EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

Brussels, 25 May 2021

COST 068/21

DECISION

Subject: Memorandum of Understanding for the implementation of the COST Action “Promoting Innovation of ferMENTed fOods” (PIMENTO) CA20128

The COST Member Countries will find attached the Memorandum of Understanding for the COST Action Promoting Innovation of ferMENTed fOods approved by the Committee of Senior Officials through written procedure on 25 May 2021.

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MEMORANDUM OF UNDERSTANDING

For the implementation of a COST Action designated as

COST Action CA20128
PROMOTING INNOVATION OF FERMENTED FOODS (PIMENTO)

The COST Members through the present Memorandum of Understanding (MoU) wish to undertake joint activities of mutual interest and declare their common intention to participate in the COST Action, referred to above and described in the Technical Annex of this MoU.

The Action will be carried out in accordance with the set of COST Implementation Rules approved by the Committee of Senior Officials (CSO), or any document amending or replacing them.

The main aim and objective of the Action is to federate and structure the scientific community working on Fermented Foods, building a multi-stakeholder vision and a transdisciplinary perspective. The long-term vision of PIMENTO is to place Europe at the spearhead of Fermented Foods, promoting health, sustainability, regional diversity, and innovation. This will be achieved through the specific objectives detailed in the Technical Annex.

The present MoU enters into force on the date of the approval of the COST Action by the CSO.

OVERVIEW

Summary
Present in all European diets, fermented foods (FF) hold a strategic place due to the benefits they offer in terms of nutrition, sustainability, innovation, cultural heritage and consumer interest. The potential of FF for improving human health but also driving food innovation and local production in the next decades has become highly relevant. The challenge is therefore to federate the scientific community and other key stakeholders working on FF. We want to collectively advance scientific evidence of their health benefits, building a benefits/risk approach in order to promote multi-modal innovation and respond to the expectations of different European communities.

The long-term goal of PIMENTO is to place Europe at the spearhead of innovation on microbial foods, promoting health, regional diversity, local production at different scales, contributing to economical and societal development as well as food sovereignty. To respond to this challenge, the scientific and non-scientific community need to join forces and co-construct a multi-stakeholder vision and dynamic in the field of FF. A COST Action is the best means of building this network and enabling this long-term vision to become reality.

The wide variety of stakeholders engaged will enable PIMENTO: i) to tightly connect and clarify scientific knowledge on health aspects of FF ii) to tackle technical, societal and legislative bottlenecks behind FF-based innovations iii) to contribute to the establishment of long-term scientific workplaces iv) to disseminate widely define scientific knowledge on FF and define strategic roadmap for future joint research.

Areas of Expertise Relevant for the Action	**Keywords**
● Agricultural biotechnology: Fermentation ● Health Sciences: Nutrition and dietetics ● Industrial biotechnology: Food microbiology	● Fermented food ● Human Health ● Dietary guidelines ● European web platform (Hub) ● Industrial cluster

Specific Objectives
To achieve the main objective described in this MoU, the following specific objectives shall be accomplished:

Research Coordination
● Assess the current place of Fermented Foods in the diets and culture of the Action partners: including type, consumption, diversity, extent of characterisation of the Fermented Foods. Each Action partner will contribute to this interactive cartography while dietary guidelines in the COST countries and beyond will be analysed too.
● Consolidate the scientific evidence regarding health benefits and risks of Fermented Foods as well as to identify gap of knowledge to be addressed in the road map. Available data need to be synthesised in a structured manner to point the major gaps and propose a strategic roadmap for future research.
● Outline a shared strategic research roadmap for future studies linking Fermented Foods properties with health benefits/risks, via an RRI approach. A common analytical strategy/methodology for evaluating health benefits and risks based on past and on-going research will be defined, taking into account stakeholders' expectations using the Dialogue model approach.

● Identify the main bottlenecks limiting fermentation-based innovations and federate academic scientists and SMEs/industry to promote innovation during and beyond the Cost Action. To ensure that Europe's SMEs are key actors for driving innovation in the field of Fermented Foods need to collectively address key issues to be identified all together.
● Disseminate the varied outcomes of PIMENTO to the wider scientific community and all related stakeholders. Key actions will contribute to build a strong scientific community, tightly connected to share technological and scientific knowledge, promote ECIs that will prolong the COST Action belong the current project and for the next decades.

Capacity Building
● Build bridges between scientific communities and stakeholders in the field of Fermented Foods in Europe and beyond, to address the issue of the health benefits and risks, but also promote innovation. This will also provide a fertile ground for participatory science in the field of fermentation.
● Provide a PIMENTO web portal (European Food Fermentation Hub platform) federating information from scientific results on Fermented Foods as well as SMEs and citizens good practices in the field of Fermented Foods. The intranet application Hub platform will be used for PIMENTO co-working and exchanges of the PIMENTO network.
● Create and deliver a capacity-building programme for young researchers targeting ECIs including the organisation of one summer school/year and Short-Term Scientific Missions. Fermented Foods is a perfect topic for developing multi-disciplinary scientists as it involves microbiology, food science and technology, nutrition and health, and the social/cultural dimensions.
● Create the first industrial cluster on Fermented Foods to boost innovation. To federate academic researchers and SMEs/industry over a long period able to support innovation in Fermented Foods from traditional foods to products development. We will set up this new place of work and initiate key tasks of collective interest.
● Engage in dialogue with regulatory authorities, including those responsible for producing dietary guidelines in order to disseminate PIMENTO aims and outcomes Europe-wide. This approach will consider the specific nature and place of Fermented Foods in the diet but also addressing the need to harmonise specific regulatory and labelling procedures.

