. - Report on main factors impacting digestion, bioaccessibility and bioavailability in terms of production and processing M24. - Report on key strategies to overcome the impact of climate change on bioavailability of nutrients M36.	- List of key procedures including food samples preparation, assessment of digestion, bioaccessibility and bioavailability of nutrients/ bioactives M6 - Identification of knowledge gaps and establishment of structure-function relationships to better predict effects of (new) production and processing methods on bioavailability of nutrients/bioactives M18 - Definition of integrated procedures within the food system to support high bioavailability of nutrients/bioactives M30
3.3 Physiological effects	- Detailed list of "at risk" nutrients and non-nutrients with impact on physiological functions in the context of climate change M12. - Report on the potential impact of alternative sustainable food sources on physiological effects M24. -Systematic reviews/meta-analyses on physiological effects of foods/food classes/dietary patterns in view of the identified at risk by considering different target groups M36.	- Identification of sensible target groups of the population M6. - Identification of knowledge gaps on the potential risk associated with the new sustainable dietary patterns in terms of health M18 - Definition of "nutritional" reference standards to be attended and be pursued within the food system approach in order to ensure the goal of optimal body function and health M30.

3.4 Dietary assessment and nutritious balanced diet	- Report on actual food sources and nutrients intake in EU population to quantify the impact in terms of nutritional coverage and variety of diets M18 - Report on existing and possible diet models for balanced food and nutrients intake considering novel /alternative food sources M36.	- List of food intake dataset and studies that could potentially be conjointly analysed M6. - Definition of criteria to develop balanced nutritious diet including alternative/novel food and sustainability M24.

6. Risk & risk Management -

Refer to the table which shows the expected risk and proposed risk management for the whole project.

2.5. Consumer Behaviour (WP4)

1. **Partners involved**

WP4 Leaders: Daniele Moro/IT; Laura D'Addezio/IT; Jesus Simal-Gandara/SP

WP members	Affiliation	Country
Daniele Moro, Elena Castellari; Paolo Sckokai; Stefano Boccaletti; and Claudio Soregaroli	SMEA, Università Cattolica del Sacro Cuore (1097)	Italy
Marika Ferrari, Anna Saba, and Fiorella Sinesio	CREA, Research Centre for Food and Nutrition (1058)	Italy
Laura D'Addezio, Lorenza Mistura	CREA, Research Centre for Food and Nutrition (967)	Italy
Jesus Simal-Gandara (WP leader)	University of Vigo (978)	Spain
Isabel C.F.R. Ferreira	IPB-CIMO (1047)	Portugal
Elsa Lamy	ICAAM, Universidade de Évora (1118)	Portugal
Talis Tisenkopfs; Sandra Sumane; Mikelis Grivins, Anda Adamsone Fiskovica; and Emils Kilis	BSC: Baltic Studies Centre (1106)	Latvia
Monica Laureati Patrizia Riso	UMIL- DeFENS (1056)	Italy
Raffaello Prugger	TECNOALIMENTI (1056)	Italy
Maria De Angelis Annalisa De Boni	UNIBA-DISSPA and DISAAT (1120)	Italy

2. Aim of WP4

Food choice is the key wild card variable defining how climate change will ultimately affect human diet, nutrition, and health. The consumers' response to modifications in food characteristics (composition, quality, nutritional value) and to concerns on sustainability will shape the future of European food systems and the success of policy interventions and mitigating strategies towards food and nutrition security. The specific objectives of the WP are:

- to analyse data from extant sources and identify key food choice trends in the EU up to 2030/2050, globally and per relevant population group;
- to match trends to targets for healthy, resilient and sustainable food systems in the face of climate change, and identify main gaps;

- to estimate the impact of foreseeable changes in EU food systems, brought about by the transition to more sustainable sourcing, production, processing (particularly of the modified or new products) and provisioning activities in the face of climate change, on food choice up to 2030/2050;
- to assess consumer acceptance and adoption of alternative sources of macro- and micro-nutrients and novel foods, and their role in mitigating strategies;
- to identify key challenges and research needs, synthesizing relevant conclusions and implications to other WPs and the KH overall.

3. Description of work and role of partners

The work will be based on existing data, projects, activities and initiatives. WP4 will focus on the following 3 major tasks.

Task 4.1. How we eat

Task Leader: CREA/IT; Partners: ICAAM/PT, BSC/LV, UMIL-DeFENS/IT, SMEA/IT)

Aim: The accurate identification and comprehensive analysis of extant food choices and eating patterns are critical to forecasting trends towards targets for healthy, resilient and sustainable food systems in the face of climate change, as well as to assess the feasibility and impact of behavioural changes introduced at the consumer level to meet such targets (Mertens et al., 2017). Food choice includes not only dietary choices determining the intake of nutrients, therefore closely related to health aspects of food consumption, but also other food-related behaviours such as food purchasing habits, food provisioning, storage, preparation and waste, as well as values, and attitudes behind these practices. The present task aims to identify relevant sources of information on food choice in the EU (e.g., national food consumption databases, project databases, and reports, published study reviews and reports) and define what data should be collected from them, and how these data should be compiled, harmonized and made available for analysis (in relation to WP1). Further, from the analysis of available datasets we aim to identify current eating patterns and key consumer food choice trends up to 2030/2050 and indicate the main gaps.

Method: In this task, we will analyse information on food choices in the EU from multiple sources (including team own data) to i) identify patterns and key trends up to 2030/2050, globally and per relevant population groups; ii) match these to targets for healthy, resilient and sustainable food systems, and identify main gaps; iii) identify the main determinants conducting to these patterns. A comprehensive dataset on food choice should include quantitative data (i.e., meat-based food consumption vs. vegetable-based consumption, measures of consumer food waste), information on socio-economic, psychological and cultural factors affecting food consumption, and indicators of acceptable, healthy and sustainable food consumption patterns, to evaluate the potential shift of consumer choices towards healthier and more sustainable ones.

Source: based on results from past projects (SUSFOOD, SUSFANS, DEDIPAC), we will also use results from WP1 to identify data availability and gaps. We will conduct systematic reviews of published studies and reports on food consumption and dietary choices. All results will be available for dissemination.

Task 4.2. Changing food practices

Task Leader: UVigo/SP and CIMO-IPB/PT; Partners: UMIL-DeFENS/IT, BSC/LV, UNIBA/IT, SMEA/IT, ICAAM/PT, CREA/IT).

Aim: Diets that adequately balance protein intake from meat, fish, plant and other sources are essential for food systems to deliver on targets for health, nutrition-resilience, and sustainability, given the well-known link between dietary patterns and environmental sustainability (GHGE, land-use, water-use). Traditionally, the empirical literature analysed the possibility of inducing a change in dietary patterns towards habits that are more sustainable. A common result is that the substitution of meat with plant-based products may induce sizeable reductions in GHGE emissions (Hallstrom et al., 2015). Knowledge of the consumers' determinants of sustainable food choices and of the trade-offs they make between products will help to pilot consumers' choices towards more sustainable practices. On the other hand, food research is promising: by 2030, EU food producers will be able to deliver safe, nutritious, abundant, sustainable, palatable and cheap sources of dietary protein that are viable alternatives to meat consumption (e.g., insects, micro-algae, farmed fish and seafood, pulses) (van Zanten et al., 2019). In addition, dietary diversification can benefit from the introduction of new foods and ingredients with high nutritional quality and health benefits (e.g., biofortified, functional). This will also contribute to raise the use of some underutilized food sources and lower the effects of seasonality on the availability of others. Of course, a relevant issue is consumers' acceptability of new ingredients and foods.

We aim to synthesize findings from literature/projects on current levels of acceptance and adoption of alternative sources, drivers of, and barriers to protein diversification by consumers (safety, ethics, availability, labelling and price, socio-cultural factors, physiological and sensory aspects); to evaluate their impact on acceptance and adoption of alternative protein sources (trade-offs).

To do so we have identified two sub-tasks.

Sub-Task 4.2.1. Sustainable food choices (Leader: BSC/LV. Partners: SMEA/IT, UMIL-DeFENS/IT, UNIBA/IT, ICAAM/PT, UVigo/SP, CREA/IT)

Aim: Sustainable diets require shifts in dietary choices and/or alternatives sources of macronutrients, mainly proteins; in any case, knowledge of the determinants of food choices and of the overall consumers' awareness about sustainable diets. The success of mitigating strategies that rely on steering food choice towards aspired nutrition, health, and sustainability goals is highly dependent on concurrent consumer actions that adequately contextualize and facilitate desired behavioural changes in everyday food practices (Meah, 2014). Beyond motivational variables (individual characteristics), capability (health and environmental literacy, food and cooking skills, and self-efficacy) opportunity (social structure, built environment, and policy) factors and hedonic aspects will also determine the extent to which desired changes in food choice translate into new and enduring everyday food behaviour (Michie et al, 2011).

Method: We will review results from previous projects and literature on motivational and other types of determinants of consumer choice related to sustainable diets (see also Task 4.1). We will review extant research on acceptance (sensory properties), capability (food literacy, skills, and self-efficacy) and opportunity (social structure, built environment, policy) determinants of everyday food practices (food provisioning, preparation, eating, and disposal) in the EU, globally and per relevant population groups. We will review the extant literature and projects on the impact of the protein-sources alternative to meat consumption (e.g., insects, micro-algae, farmed fish and seafood, pulses, etc.), assessing their potential, and taking also into account the sensory perception as one crucial driver for changing choices.

Sources: We build on DEDIPAC outcomes (Stok et al., 2017; Symmank et al., 2017). Results will enable the mapping of related key drivers of, and barriers to changes in food choice to meet the targets for healthy, acceptable, resilient and sustainable food.

SubTask 4.2.2 Innovative diets (Leader: UMIL-DeFENS/IT. Partners: ICAAM/PT, UNIBA/IT, UVigo/SP, CREA/IT)

Aim: In this subtask, we will estimate the impact of some novel foods on the evolution of food choice in the EU and assess their potential to mitigate the gaps to food system targets. Novel foods will allow increasing dietary diversification and raising the use of some underutilized food sources, but the assessment of their impact requires a comprehensive knowledge of their acceptance and adoption in different population groups by geographical area, age class, gender, and socio-economic status and legal framework.

Method: We will systematically review and analyse findings from previous literature and projects to assess consumer attitudes and acceptability towards new functional food and ingredients. To assess the feasibility of introducing these products in the EU food systems, we will focus on current consumption habits across EU countries, on consumers determinants in buying and eating novel and functional foods, including sensory characteristics, and on the legal framework (labelling, market authorization, certifications, health claims, etc). Case studies will be selected on specific test cases, including cereals, legumes, and olive oil for terrestrial, and fish, mollusks and algae for aquatic systems.

Source: Findings from the project (Task 3.1) and other past and ongoing projects, scientific literature and reports. Results will enable the mapping of key drivers of consumer acceptance of novel foods and of their role in mitigating strategies.

Task 4.3. Consumer Food Future Scenarios (C-FFS)

Task Leaders: SMEA/IT and BCS/LV; Partners: UMIL-DeFENS/IT, UNIBA/IT, ICAAM/PT, CREA/IT, TECHNO ALIMENTI/IT).

Aim: Scenario exercises are important for the evaluation of future food choice trajectories within EU food systems, as there is high uncertainty about how such trajectories will evolve, not only in the face of the effects of climate change and associated mitigating strategies and policy decisions but also as food and societal innovation pathways unfold over time.

Method: Identifying and selecting food scenarios will require considering many different aspects (food system constraints, dynamics, and driving forces, policy goals, and consumers' adaptation, at either the aggregate or the individual level). We will identify focal issues and driving forces, ranking their importance and the related uncertainty, in order to assess their impact. Key challenges and research gaps uncovered by this exercise will be summarized, along with relevant conclusions and implications to other WPs and the KH overall.

Sources: We build on scenarios developed in EU research projects (TRANSMANGO, SALSA, SUFISA, SUSFANS and other) and apply SUSFANS approach (Zurek et al., 2018). Findings from Tasks 4.1 and 4.2, will be synthesized in the form of proposed C-FFS for 2030 and 2050, which will then be reviewed by remaining KH partners and stakeholders from the food processing and distribution industries.

4. Description of the activities (networking and scientific)

WP4 will assess a state-of-the-art knowledge of drivers of food choices and develop food consumption scenario for 2030/2050, and individuate existing gaps and identify key challenges, and provide recommendations for research and policy development. We will achieve this by writing systematic reviews and/or position papers on the analysis of key food choice trends in the EU up to 2030, on drivers of sustainable food choices and on the acceptance of novel foods.