TECHNICAL ANNEX

1. S&T EXCELLENCE

1.1 Soundness of the Challenge

1.1.1 DESCRIPTION OF THE STATE-OF-THE-ART

Fermented foods (FF) have played a **key role in human diets for millennia**. Historically, the main role of the fermentative microorganisms was to counteract the action of spoilage or pathogenic microorganisms, thus improving shelf-life in the absence of any cold chain. The diversity of matrices and in fermentation practices has led to a huge diversification in terms of taste and texture of FF all over the world. Several of them are highly emblematic of the culture and culinary diversity of European regions and are consumed every day for our greatest pleasure. FF account for 5 to 40% of our diet (country depending). Thanks to revolutionary tools such as 'omics' approaches, the diversity of the microbial ecosystems present in FF is much better known. The question of FF as a "**dietary source of live microorganisms**" was strongly put forward by Rezac et al. (2018), providing a literature review of microbial biomass and species ingested through varied kinds of retailed FF. These authors found that most FF are good sources of living lactic acid bacteria (LAB), including species that reportedly provide human health benefits, reinforcing the position of several authors already considering FF as a natural whole probiotic delivery system. Recent findings showing the presence of numerous LAB strains in both food and gut environments clearly provides evidence that FF is a major source of LAB for the gut microbiome or increase levels in LAB. However, although there have been consistent efforts to reach optimal organoleptic qualities and microbial safety for decades, details as to what happens in the human digestive system after ingestion of these 'microbial foods' have been the object of much fewer studies, mostly limited to dairy products and specific physiological targets. There is increasing evidence that food microbiota can survive and are still metabolically active in the intestinal tract. Taylor et al. (2020) recently demonstrated that consumption of fermented foods is associated with systematic and consistent differences in the gut microbiome and metabolome. Many promising data have been produced in recent years on the **nutritional and health benefits** of FF. For instance, FF have been reported to improve cognitive function and reduce the risks of high blood pressure, or CHD and the occurrence of atopic dermatitis. However, these studies focused only on few matrices representative of FF, pointing out to a first limitation in the research landscape in the field. Literature is heterogeneous, covering the effect on varied physiological targets (e.g., gut, immune system) in line with the specific interests and skills of those research teams working in the field. The overall picture of evidence is therefore auspicious but also very scattered hindering a clear picture of the health benefits or mechanisms involved. On the other side, industrialisation of foods, modifications of diet habits, sedentary life, smoking, alcohol intake and drug usage have been associated with a dramatic increase in different pathologies and can, at the same time, **negatively impact on human gut diversity**, with enormous associated costs for our health systems as well as negative social impacts. The need to preserve microbial diversity in all aspects of our life has become increasingly recognised including *"changing diet to* emphasise foods that promote microbial diversity and metabolism that benefit our health". In that regard, dietary diversity was recently demonstrated to be an important determinant of microbiota stability. As FF provide a large diversity of microorganisms and metabolites, the hypothesis that FF could be an important component of dietary strategies aiming at improving human health and preventing metabolic diseases has become highly relevant. Besides these emerging scientific hypotheses, other significant technological, economic, and societal aspects need to be highlighted as well. From this transdisciplinary point of view, it is of particular relevance to underline that fermentation is one of the most **innovative and sustainable food processes**: because of the huge microbial diversity and the plasticity of the process, food fermentation has extraordinary potential for food innovation, in particular for SMEs and for local development. It is one of the very few food processes common to individual citizens and industry. Growth and development of local food producers and distributors can be driven by FF and contribute to food sovereignty. Fermentation requires little energy and equipment and can be performed from very small (farms, households) to large industrial scales.

Also, it has been clearly positioned as a sustainable procedure to revalorise co-products and sub-products from agro-industries for human and animal feeding and contribute to the circular economy. FF innovation requires the involvement of a wide range of stakeholders throughout society: citizens or farmers making their own products, innovative chefs, hundreds of companies, mainly SMEs, are and will be the leading actors of this active and fast- developing food market. **There is a need to federate and involve in common approach these key stakeholders, but also many other actors with different background, objectives and duties, including especially academic researchers in science and humanities, journalists and media as well as regulatory agencies.** Knowledge about the health effects is among the first lines of public enquiry, but societal and ethical considerations request that a careful scientific assessment be conducted to objectively balance benefits of the processes associated with the production of FF.

1.1.1. DESCRIPTION OF THE CHALLENGE (MAIN AIM)

Present in all European diets, FF clearly hold a strategic place in our dietary systems, due to the benefits they offer in terms of nutrition, sustainability, plasticity for innovation, cultural heritage, and strong consumer interest. **However, scientific guidance for the evaluation of the health benefits and risks of FF are not harmonised, even lacking.** The challenge is now to **federate and structure the scientific community working on FF** in order to collectively advance scientific evidence of their health benefits and risks. **This community should foster the design of inclusive and sustainable innovations on FF through a responsible research and innovation approach (RRI).** To respond to this challenge the scientific community needs to build a multi-stakeholder vision and a transdisciplinary perspective in the field of FF and create a network that will adhere to this vision to draw a common mission. **The long-term vision of PIMENTO is to place Europe at the spearhead of FF foods, promoting health, sustainability, regional diversity, and innovation**. To integrate geographical, cultural diversity as well as varied scales of production is, therefore, a crucial point to contribute to local development and sovereignty as well as to position Europe at the head of key stakeholders worldwide. PIMENTO will also put in place a capacity building program to ensure that all those actors who are required to fulfil the long-term vision of PIMENTO are fully engaged in both the road mapping process as well as 'buy in' to the long-term. This vision requires building and connecting three dynamics, namely a **transdisciplinary research**, **innovation,** and **dissemination of knowledge**. PIMENTO will therefore establish and federate a multi-actor network that will build and connect these three dynamics ensuring that future research is carried out in a continuum science-innovation-society thus delivering optimal health, socio-economic and cultural impacts (also facing global challenges such as weakness of food systems associated with climate trends and with COVID19/post-COVID19 scenarios).

<u>Multi-disciplinary research</u>

To what extent these unique microbial food products contribute to a healthy diet, and via which mechanisms, has never been collectively assessed. The health-promoting properties of FFs came to light a century ago, when the immunologist and Nobel Prize winner Élie Metchnikoff advocated the daily consumption of yoghurt to improve longevity. Since then, most studies related to the health benefits of FF have focused on dairy products, often narrowly focusing on specific probiotics strains. This is a very reductive approach as the European diet contains many different types of FF involving a massive number of bacteria, yeasts, and moulds species. The EU has strong research teams in the fields of human nutrition and health, in particular gastrointestinal tract physiology, food science and technology, as well as food studies (including history, anthropology and sociology of human nutrition) that need to join forces. **PIMENTO network, representing a large diversity of countries, stakeholders, and partners/actors, can collectively fully address the health-promoting properties of FF and implement a coordinated future research strategy.** Three key research objectives will be followed to evaluate these properties: i) to document and federate current scientific knowledge on health benefits and risks of FF, ii) to identify gaps in current knowledge, and iii) to define a strategic roadmap for future joint research hand in hand with a wide spectrum of stakeholders. PIMENTO will therefore organise a **transdisciplinary research** focusing on the interaction mechanisms of FF with the human host, particularly as vectors of bioactive molecules and of living and diversified microorganisms. Clarifying the question of the health effects of FF is a significant challenge for scientists for different reasons. **PIMENTO will list and prioritise the main research questions that should be addressed to firmly**

establish FF as safe and healthy sustainable food products. Should the research strategy be tailored at the level of the food products or at more general level of microbial ecology given microbial dominances in the fermenting ecosystem? Which are good model matrices/organisms to speed up the understanding in the field? Can systemic approach propose new perspectives on health benefits that are common to all FF? Which are the socio-economic determinants susceptible to shape the market of FF? Which knowledge gaps still exist, and should their resolution be prioritised? What can objectively be demonstrated in terms of health benefits of FF in randomised trials or epidemiology studies, and how? Which is the potential of FF as reservoir of latent biotechnological potential? Which is the role of FF in the on-going sustainable revolution? Further, PIMENTO will address the safety and regulatory issues associated with the consumption of FF in particular hazards associated with starters and other microbes used in food production (e.g., biogenic amines…). Microbes exclusively associated with pathogenic properties have been extensively explored by scientists and will not be considered directly in PIMENTO. The network will address microbiological risks, which might indirectly arise from the impact of beneficial microbes on microbial intestinal ecology and on pathogens.

Innovation

An **innovation** policy led by SMEs will be conducted by PIMENTO to establish FF are a source of safe and sustainable products potentially produced locally, generating added value, preserving microbial diversity in food, within a circular economy framework. Focusing on health benefits and risks of FF will boost innovation by unlocking crucial bottlenecks limiting the development of innovative products. These bottlenecks will alleviated by federating the multiple actors involved in food fermentation. PIMENTO will fill the gap between scientific research and the needs and level of knowledge of the stakeholders (from society to SMEs/industry) in order to boost innovation. PIMENTO intends to build a dynamic multi-actor network, to share interest and expectations and build unusual bridges leading to a creative community connected with science. Limiting factors, including scientific, technological, regulatory and communication, will be identified and addressed to foster the development of a novel generation of innovative and sustainable FF. **Through fermentation and FF, local and regional products will be promoted according to the expectations of society and food sovereignty of the EU will be strengthened.**

Dissemination of knowledge

An active **dissemination of knowledge** to society and all interested bodies, including regulatory, will be pursued by PIMENTO so that the right information is available to all. Positioning FF in the diet of tomorrow cannot be defined only by those who know the health benefits and risks or are working on them (the scientists). PIMENTO also intend to bring on board those who consume FF or advise (consumers, journalists, and media), those who produce them and are likely to innovate (SMEs, Chefs etc…) and finally the regulatory framework actors who guarantee that safe products meeting their claims reach the consumers. For that purpose, methods of participatory science (i.e., Dialogue model) will be used to explore the scientific field of FF, engage stakeholders, and facilitate dialogue between them. The aim is to build efficient bridges between scientists and stakeholders in the field of FF in Europe.