5. Deliverables & Milestones

Task	Deliverables	Milestones
4.1 How we eat	List of information sources and protocols for the compilation, harmonization and internal dissemination of data on food choice. Report summarizing key food choice trends, assessing gaps to targets, evaluating potential impacts on EU food systems and formulating policy implications.	Database of available sources and data describing food choices in the EU. Database of indicators and targets for healthy and sustainable food choices in the EU. Map of key food choice trends and identification of gaps to food system targets completed.
4.2 Changing food practices Sub-task 4.2.1. Sustainable food choices	Report on drivers of individual food choice related to sustainable consumption behaviour.	Map of determinants with the assessment of their impact.
4.2 Changing food practices Sub-task 4.2.2. Innovative diets	Report on key drivers of consumers' acceptance of novel foods, and related aspects. Report(s) on case-studies	A map on consumers determinants in buying and eating novel and functional foods with special focus on sensory characteristics and consumers acceptability
4.3 Consumer food future scenarios	Design of C-FFS for 2030/2050 Report summarizing key challenges and gaps on C-FFS for 2030/2050	C-FFS for 2030/2050 proposed.
	Final report on WP4	

6. Risk & risk Management

Refer to the table which shows the expected risk and proposed risk management for the whole project)

2.6. Public Health and Environmental Impacts (WP5)

1. <u>Partners involved</u>

WP5 Leader: Duarte Torres, ISPUP (PT), and Lise Madsen, IMR (NO)

Name KH member	**Organization**	**Country**
Carl Lachat, Chen Yang	UGent	Belgium
Francois Mariotti	INRA-PNCA (1124)	France
D. Remondini, Frederique Pasquali, Alessandra De Cesare, Anna Zaghini, Diego Marazza, Nicolas Greggio, Serena Righi, Alessio Bonaldo	UNIBO (1121)	Italy
Maurizio Cellura, Sonia Longo, Francesco Guarino	UNIPA (1016)	Italy
Marika Ferrari, Angela Polito, Laura Censi	CREA-AN (1058)	Italy
Maria De Angelis, Piero Portincasa	UNIBA (1120)	Italy
Francesco Beltrame, Tiziano Caruso, Angela Zinnai	ENR (EOI 1093)	Italy
Daniele Moro, Elena Castellari, Paolo Sckokai	SMEA (1097)	Italy
Patrizia Riso, Cristian Del Bo’	UMIL- DeFENS (1056)	Italy
Lise Madsen, Jannike Øyen, Ole Jakob Nøstbakken	IMR (1022)	Norway
Cristina Delerue-Matos, Francisca Rodrigues, Elsa F. Vieira	REQUIMTE/LAQV (1107)	Portugal
Isabel Mafra, Joana Costa	REQUIMTE/LAQV (1044)	Portugal
Duarte Torres, Carla Lopes, Andreia Oliveira, Catarina Carvalho, Daniela Correia	ISPUP (1122)	Portugal
Ana Gomes, Elisabete Pinto, Marta Vasconcelos	UCP (1125)	Portugal
Isabel C.F.R. Ferreira	IPB-CIMO (1047)	Portugal
J. Simal-Gandara	UVigo (978)	Spain

2. Aims of the WP

In this WP we aim to review food and nutrition policy measures across Europe to support the identification of possible future food scenarios. Relevant health effects and environmental impacts associated with shifts between scenarios will be described and quantified using a risk-benefit approach. We will combine data on exposure to foods, food components or dietary patterns in the several scenarios with dose-response associations between exposure and beneficial or detrimental health effects. Multiple environmental impacts associated with each potential scenario will be assessed. The comparison of the health risks and benefits and environmental impacts of each scenario will allow prioritizing the most effective interventions to promote human health and sustainable environments. Finally, a graph database in RDF (Resource Description Framework) format will be delivered as one of the outputs to FAIR share the reviewed policies and the inferred future food scenarios. The WP will be focused on five main tasks.

3. Description of the work and role of partners

TASK 5.1. Review of food and nutrition policy measures across Europe
Leader: Carl Lachat (UGent, BE), and Lise Madsen (IMR, Norway)
Partners: ISPUP (PT), CREA (IT), UCP (PT), UNIBA (IT), SMEA (IT), REQUIMTE/LAQV (PT), UNIBO (IT), INRA-PNCA (FR)

Aim: Evaluate the evidence for the effectiveness of intervention policies undertaken in EU countries in terms of promoting, supporting and improving nutritional behaviour at population and population groups level. Identify gaps i.e. what is missing in the actions that are taken in charge for public health related to climate change and malnutrition. Also, we will discuss peculiar aspects related to population minorities/immigration towards/across Europe with the idea of harmonizing the conclusions of this survey.

Methods: Collect and compile information on public health nutrition activities/programs:

a. Literature search on consensus documents for public health and the different policies in Europe.
b. Identify databases and collect data on food allergy prevalence.
c. Identification of national official authorities in Public Health in each country of the Knowledge Hub, and the respective focal points that will provide data on the different policies.
d. Develop a graph database to store the findings of the review, which can be read by humans and processed by computer. By developing the graph database, we aim to i) integrate the identified policies; ii) clarify the relationships between the policies and evidence, datasets, etc. and iii) indicate the gaps in the semantic network.

Source: Literature review and secondary data sources.

TASK 5.2. Identification of future food scenarios
Leaders: Isabel Ferreira (IPB-CIMO, PT) and Jesus Simal-Gandara (UVigo, SP)
Partners: CREA (IT), UCP (PT), UNIBA (IT), UMIL-DeFENS (IT), REQUIMTE/LAQV (PT), UNIBO (IT), ISPUP (PT), IMR (NO), INRA-PNCA (FR)

Aim: From the results obtained in the other WPs, food consumption scenarios will be defined, based on identified public health policies and from ongoing discussion topics in European/global health authorities.

Method: Different case studies will be considered. These may include the studies of selected foods, nutrients/ bioactive content, or a more comprehensive integrated approach through the definition of dietary patterns. Possible examples include the substitution of different food sources of proteins; the substitution of conventional plants with unconventional edible plants that may provide health benefits; the substitution of conventional foods with novel/enriched food in nutrients or in bioactive molecules; the change from standard current diets to a scenario of healthier patterns of eating by certain population groups. Specifically, individual dietary intake data will be used to measure the adherence to an a priori dietary pattern, recently proposed by the EAT-Lancet Commission (Willett et al., 2019), where the scientific targets for healthy diets and sustainable food systems were integrated into a common framework. Dietary patterns represent the set of foods and nutrients that are consumed together, thus they allow to study the role of multiple dietary exposures and their association with health benefits/risks. They take advantage of the collinearity between dietary variables to examine their cumulative effects instead of looking at individual nutrients or foods, with smaller effects (Tucker, K. L., 2010). From the available data regarding the dietary habits of the population, and from the gaps identified in WP1, alterations in the eating behaviours will be carried out and proposed in order to provide the population, not only with enriched foods in nutrients, but also with matrices that are rich sources of bioactive ingredients able to provide important health-promoting effects, thus having a strong impact on the population´s well-being.

Source: Literature review and secondary data sources.

TASK 5.3. Relevant health effects and environmental impacts
Leader: Andreia Oliveira (ISPUP), Elisabete Pinto (UCP)
Partners: UNIPA (IT), ISPUP (PT), REQUIMTE/LAQV (PT), UMIL-DeFENS (IT), INRA-PNCA (FR)

Aims: Identification, prioritization, and selection of relevant health effects and environmental impacts associated with foods, food components and/or dietary patterns.
Method: Gather information on health effects associated with food/dietary patterns shifts proposed in the scenarios defined on task 5.2, regarding the domains of nutrition, toxicology, and microbiology. Collect consolidated information of multiple environmental impacts (land use, GHG emissions, acidifying emissions, atrophying emissions, freshwater use) of different food groups (Poore J and Nemecek T, 2018), in collaboration with WP1. Prioritization of beneficial and detrimental health effects to be included in the risk-benefit assessment (RBA) by evaluating the degree of evidence of the association between the health effects and exposure to food component/food or dietary pattern. The health risks associated with new potential sources of food allergens in each scenario will also be evaluated.