Relevance

The PIMENTO network is relevant and timely because: i) there is a wealth of **new scientific knowledge** emerging on the role of the gut microbiota and the gastrointestinal tract in health and disease onset or predisposition and a parallel wealth of knowledge on food ecosystems, systemic approaches in food microbiology, foodomics, nutrigenomics and transdisciplinary studies on FF; ii) It is crucial to maintain **vectors of biodiverse food microbiota** and related metabolites in a period where diets are drastically changing toward highly-processed foods due to urbanisation and concentration of the food industry with detrimental health consequences. In particular, the production of FF by SMEs or at home are precious reservoir and source of microbial diversity; iii) There is a much- needed transition towards a more **sustainable diet** and food consumption decreasing waste by promoting local production as well as promoting innovation and food sovereignty. **PIMENTO will contribute to the European Green deal strategy "Farm to Fork"** by enhancing research and innovation into fermentation based solutions for food products and process improving nutritional, structural and functional properties. iv) There is also growing demand for simple (do it yourself), natural (zero additives, clean label) and healthier products

(they should be available at affordable costs as part of a public health policy promoting health in low-income groups). v) **Lay knowledge** on microorganisms and fermentation is highly heterogeneous. **It will contribute to open access identification, standardisation, and mapping of existing and potential beneficial microorganisms and communities.** vi) An **innovation strategy** is mandatory to boost the development of FF and place EU among the leading area (700 new fermented products were introduced worldwide as opposed to around 60 in Europe)

1.2 Progress beyond the state-of-the-art

1.2.1 APPROACH TO THE CHALLENGE AND PROGRESS BEYOND THE STATE-OF-THE-ART

PIMENTO Action is innovative for four reasons: i) PIMENTO will bring together different scientific communities/skills: food science and technology, microbiology, ecology, nutrition, epidemiology, sociology, anthropology, to reach a more integrated approach and vision about the place of FFs and their real benefits in the diet. The Action will consider the heterogeneity in current research in FF nutritional and health benefits and risks by addressing the quality of the available data in a differentiated manner, making use of the lessons learned in relevant domains (e.g., meta-analyses of observational studies on fermented dairy products). Clear collective statements, gap identification and shared agreement on physiological targets and relevant methodologies will be the basis of a goal-oriented research roadmap. A key tool for evaluating the nutritional and health benefits and risks of FF will be the establishment of a modular database on FF (FFDb). The FFDb will integrate data from the most relevant determinants (food matrices, fermenting microbes, bioactive compounds, host organisms, target organs, diseases, bioactive properties, direction of effect) and develop a scoring system enabling a quantitative risk/benefit analysis. **ii) This transdisciplinary network will work on a huge range of matrices** (FF deriving from milk, vegetables, fruit, condiments, meat, fish, etc.) requiring scientists to exchange outside their usual food communities as well as addressing more generic questions on FF, thus overcoming the classical product by product approach. This will valorise European FF products diversity, which is strongly linked to the terroir and thus a source of local development. In particular, ITC and NNC present in the network still have a vivid and rich heritage on traditional FF, which is threatened by the progressive influence of western diets. **iii)** PIMENTO will establish **the first cartography regarding the diversity and consumption of FF** in the Action partners' diet. Lists of FF exist in literature, but the type and volume of the main products consumed in the countries analysed have never been assembled. By crossing text mining, literature, and the PIMENTO cartography, a first assessment of the microbial diversity ingested daily through FF will be provided, and species redundancy pinpointed. This cartography will allow proper choice of a panel of priority products or microbial species, which should be investigated for interventional studies (as part of the research roadmap) and will contribute to future epidemiological approaches. FFQ and 24h recall validated for the intake of FF will be used. This cartography will be a free resource available on the project website and useful beyond PIMENTO. **iv) A wide variety of stakeholders will be engaged** throughout the project with the aims 1) to tightly connect scientific knowledge on microbial foods to promote multi-scale innovations; 2) to promote early dialogue with policymakers and regulatory bodies for an efficient benefits/risks analysis regarding FF; 3) to tackle efficiently the bottlenecks of FF-based innovations and establish novel work and exchange places.

1.2.2 OBJECTIVES

PIMENTO key challenges will be addressed through Research Coordination Objectives (RCOs) including Working Groups 2 to 5 and via Capacity Building Objectives (CBOs) including WG 1 & 3 to 5.

1.2.2.1 Research Coordination Objectives

RCO-1: Assess the current place of FF in the diets and culture of the Action partners: including type, consumption, diversity, extent of characterisation of the FF mainly consumed, research teams working on health benefits and risks and existing nutritional surveys (e.g., Nutrinet Santé in France). Each Action partner, scientist or not, will contribute to this interactive cartography when entering the network. The dietary guidelines in the COST countries and beyond will also be analysed pinpointing any reference to FF (D2.1, D2.2, D2.3).

RCO-2: Consolidate the scientific evidence regarding health benefits and risks of a selection of FF as well as to identify gap of knowledge to be addressed in the road map (D3.1, D3.2, D3.3D4.1). The available research information will need to be synthesised in a structured manner in order to identify the major gaps and to propose a strategic roadmap for future research.

RCO-3: Outline a shared strategic research roadmap for future studies linking FF properties with health benefits and risks, via an RRI approach. Further to the gap analysis (RCO-2) clear priorities for future joint research programs will be defined, taking into account the key FF consumed (RCO1). A common analytical strategy/methodology for evaluating health benefits and risks based on past and on-going research will be defined during both live and virtual workshops. To help in prioritising, the research roadmap will also take on board stakeholders' expectations using the Dialogue model approach.

RCO-4: Identify the main bottlenecks limiting fermentation-based innovations and federate academic scientists and SMEs/industry to promote innovation during and beyond the Cost action. To ensure that Europe's SMEs are key actors for driving innovation in the field of FF need to collectively address key issues to be identified all together (D4.2). Bottlenecks will be provided by the SMEs/industry themselves as members of the PIMENTO network or as external stakeholder participants (D4.1), and by specific actions like targeted workshops during the annual meeting (D1.1) or virtually using the intranet application of the European Food Fermentation Hub platform (D1.2).

RCO-5 Disseminate the varied outcomes of PIMENTO to the wider scientific community and all related stakeholders (D5.1, D5.2, D5.3) Key actions will contribute to build a strong scientific community, tightly connected to share technological and scientific knowledge, promote early carrier development of new actors that will prolong the COST Action belong the current project and for the next decades.

1.2.2.2 Capacity-building Objectives

CBO-1: Build bridges between scientific communities and stakeholders in the field of FF in Europe and beyond to address the issue of the health benefits and risks as well as innovation. Recent methods of participatory science and large audience events will be used to facilitate dialogue between these different actors. Pairs (scientist-non-scientist) will be appointed for each country with the task of identifying the missing stakeholders in their countries, which will then be invited into PIMENTO during the first year. These bridges, which do not exist yet, will enable not only the Action aim and objectives to be met but will also provide fertile ground for participatory science in the field of fermentation (D1.1).

CBO-2: Provide a PIMENTO web portal (European Food Fermentation Hub platform) federating information from scientific results on FF as well as SMEs and citizens good practices in the field of FF. This hub will include news related to the activities of PIMENTO, as well as summaries of scientific results in a language tailored for consumer and nutrition-health stakeholders and be a source of useful addresses, links, connected to social networks. The Hub will be collaborative so that all stakeholders will contribute to defining and providing content (cartography, D1.3), so as to ensure that it is designed to meet the needs of all those who have an interest or stake in FFs. The intranet application of the European Food Fermentation Hub platform will be used for PIMENTO co-working and exchanges of the PIMENTO network (D1.2).

CBO-3: Create and deliver a capacity building programme for young researchers targeting ECIs. This will be done through the organisation of one summer school/year (D5.2) and Short-Term Scientific Missions (STSM). FF is a perfect topic for developing multi-disciplinary scientists as it involves microbiology, food science and technology, nutrition and health, and the social/cultural dimensions.

CBO-4: Create the first industrial cluster on FF to boost innovation beyond the COST initiative. To federate academic researchers and SMEs/industry over a long period able to support innovation in FF from traditional foods to products development. We will set up this new place of work and initiate key tasks of collective interest, promoting innovation during COST action. The economic and operating model will be selected by SMEs and industry to ensure its growth and activity for a decade at least (D4.3).

CBO-5: Engage in dialogue with regulatory authorities, including those responsible for producing dietary guidelines in order to disseminate PIMENTO aims and outcomes Europe-wide. This approach will consider the specific nature and place of FF in the diet of the European partner countries whilst at the same time addressing the need to harmonise specific regulatory and labelling procedures across the EU (D1.1-D3.4).