Sources: Literature search on systematic reviews and meta-analysis and on official reports/opinions of international research organizations and regulatory agencies.

TASK 5.4. Risk-benefit characterization of future food scenarios
Leader: Daniela Correia (ISPUP)
Partners: UNIBO (IT), IMR (NO), ISPUP (PT)

Aim: Quantification of individual health effects and individual environmental impacts of food scenarios.

Method: Combination of exposure data in the several scenarios with dose-response associations between the risk-benefit factor and the health effects (beneficial or detrimental) identified in task 5.3. Individual consumption data in national representative samples (from task 3.4) will be used to assess exposure to foods or dietary patterns in the current scenario. Combining individual consumption data with information on food composition (from task 3.1) will allow assessing individual exposure to specific nutrients or other bioactive compounds. The dose-response study can be based on two approaches: i) the bottom-up approach, which estimates the incidence of

disease due to exposure via dose-response models (if the biological mechanisms are known and transcribed into a mathematical model), or ii) the top-down approach, that starts from epidemiological data (relative risks) and incidence data and estimates the number of attributable cases of a certain disease due to an exposure. If the association between the risk/benefit factors and the health effects cannot be quantified (lack of dose-response data) the effects will be considered through a qualitative or semi-quantitative approach (e.g. comparison with Dietary Reference Values). Environmental impacts will be calculated by combining food consumption data in current and alternative scenarios and environmental impacts (land use, GHG emissions, acidifying emissions, atrophying emissions, freshwater use) of different food groups (from task 5.3).

Source. Literature review and/or other sources of epidemiological data.

TASK 5.5. Health effects and environmental impacts: scenarios comparison
Leader: Catarina Carvalho (ISPUP)
Partners: UNIPA (IT), CREA (IT), ISPUP (PT), UMIL-DeFENS (IT)

Aim: Quantification of health effects using common metrics and environmental impacts of the substitutions proposed in the scenarios and integration of results.

Method: To quantify beneficial and detrimental health effects, we will use composite metrics such as the Disability-Adjusted Life Years (DALYs), in order to consider both mortality and morbidity in the assessment. DALYs can be estimated using the following equation: DALYs=YLL+YLD, where YLL refers to the years of life lost because of the disease (YLL=Number of deaths×Remaining life expectancy) and the YLD refers to the years of life lived with disability (YLD=Incident cases×Disability weight×Average duration of the symptoms or the disease). Comparison of DALYs and environmental impacts between scenarios will be performed. The differences between the current/reference scenario and the alternatives provide a measure of the change in the burden of disease and in the environment if the substitutions proposed are effectively implemented (Nauta MJ et al, 2018; Thomsen ST et al, 2018; Thomsen ST et al, 2019).

Source: Data needed for DALYs calculations, includes the disability weights, duration of each stage, the probability of death, age of onset of the disease and life expectancy. This data will be used to develop a schematic tree for each health effect. Integration of all health effects, by adding the all DALYs estimated, in each scenario.

4. Description of the activities (networking and scientific)

Effective public health policies need to address a wide variety of complex issues, ranging from individual lifestyle choices to environmental exposure factors. This WP5 will develop new expertise to tackle these challenges. WP5 tasks are strongly interconnected and connected with other tasks from other WPs. Regular networking activities (face-to-face or via internet, teleconferences) will take place to promote harmonization between tools used during the RBA process. Existing scientific literature will be collected to identify and summarize current knowledge on the effectiveness of policy measures to decrease nutrition related diseases and environmental impacts of food consumption. Harmonizing existing food composition databases and individual food intake will allow estimating exposure to diets, foods, nutrients (and other bioactive compounds) and food hazards. Health effects associated with exposure changes between scenarios will be reviewed by literature search allowing to quantify beneficial and detrimental health effects. Harmonizing databases on environmental impacts of different food groups will allow assessing changes in environmental impacts between scenarios. Applying this holistic approach, a clearer consensus about the knowledge gaps and research needs can emerge.

5. Deliverables and Milestones

Task	Deliverables	Milestones
5.1	Report describing a graph database of food and nutrition policy measures	Graph database to store the findings of the review on food and nutrition policy measures is published online (eg. bioportal)
5.1	Report/Review document of food and nutrition policy measures across countries (main objectives, target, type of intervention, monitoring process, impact)	
5.1	Webinar among partners and different stakeholders to identify the gaps	
5.2		List of case studies and respective scenarios to be considered
5.2		Definition of scenarios profile [e.g. level of aggregation (food component, food product, dietary pattern), population groups of interest, a risk-benefit question with the description of the scenarios to assess (reference and alternative scenarios)
5.3	Summary document containing measures of association between health effects and exposure	Schematic trees of health effects and environmental effects for each case-study
5.4	Intermediate document containing the results of risk-benefit characterization for both quantitative or semi-quantitative approaches	Harmonized datasets of individual food consumption data in national representative samples of at least two countries (North and South of Europe) for health risk-benefit and environmental impact assessment purpose.
5.4		Harmonized dataset food composition data (nutrients and other dietary components)
5.4		Harmonized dataset of occurrence/concentration of chemical and microbiological hazards in foods
5.4		Harmonized dataset of environmental impact factors related to food
5.5	Estimation of the change in the burden of disease and the environmental impact, for each scenario	
5.5	Integration of results from all case studies, identification of knowledge gaps and future research priorities	

6. Risk & risk Management-

Refer to the table which shows the expected risk and proposed risk management for the whole project.

2.7. Dissemination and capacity building (WP6)

1. Partners involved

WP6 Leaders: Alem (Norway), Bindi (Italy) and Torres (Portugal): partners. All WP leaders

Name KH member	Organization	Country
Maria Beatriz P.P. Oliveira, Thelma de Barros Machado, Leonardo Ricciardi	Faculty of Pharmacy, University of Porto (REQUIMTE/FF/UP)	Portugal
J. Simal-Gandara	University of Vigo (978)	Spain
Cristina Delerue-Matos, Francisca Rodrigues, Elsa F. Vieira	REQUIMTE/LAQV (1107)	Portugal
Cristina Delerue-Matos, Francisca Rodrigues, Elsa F. Vieira,	REQUIMTE/LAQV (1107)	Portugal
Isabel Mafra, Joana Costa	REQUIMTE/LAQV (1044)	Portugal
Isabel C.F.R. Ferreira	IPB-CIMO	Portugal
Daniela Pacifico	CREA-CI (967)	Italy
All members contribute	All organization involved in WP1-WP5	All countries

Aim: To assess the communication, dissemination, and exploitation of the KH project results. Works in 4 main tasks

TASK 6.1: Sustainable education for increasing consumption of low environmental impact products
Task Leaders: project leaders and partners are all WP task leaders

Aim: Dissemination activities will be carried out to reach different and specific audiences.