2. NETWORKING EXCELLENCE

2.1. Added value of networking in S&T Excellence

2.1.1. ADDED VALUE IN RELATION TO EXISTING EFFORTS AT EUROPEAN AND/OR INTERNATIONAL LEVEL

The PIMENTO Action is completely aligned with the strategic vision of key actors and Horizon Europe: i) The FAO clearly promoted the sustainable use of microorganisms in food processes; ii) The European Technology platform «Food for life» in its strategic research and innovation agenda (2014) published the topic «Use of beneficial fermentative microorganisms to improve food safety and quality» as one of the 20 strategic priorities. As beneficial microorganisms raise transversal issues, the results will be applicable to the entire food industry; iii) **The JPI Healthy diet for healthy life** strategic research agenda indicates in "diet and food production" that the challenges are to stimulate the European consumers to select foods that fit into a healthy diet and to stimulate the food industry to produce healthier, higher-quality foods in a safe, sustainable and affordable way. PIMENTO is in line with challenges of **the Knowledge platform INTIMIC** including the need for moving from association to causality in the relation between food, microbiota and health as well as, on a technological level, the need for comparability and interoperability of research data. PIMENTO is also aiming at better integrating and promoting sustainable development goals of fermentation and FF production. PIMENTO will bring the questions of the food transient microbiota to the on-going **CSA Microbiome Support**. Collaboration will be sought with **EIT food** whose mission is to connect "consumers with businesses, start-ups, researchers and students from around Europe… and supports innovative and economically sustainable initiatives which improve our health, our access to quality food, and our environment." EIT Food can therefore act as a relay for PIMENTO- capacity building and dissemination activities and possibly launch calls based on the PIMENTO' roadmap. Overall **PIMENTO will contribute to European Green Deal priorities and the Farm to Fork Strategy** by providing healthy and sustainable diets and helping to tackle the EU's 2030 and 2050 climate ambitions. It will especially support advances **in research related to microorganisms for healthier and more environmentally friendly food processing already prioritised in the coming Horizon Europe**.

Meaningful connections **can be highly relevant for PIMENTO implementation plan**: i) the European e-infrastructure project OpenMinTed for text and data mining that the Action will use with a focus on microbial biodiversity and food biotope; ii) considering the health benefits side, FOODBALL (JPI funded about food metabolome) is a systematic exploration and validation of biomarkers to obtain a good coverage of the food intake in different population groups within Europe, by applying metabolomics; iii) RiskBenefit4EU offers an opportunity to build on shared risk-benefit assessment approaches within EU using a holistic approach. It aims at strengthening the EU capacity to assess and integrate consumers' food risks and benefits in the areas of microbiological, nutritional, and chemical components through the development of a harmonised framework that will be available to EU member states organisations. Some of these actions, e.g., FoodBAll, have been closed. However, networks of scientists are still active in reporting key outcomes of these programs. **PIMENTO will be fully focused on food fermentation and especially innovation of FF, in all its forms. As such PIMENTO will go beyond the limited scope of the previous projects related to various extents to FF:** µANDES - 2010-2014 Microbiota from Andean foods: tradition for healthy products, Fishfermplus (fish fermentation) 2012-2015, and the Eranet FolEA: collaborative research project ERAfrica entitled "Contribution of cereal-based FF to Folate intake in European and African countries", Glamur 2013-2016 explored the place in the diet of specific food (including a few FF) from local to global or more recently Sourdomics 2019-2023 focusing on a single FF. The conclusions and methods will be useful for the Action.

2.2. ADDED VALUE OF NETWORKING IN IMPACT

2.2.1. SECURING THE CRITICAL MASS AND EXPERTISE

The necessary skills and expertise are present in the PIMENTO Action: including food scientists, microbiologists, biochemists, nutritionists with varied expertise (nutrigenomics, meta-analysis, and epidemiology), text mining specialists, food anthropologists and sociologists. This core group will be the bridgehead to attracting more experts in their respective fields and thus consolidate the network.

The Action has a very large geographical coverage: 66 partners support the PIMENTO Action from 26 countries including 18 COST Member countries, 1 Near Neighbour Country, and 7 COST international partners. All this regional diversity will give the opportunity to consider a contrasted panel of FF in diets. A US team very active in the field of food microbiota, plus international experts from India, Ethiopia Argentina, and South Korea countries all rich in fermentation practices, in particular on vegetables, have also joined PIMENTO representing a highly valuable input and opportunity to build international collaborations. **Food companies are well represented too:** 13 SMEs (starter cultures, FF producers etc..), European platforms, food federations and technical institutes dedicated to food which will bring economic issues. Other European industries producing FF, or starters, at a larger scale compared to SMEs will be invited at the kick-off to join the Action. **The presence of non-scientific actors is a key asset of the Action and the ideal configuration to increase the social impact of the network as expected from a RRI approach**: journalists, dieticians, international or national organisations, SMEs etc. will interact with scientists. Their participation to the WGs will improve the connection between science and society and favour knowledge dissemination and innovations. Policy makers, like EFSA, will be contacted early to generate the necessary dialogue on the benefits/risks of FF for human health, and the strategies needed to promote healthy, safe and sustainable innovations through fermentation. During the kick-off meeting a strategy to attract missing participants will be outlined collectively. Involved stakeholders will be in charge of widening membership within their stakeholder group to increase the number of partners of the PIMENTO Action. The 13 ECI will greatly contribute to creating a communication "buzz" by using social media as a means of dissemination. The enlargement of the network is certain, as basically each COST country possesses FF in their diet.

2.2.2. INVOLVEMENT OF STAKEHOLDERS

Stakeholder	Examples	Plan for involvement
Scientists	Food scientists, nutritionists, microbiologists, epidemiologists, food safety and processing, sociologists, food anthropologists.	i) provide inputs into WGs on past and on-going R&D initiatives, results and scientific evidence, as well as evolution and perspective in 2021 and 10 years after (WG2 & 3); ii) promote and/or involve their ECIs in ECI capacity building, STSMs (Task 5.2) and the Summer school; iii) attend and contribute to fermentation Festivals and workshops in scientific symposia; iv) disseminate scientific results and the roadmap to the wider R&D community (WG5); v) translate the training material into local language and contribute to the establishment of exchange tools and workplaces such as the European Food Fermentation Hub platform, the FFDb and the FF industrial Cluster on FF (Task 4.3 and Task 5.1).
SMEs & industry	SME FF producers, EIT Food, ETP Food for life, EFFCA.	i) provide input to the cartography (WG2) and on current bottlenecks to innovation as well as success stories (Task 4.1) virtually or via interviews; ii) validate and disseminate the position paper for boosting innovation (Task 4.1); iii) participate in and/or promote SME capacity building activities (Task 4.2); iv) contribute to defining the specifications (user requirements), priorities and model of the FF industrial Cluster (Task 4.3); v) be informed of

		and then disseminate all results and outcomes to members and networks (Task 5.3).
Culinary schools & Chefs; Journalists and Media	Worldchefs, culinary Schools, Media and social media dedicated to foods.	i) contribute to defining the requirements of the Hub (Task 1.2); ii) provide input on current bottlenecks to innovation as well as success stories (Task 4.1); iii) be informed of and then disseminate the health benefits/risks assessment of FF to customers and colleagues (Task 5.3).
Food and nutrition councils and bodies	EUFICWHO, EFAD (Dietitians) EASO (Obesity).	i) provide input to the cartography and overview of existing FF related initiatives and guidelines (Task 2.1 -2.2); ii) be informed of and disseminate all results and outcomes to members and networks (Task 5.3).
Public health and regulatory bodies	EFSA, National public health programme.	Provide feedback on benefits/risks analysis, validate and disseminate results at EU and national levels (Task 5.3).
Consumers	BEUC and national members	i) contribute to defining the Hub requirements (Task 1.2) attend FF Festival or participate by webinar (Task 5.3). ii) provide feedback on research priorities in line with key consumer issues (Task 3.4).

2.2.3. MUTUAL BENEFITS OF THE INVOLVEMENT OF SECONDARY PROPOSERS FROM NEAR NEIGHBOUR OR INTERNATIONAL PARTNER COUNTRIES OR INTERNATIONAL ORGANISATIONS

Researchers from IPC have been invited to build bridges with EU scientific programs on FF health benefits. Mutual interest is firstly scientific: wider dissemination of results, enhanced state-of-the- art and a place to build joint research projects. Secondly there are shared questions (e.g. change in microbiota expression through FF ingestion?) that can then be explored with an identical strategy agreed through the Action i.e. testing different local FF using the same approach on the same physiological target will make results more comparable and more generic for FF. To be aware of the relevant scientific results on the interest of microbial foods in diet may help them to reconsider the value of the local FF and to promote local production and circular economy. **Our COST Action will be boosted by this cross-fertilisation of culinary cultures, knowledge and innovation exchanges.**

3. IMPACT

3.1. IMPACT TO SCIENCE, SOCIETY AND COMPETITIVENESS, AND POTENTIAL FOR INNOVATION/BREAK-THROUGHS

3.1.1. SCIENTIFIC, TECHNOLOGICAL, AND/OR SOCIOECONOMIC IMPACTS (INCLUDING POTENTIAL INNOVATIONS AND/OR BREAKTHROUGHS)

PIMENTO aims via the WG activities to achieve the scientific, technological and socio-economic impacts outlined below.

Scientific impacts. Short term PIMENTO will generate new knowledge and resources for the research community (publications, cartography, gap analysis…) that will benefit all researchers working in the field of FF or related fields. Medium to long term there are three main impacts for the scientific community as well as for funders: i) Future research on the nutritional/health benefits and risks of FF will be carried out in a more harmonised and transdisciplinary manner taking on board societal expectations and thus leading to more homogenous and widely applicable R&D outcomes (RCO-3). Rather than exploring the relationship between one aspect of FF and health aspects, we will consider a

more holistic approach exploring wider attributes of FF to promote sustainable innovations. ii) Overview of the status of R&D and the identification of gaps at EU level will stimulate further R&D and enable future research to be carried out in a synergistic manner creating new transnational partnerships and thus stimulating the production of new knowledge but also knowledge transfer for innovation and development of products to be launch on local and EU markets (RCO-1; RCO-6). iii) The capacity building targeting ECI will lead to a new generation of multi-disciplinary researchers mastering metagenomics and nutrigenomics and thus reinforce EUs research capacity in the field, leading to new scientific breakthroughs (CBO-3). The European Food Fermentation Hub platform and the FFDb will become major tools for scientists conducting research on FF.