Method: The structure and expected results of the proposed project will be shared with citizens to make them aware of the efforts and results that EU funded science is currently obtaining with the final aim of meeting societal needs. In this scenario, scholarships are frequently hosted at some partners' institutes.

Source: Ongoing research activities and project are presented during these public events.

TASK 6.2: To launch a common education outreach data sharing

Task Leaders: project leaders and partners are all WP task leaders

Aim: Data sharing among the partners is the main objectives of the knowledge Hub.

Method: the project facilitates the sharing of data and avoids duplication of research.

Source: data source from all WPs and tasks

TASK 6.3: Capacity building and networking.

Task Leader: M. B. P. P. Oliveira (REQUIMTE/FF/UP, Portugal).
Partners: Thelma B. Machado, Leonardo Ricciardi (REQUIMTE/FF/UP; UFF)

Aim of the task: National and transnational collaboration in R&D projects management using Blockchain Technology and transfer of knowledge and technology to industry. Recently there has been great interest in the latest developments in the fields of big data and machine learning aimed at assisting decisions in scientific research. The success of scientific research focusing on the role of diet in human health depends on an interdisciplinary approach that allows the decentralization of information among networking research groups. In this context, traceability of research from "research group to research group" requires a complex distribution and processing system that involves everything from human resources to materials, methodologies, equipment, and environment. In order to solve this problem, the advantage use of blockchain and IoT technologies to monitor and register the processes chain, as well as give each networking partner access to register all the steps of the research is proposed, *i.e.*, a solution designed for mapping the effectiveness of research management parameters, presenting blockchain technology as a decentralized solution aimed at safety and traceability of results in the scientific process. In this way, the search for data through blockchain can be done, providing tools to the networking research groups to make validations and contributing to the safety and reliability of results. The opportunity to use this technology in the Knowledge Hub will allow not only the implementation of this technology in the transnational project but also the dissemination of its application in scientific research (Machado, Ricciardi & Oliveira, 2019).

Method: The Blockchain solution uses decentralized technology, in which nodes are connected in a peer-to-peer network crossed by a consensus algorithm, consequently, the hierarchical relationship is eliminated (FAO, 2019; Lin et al., 2019; Guo, Liu & Zhang, 2018). Mapping the efficiency of the research management, at least six critical variables that are directly involved with the supply chain and scientific state-of-the-art will be established: Field and Agricultural practices, Processing, Materials, Equipment and Environment, Methodologies, Results, and Human resources. The blockchain technology helps build up a platform where information is shared, and efficiency and security rules are executed automatically. The business architecture design for mapping efficiency parameters defines the main events that will be worked with smart contracts. These smart contracts will be responsible for managing permissions, executions and ledger records using a chain code that manages the business logic introduced in blockchain and defining the accepted business contexts through Blockchain Hyperledger for all involved parties. Thus, all nodes will have access to the data according to their permissions and the agents will be able to perform their research activities with the safety, transparency, and traceability that Blockchain technology offers. Using Hyperledger framework, researchers will be able to create their own Blockchain without the need for much technical knowledge, because Hyperledger, through its composer, offers ready-made business models that can be specialized for more diverse purposes. The blockchain technology could also help companies and public health officials determine which communities might have been exposed to the results/products of the research. This architecture can be replicated for any type of research as the benefits of the technology will be present.

TASK 6.4: - Organization of thematic workshops and seminars

Task Leaders: project leaders and partners are all WP task leaders

Aim: disseminating information to the scientific community

Method: conduct scientific conference and workshops specific to the subject matters, for example, the activities and progress of plant science are worldwide acknowledged during the "Fascination of Plant Day", an event organized by the European Plant Science Organisation (EPSO). One of the aims is to inform people about "the importance of plant science for the sustainable production of nutritious food, horticulture, forestry, the protection of biodiversity and the production of plant-based non-food products such as paper, timber, chemicals, energy, and pharmaceuticals." The structure, expectations, importance, and goals of the Knowledge Hub will be presented during the Fascination of Plant Day to further strengthen how networking activities can amplify the results obtained in plant science.

Source: results and findings of the project tasks

4. Description of the activities (networking and scientific)

All partners will be engaged in WP6. A detailed dissemination and communication plan for the project will be developed. This will improve collaboration with institutions and existing cooperatives to raise public awareness. We will develop an exploitation strategy for the management of knowledge and intellectual property which will be linked with the various dissemination activities planned. Data gathered through WP 1–5 will be used as a source of baseline data for researchers and policy-makers. Available data on the lake from ongoing and previous research projects will also be included

5. Deliverables and milestones

- Education, training and capacity building measures (fellowships, grants, seminars, schools…);
- Diffusion and transfer conferences and workshops;
- Knowledge Hub meetings, Work Package meetings, and Thematic Area meetings
- Databases and biobanks on food production; Legal harmonization reports with scientific basis;
- Look for solutions and minimization strategies to the great challenges that lie ahead in the production of food; and
- Exchange of food research information and resources (researchers' mobility), etc.

Detail work plan with deliveries and milestones presented in the Gantt chart. The milestones for this working package reported as follows

Task	Milestone	Timing
T6.1	Education, training and capacity building measures	Every 3 months of the year
T6.2	Data sharing	Every month
T6.3	Capacity building and networking	Every 6th month
T6.4	Workshops and seminars	Once every year

6. Risk & risk Management

Refer to the table which shows the expected risk and proposed risk management for the whole project

2.8) Cross-cutting activities

The WP will benefit from cross-cutting activities to implement a new variety of plant food, for example, with high nutritional quality in a balanced and sustainable diet. Specific test cases including cereals, legumes, and olive oil for terrestrial, and fish, mollusks and algae for aquatic systems.

Case study (CS) on Olive oil: leader: Francesco Beltrame and T. Caruso, A Zinnai)

In olive, climate changes, (evidenced by recording seasonal variations of temperatures and rainfall) deeply affect growth and development processes of both vegetative (shoots) and reproductive (flowers and fruits) and in turn, the phenology of the tree. Because of the above variations, the quality of the product (particularly olive oil) can change is composition and, in turn, its nutritional value. Studies carried out in the main olive growing areas evidenced the hard effects of high temperature on fatty acid composition (increasing of the saturated respect to the not saturated) as well as the deep effect of heavy rain, particularly close to harvest time, on bio phenols compositions and concentration in the olive oil. Processing temperatures in the mill, during olive oil extraction which affect its final composition. Due to the above changes in shelf life, the nutritional and hedonistic value of olive oil evidences large variations. How wide these changes could depend on the biological flexibility/plasticity of the cultivar (biodiversity) horticultural practices (grower) mill, packaging and storage management.

CS1. How wide climate changes could depend on the biological flexibility/plasticity of the cultivar (biodiversity) horticultural practices (grower) mill, packaging and storage management. How the climate changes affect the final nutritional property of olive oil, affecting the different rings of the production chain.

CS2. Identify olive oil planting systems (leader: Francesco Beltrame and T. Caruso, A Zinnai). The constant increase in the consumption of extra virgin oil encourages to look for new planting systems that increase the efficiency of the olive growing-sector and reduce its environmental impact. In addition, problems of low productivity are increasingly reported for large areas and eco-physiological investigations lead to unexpected seasonal variations in the climate, which lead to a reduction in the overall fertility of the plant. As far as the olive tree is concerned, there is vast biodiversity in Europe with several hundred cultivars spread over almost national continental territory many of which are little known and used, that could be adopted in new planting systems to solve the above-reported problems.

CS3. An extensive scientific literature has been published on the beneficial effects of the extra-virgin olive oil on human health and on the prevention of the development of cardiovascular diseases, on the reduction of risk of contracting tumours and degenerative diseases particularly frequent in old age. The evaluation of olive oil based on the characteristics above mentioned should then be supported.

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APPENDIX – Name of EOI member involvement in WP-Task and sub-Tasks

Submission	**EOI name**	**Member name**		**WP**		**Task**		**Sub-task**
			Leader	Contributor	Leader	Contributor	Leader	Contributor
951	EOI Marco Bindi		WP0, WP1, WP6			task1.1, 1.2, 2.1		
		Roberto Ferrise		WP1,WP2	Task1.1	task 1.1,1.2,2.1		
		Camilla Dibari		WP2		task2.1		…...
		Stefano Benedettelli		WP2		task2.1		
		Giuliana Parisi		WP2		task2.2		
		Gloria Padovan		WP1,WP2		task 1.1,1.2,2.1		
		Domenico Ventrella		WP1		task 1.2		
		Gabriele Dono		WP1		task 1.3		
		Raffaele Cortigiani		WP1		task 1.3		
		Nicola Lacerata		WP1		task 1.2		
		Andrea Vitali		WP1		task 1.2		
		Massimiliano Pasqui		WP1		task 1.1,1.2		
		Marco Moriondo		WP1,WP2		task 1.1,1.2,2.1		
		Pier Paolo Roggero		WP1,WP2		task 1.1,1.2,2.1		
		Giovanna Seddaiu		WP1,WP2		task 1.1,1.2,2.1		
		Laura Mula		WP1,WP2		task 1.1,1.2,2.1		
		Antonio Pulina		WP1,WP2		task 1.1,1.2,2.1		
		Ignazio Floris		WP2		Task 2.2, 2.3		
		Alberto Satta		WP2		Task 2.2, 2.3		
		Roberto Mannu		WP2		Task 2.2, 2.3		
		Arturo Cocco		WP2		Task 2.2, 2.3		
submission 1126	EOI Emmanuelle Reboul		WP3	WP2, WP3		Tasks 2.3, 3.1 and 3.2		

		Patrick Borel		WP2, WP3		Tasks 2.3, 3.1 and 3.2		
submission_1056	EOI Patrizia Riso			WP3, WP4, WP5	Task 3.3	Tasks 3.2, 3.4; Task 4.1; Tasks 5.3, 5.5		
		Gian Attilio Sacchi		WP2		Task 1		
		Raffaello Prugger (Collaborator)		WP3, WP4		Task 3.2; Task 4.3		
		Monica Laureati		WP4		Tasks 4.1, 4.2, 4.3	task 4.2.2	
		Cristian Del Bo'		WP3, WP5		Tasks 3.1, 3.3, 3.4; Task 5.2, 5.3		
		Carlo Massimo Pozzi		WP2		Task 1		
submission_1105	EOI Anna Dalla Marta			WP1, WP2		Task 2.1; Task 1		
		Marco Napoli		WP1, WP2		Task 2.1; Task 1		
		Simone Orlandini		WP1, WP2		Task 2.1; Task 1		
submission1109	EOI Helene Gautier			WP3		Tasks 3.1 and 3.2		
		Anne Laure Fanciullino		WP3		Tasks 3.1 and 3.2		
		Nadia Bertin		WP3		Tasks 3.1 and 3.2		
		Gilles Vercambre		WP3		Tasks 3.1 and 3.2		
		Michel Génard		WP3		Tasks 3.1 and 3.2		
		Daniele Bevacqua		WP3		Tasks 3.1 and 3.2		
submission_962	EOI Laila Meija							
		Māra Grundmane		WP3		Tasks 3.3. and 3.4		
submission_967	EOI Giuseppe Mandolino			WP2		Task 2.1, Task 2.2		
		Laura D'Addezio	WP4	WP3, WP4	Task 4.1	Task 3.4,Task 4.2, Task 4.3		
		Giulia Bianchi		WP2		Task 2.3		
		Donatella B.M. Ficco		WP2		Task 2.1		
		Katia Petroni		WP3		Task 3.2, Task 3.3, Task 3.4		
		Chiara Tonelli		WP3		Task 3.2, Task 3.3, Task 3.4		
		Ephrem Habyarimana	WP2	WP1		Tasks 1.1, Tasks 1.2, Tasks 2.1, Task 2.2		
		Laura Bassolino		WP2		Tasks 2.1, Task 2.2		
		Roberta Paris		WP2		Tasks 2.1, Task 2.2		

		Lorenza Mistura		WP3, WP4		Task 3.4, Task 4.1		
		Pasquale De Vita		WP2		Tasks 2.1		
		Daniela Pacifico		WP2, WP6		Tasks 2.1, Task 6.1		
		Marina Buccheri		WP2		Task 2.3		
submission_1016	EOI Maurizio Cellura			WP1, WP2, WP5		Task 1.1, Task 2.3, Task 5.3, Task 5.5		
		Sonia Longo		WP1, WP2, WP5		Task 1.1, Task 2.3, Task 5.3, Task 5.5		
		Francesco Guarino		WP1, WP2, WP5		Task 1.1, Task 2.3, Task 5.3, Task 5.5		
submission_1093	EOI Francesco Beltrame		case study					
		Tiziano Caruso		WP1, WP2, WP3, WP4,WP5		Task 1.1, 1.3, 2.1, 2.3, task 3.1, Task 4.1,		
		Angela Zinnai				and task 5.5.		
submission_1117	EOI Alberto De Santis			WP3		Task 3.4		
		Luca Benvenuti		WP3		Task 3.4		
submission_1051	EOI Habtamu Alem		WP0, WP6		Task 1.3	Task 2.4		
		Clever Mafuta				Task 1.3		
submission 1008	EOI Carolina Rausell			WP2	Task 1	Task 1.2, 1.3		
		M. Dolores Real		WP2		Task 1.2, 1.3		
		Inmaculada García-Robles		WP2		Task 1.2, 1.3		
submission 1121	EOI Daniel Remondini		WP1	WP1, WP2, WP3, WP5	Task 2.1	Task 1.1, Task 1.2, Task 2.1, Task 3.1, Task 5.5		
		Alessandra De Cesare		WP5		Task 5.4, Task 5.5		
		Diego Marazza		WP1, WP2, WP5		Task 1.1, Task 1.2, Task 2.1, Task 5.3, Task 5.5		
		Serena Righi		WP5		Task 5.3, Task 5.5		
		Frederique Pasquali		WP5		Task 5.1, Task 5.2		

		Nicolas Greggio		WP1, WP2, WP3, WP5		Task 1.1, Task 1.2, Task 2.1, Task 3.1, Task 5.3		
		Daniele Torreggiani		WP2		Task 2.1; Task 2.2		
		Patrizia Tassinari		WP2		Task 2.1; Task 2.2		
		Alberto Barbaresi		WP2		Task 2.1		
		Alessio Bonaldo		WP3, WP5		Task 3.1, task 5.1		
		Anna Zaghini		WP3, WP5		Task 3.1, task 5.1		
submission 1103	EOI Claire DUFOUR			WP3		Task 3.2		
		David Page		WP3		Task 3.1		
		Agnès Sabaté		WP3		Task 3.1		
		Sylvie Bureau		WP3		Task 3.1		
		Carine le Bourvellec		WP3		Task 3.1		
submission_1130	EOI Pascal BONNARME			WP2	Task 2.3	Task 2.3		
		Anne Saint Eve		WP2		Task 2.3		
		Eric Dugat-Bony		WP2		Task 2.3		
		Sophie Landaud		WP2		Task 2.3		
submission_1063	EOI Luigi Cattivelli			WP2, WP6		Task 2.1		
		Agostino Fricano		WP2, WP6		Task 2.1		
		Raffaella Battaglia		WP2, WP6		Task 2.1		
		Elisabetta Mazzucotelli		WP2, WP6		Task 2.1		
		Alessandro Tondelli		WP2, WP6		Task 2.1		
submission_1058	EOI Marika Ferrari		WP3	WP4, WP5, WP6		Task 3.3, 3.4, 4.1, 5.2, 5.5		
		Filiberto Altobelli		WP1, WP2		Task 1.1, 1.2, 1.3, 2.1		
		Andrea Carboni		WP2		Task 2.1		
		Bruno Campion, Alessia Losa		WP2		Task 2.1		
		Marina Carbonaro		WP3		Task 3.1, 3.2		
		Angela Polito		WP3, WP5		Task 3.3,3.4, 5.2, 5.5		
		Laura Censi		WP3, WP5		Task 3.4. 5.1, 5.5		
		Anna Saba		WP4		Task 4.2		

		Fiorella Sinesio		WP4		Task 4.2		
submission_1064	EOI Maurizio Mulas							
				WP1, WP2		Task 1.2, 2.1, 2.4		
		Virgilio Balmas		WP2		Task 2.1		
		Angela Fadda		WP2		Task 2.4		
	EOI Didier Dupont			WP3		Task 3.1, 3.2		
		Françoise Nau		WP3		Task 3.1, 3.2		
		Amélie Deglaire		WP3		Task 3.1, 3.2		
submission_979	EOI Luísa Barreira			WP2, WP3	Task 3.1	Task 2.2, 2.3, 3.1, 3.2		
		Leonardo Mata		WP2, WP3		Task 2.2, 2.3, 3.1, 3.2		
		João Varela		WP2, WP3		Task 2.2, 2.3, 3.1, 3.2		
		Rui Santos		WP2, WP3		Task 2.2, 2.3, 3.1, 3.2		
submission _1127	EOI Christina Nielsen-Leroux							
				WP3		Task 3.1 , 3.2		
		Françoise Rul		WP3		Task 3.1, 3.2		
		Agnès Rejasse		WP3		Task 3.1		
	EOI Holger Kühnhold							
submission_1131				WP1	Task 2.2	Task 2.2		
		Andreas Kunzmann				Task 2.2		
	EOI Marian Kjellevold							
sumbission_1033				WP3	Task 3.1	Task 3.1		
		Anita Alvheim		WP3	Task 3.1	Task 3.1		
		Lisbeth Dahl		WP3	Task 3.1	Task 3.1		
		Maria Wik Markhus		WP3	Task 3.1	Task 3.1		
		Inger Aakre		WP3	Task 3.1	Task 3.1		
	EOI Talis Tisenkopfs							
Submission_1106				WP4	Task 4.3	Task 4.3	Leader	
		Emils Kilis		WP4		Tasks 4.1, 4.2, 4.3	Contributor	
		Sandra Sumane		WP4		Tasks 4.1, 4.2, 4.3	Contributor	
		Mikelis Grivins		WP4		Tasks 4.1, 4.2, 4.3	Contributor	

		Anda Adamsone-Fiskovica						
				WPw		Tasks 4.1, 4.2, 4.3	Contributor	
	EOI Maria Beatriz P.P. Oliveira							
Submission_1115				WP2, WP6	Task 2.4	Task 2.3		
					Task 6.3			
		Thelma de Barros Machado						
				WP2, WP6		Task 2.3, 2.4, 6.3		
		Leonardo Ricciardi		WP2, WP6		Task 2.4 and 6.3		
	EOI Jesus Simal-Gandara							
submission_978			WP2, WP4	WP1-6	Task 5.2	Task 3.1-4		
						task 4.1; task 4.2; task 4.3 and task 5.1		subtask 4.2.1
submission_1097	EOI Daniele Moro		WP4		task 4.3			
						task 4.1; task 4.2; task 4.3 and task 5.1		subtask 4.2.1
		Elena Castellari		WP4, WP5				
						task 4.1,;task 4.2; task 4.3 and task 5.1		subtask 4.2.1
		Paolo Sckokai		WP4, WP5				
								subtask 4.2.1
		Stefano Boccaletti		WP4		task 4.1; task 4.2; task 4.3		
								subtask 4.2.1
		Claudio Soregaroli		WP4		task 4.1; task 4.2; task 4.3		
submission 1118	EOI Elsa Lamy			WP4		tasks 4.1, 4.2 and 4.3		
	EOI Ana Maria Gomes			WP1, WP2, WP3		Task 1.2; Task 2.3; Task 3.1 and Task 3.2		
Submission 1125					Task 3.2			
		Marta Vasconcelos		WP1, WP2	Task 1.2	Task 1.2; Task 2.3; Task 3.2		
				WP1, WP3, WP5		Task 1.2; Task 2.3; Task 3.2; Task 5.3		
		Elisabete Pinto						
		Ana Cristina Freitas		WP2, WP3		Task 2.3; Task 3.1 and 3.2		
		Manuela Pintado		WP2, WP3		Task 2.3; Task 3.1		
Submission1022	EOI Lise Madsen			WP3		task 3.1		
		Ole Jakob Nøstbakken		WP3		task 3.1		
				WP2, WP3, WP4, WP5, WP6		Task 2.3; Task 3.1; Task 3.2; Task 3.3; Task 4.2; Task 5.1; Task 6.4		
	EOI Maria De Angelis							subTask 4.2.1
Submission 1120		Maria De Angelis	Maria De Angelis					
				WP2, WP4, WP6		Task 2.3; Task 3.1; Task 4.2; Task 4.3; Task 6.4		subTask 4.2.1;
		Annalisa De Boni						

								subTask 4.2.2
		Piero Portincasa		WP3, WP5, WP6		Task 2.3; Task 3.2; Task 3.3; Task 3.4; Task 5.1; Task 5.2; Task 6.4		
		Fabio Minervini		WP2, WP3, WP6		Task 2.3; Task 3.1; Task 6.4		
		Carlo Giuseppe Rizzello		WP2, WP3, WP6		Task 2.3; Task 3.1; Task 3.2; Task 6.4		
Submission 1094	EOI Marco Gobbetti	Marco Gobbetti	Marco Gobbetti	WP2, WP3, WP6		Task 2.3; Task 3.1; Task 3.2; Task 3.3; Task 3.4; Task 6.4		
		Raffaella Di Cagno		WP2, WP3, WP6		Task 2.3; Task 3.1; Task 3.2; Task 3.3; Task 6.4		
Submission 1112	EOI Francesca Comitini	Francesca Comitini	Francesca Comitini	WP2, WP3, WP6		Task 2.3; Task 3.1; Task 3.2; Task 6.4		
		Maurizio Ciani		WP2, WP3, WP6		Task 2.3; Task 3.1; Task 3.2; Task 6.4		
		Laura Canonico		WP2, WP3, WP6		Task 2.3; Task 3.1; Task 3.2; Task 6.4		
		Alice Agarbati		WP2, WP3, WP6		Task 2.3; Task 3.1; Task 3.2; Task 6.4		
submission_1122	EOI Duarte Torres	Duarte Torres	Duarte Torres	WP0, WP3, WP5, WP6	WP0, WP5, WP6	Task 3.4; Task 5.1; Task 5.2; Task 5.3; Task 5.4; Task 5.5		
		Carla Lopes		WP3, WP5		Task 3.4; Task 5.1; Task 5.2; Task 5.3; Task 5.4; Task 5.5	Task 3.4	
		Catarina Carvalho		WP3, WP5		Task 3.4; Task 5.1; Task 5.2; Task 5.3; Task 5.4; Task 5.5	Task 5.5	
		Andreia Oliveira		WP3, WP5		Task 3.4; Task 5.1; Task 5.2; Task 5.3; Task 5.4; Task 5.5	Task 5.3	
		Daniela Correia		WP3, WP5		Task 3.4; Task 5.1; Task 5.2; Task 5.3; Task 5.4; Task 5.5	Task 5.4	
submission_983	EIO Thomas Skurk	Thomas Skurk		WP2, WP3		Task 2.3; Task 3.1; Task 3.2; Task 3.4;		
		Beate Brandl		WP3		Task 3.1; Task 3.2; Task 3.4;		
submission_1128	EOI Jörn Schmidt	Jörn Schmidt		WP1, WP2, WP3, WP4, WP6				
		Karin Schwarz		WP2				
		Christian Henning		WP2				
		Wiebke Müller-Lupp		WP6				

submission_1047	EOI Isabel Ferreira	Isabel Ferreira		WP2, WP3, WP6		task 2.3, task 2.4, task 3.1, task 3.2, task 6.1, task 6.2, task 6.3		
		Susana Casal		WP2, WP3, WP6		task 2.3, task 2.4, task 3.1, task 3.2, task 6.1, task 6.2, task 6.3		
		Miguel Faria		WP2, WP3, WP6		task 2.3, task 2.4, task 3.1, task 3.2, task 6.1, task 6.2, task 6.3		
submission_1107	EOI Cristina Delerue-Matos	Cristina Delerue-Matos		WP2, WP3, WP5, WP6		Task 2.3, Task 2.4, Task 3.1, Task 3.2, Task 5.1, Task 5.2, Task 5.3, Task 6.1, Task 6.2, Task 6.3	Task 3.1	
		Francisca Rodrigues		WP2, WP3, WP5, WP6		Task 2.3, Task 2.4, Task 3.1, Task 3.2, Task 5.1, Task 5.2, Task 5.3, Task 6.1, Task 6.2, Task 6.3		
		Elsa Vieira		WP2, WP3, WP5, WP6		Task 2.3, Task 2.4, Task 3.1, Task 3.2, Task 5.1, Task 5.2, Task 5.3, Task 6.1, Task 6.2, Task 6.3		
submission_1044	EOI Isabel Mafra	Isabel Mafra		WP2, WP5, WP6		Task 2.4, Task 5.2, Task 6.1, Task 6.2, Task 6.3, Task 6.4		
		Joana Costa		WP2, WP5, WP6		Task 2.4, Task 5.2, Task 6.1, Task 6.2, Task 6.3, Task 6.4		
submission_1124	EOI Claire Gaudichon	Claire Gaudichon		WP3		Task 3.2; Task 3.3; Task 3.4		
		François Blachier		WP3		Task 3.2; Task 3.3; Task 3.4		
	EOI Carl Lachat	Carl Lachat		WP5	Task 5.1			

Overview budgetary table per Work Package (in € for 36 months)

	WP1	WP2	WP3	WP4	WP5	WP6	WP7	Total
PM	11	27	38	76	25	19	26	222
personnel	64002	94225	155830	377174	110788	95315	123913	1021247
consumables	2500	8456	15107	8194	2611	4844	3003	44715
equipment	3500	3500	3500	4700	0	5500	3500	24200
travel	34950	41589	86569	78435	41112	64792	39100	386547
other costs	0	10829	26404	16362	13095	8351	21760	96801
								0
total direct costs	104952	158599	287410	484865	167606	178802	191276	1573510
total indirect costs	13120	13016	24729	81864	11327	11680	15599	171335
total costs	118072	171615	312139	566729	178933	190482	206875	1744845
								0
Own contributions	24656	62065	186490	414997	74364	111268	95499	969339
Requested funding's	93416	109550	125649	151732	104569	79214	111376	**775506**