Technological impacts. Medium to long-term technological impacts are three-fold: i) The collective work on health benefits and risks will secure the scientific and legal environment of all the stakeholders to boost innovation of FF. The industrial cluster will prolong interactions between scientists and SMEs/industries beyond the COST action contributing to long term market development in EU and especially during the next decade. ii) The use of food cultures in products is a safe and controlled way of reducing the risk of contamination via a mixture of indigenous microorganisms coming from the food itself or from its environment. PIMENTO will thus disseminate the correct use of starter cultures promoting this way the safe and beneficial use of natural food protection solutions. Consequently, consumers' demand for the use of fewer additives while still maintaining an adequate shelf life will be satisfied as well as ensuring sustainable production and a decrease in food waste (RCO-4; CBO-4). iii) The promotion of FF in diets will also lead to an increased demand and market for FF kits (and starter cultures) both at household, restaurant and SME/Industry level thus stimulating new technological developments, as well as local and regional production.

Socio-economic and public health impacts. In short to medium term PIMENTO will boost growth and markets for EU SMEs. PIMENTO will provide SMEs with information, resources, and know-how to propose and develop new FF products (RCO4 & CBO4) for the market as well as expanding current markets (RCO1 and all CBOs) thus responding to a growing consumers' demand for 'healthy natural' products. The global FF market was estimated at $ 637 billion in 2016 and expected to reach $ 889 billion in 2023 (BIS Research). However, the EU is currently lagging the rest of the world in terms of innovation in FF, representing only 8.5% of new FF products launched in 2016. The starter culture market is none the less expanding at a CAGR of 6.1% by value and 5.8% by volume from 2016 to 2024 (Source: Credence Research). Fermentation is a process that requires little investment in terms of equipment and thus accessible to even micro-enterprises which could flourish in ITC and NNC countries. The launching of the first industrial cluster on FF will boost innovation beyond the cost initiative. It will help to federate researchers and industrials (mainly SMEs) working on FF contributing to projects building and products developments to enrich the EU market and overall food sovereignty of the continent.

3.2 MEASURES TO MAXIMISE IMPACT

3.1.2. KNOWLEDGE CREATION, TRANSFER OF KNOWLEDGE AND CAREER DEVELOPMENT

Knowledge creation: a publication policy and plan will be put in place at the start of the Action. ECIs will be encouraged to take the lead on the publications and position themselves as first authors as a means of enhancing their career perspectives (WG5). We will collectively establish and launch the first industrial Cluster on FF to boost innovation during and beyond the Cost Action, by targeting collective action and dedicated work on key aspects (from scientific to regulatory contribution).

Transfer of knowledge: to fulfil the long-term vision of PIMENTO it is necessary for knowledge and know-how to both be shared and transferred across categories of researchers and stakeholders (WG4 and WG5). For this reason, PIMENTO has put in place a strong capacity building programme (CBOs) which will ensure: i) transfer of technical know-how amongst scientists, SMEs/industries and society including professional training organisations. ii) transfer of scientific knowledge amongst researchers notably to ECIs, but also to citizens and all interested stakeholders by "vulgarisation" papers and culinary journalists' papers or blogs. iii) transfer of results and culture in particular through Food festivals,

scientific or business symposia targeting food and nutrition. iv) The FF Hub on the extranet section of the website and the FFDb will contribute to the transfer of relevant and validated scientific knowledge to different stakeholders: from Society to SMEs/Industries.

Career Development: A number of actions will be put in place (WG3 & 5) to enable the 13 ECIs currently involved in PIMENTO to boost their career potential notably through the possibility of 12 STSMs in 4 years (3/y). Because unfamiliar connections will be made amongst stakeholders, scientists will have new opportunities to be involved as experts in varied scientific councils of authorities relative to food & diet, or in industry. Strengthened connections will be made amongst stakeholders, scientists will have new opportunities to be involved as experts in varied scientific councils of authorities relative to food & diet, or in industry.

3.2.2 PLAN FOR DISSEMINATION AND/OR EXPLOITATION AND DIALOGUE WITH THE GENERAL PUBLIC OR POLICY

The dissemination is under the responsibility of the Dissemination coordinator (WG5 Leader) and the dissemination focus group composed mainly of ECIs (see Section 3.2) to favour the most efficient use of social media & new communication technologies. An initial strategy for dissemination activities has been outlined in consultation with stakeholders and this strategy will be shared with stakeholder representatives at the kick-off meeting (or virtually) to ensure its relevance and impact. The dissemination plan as outlined below will then be validated.

Dissemination plan

Target: Scientists. Key messages: There is a growing scientific interest in FF and their impact on human health, however, how to move from promising results to scientific evidence that FF have health benefits together with balancing risks? A transnational collaboration is necessary on FF, including training ECI and STSM. Resources for R&D in FF are available in EU and accessible for further R&D. The issue of health claims approval by the EU (EFSA) should also be thoroughly discussed towards a legislative framework that will facilitate the reliable but also easier introduction of functional foods in the EU market. Means of delivery: Collaborative article(s) in international and national peer-review journals, ensuring collaboration (and not competition). Open call and summer school for ECIs published on the Hub, SummerSchoolsinEurope.eu and via network's own dissemination tools, such as Research Gate, LinkedIn, and Euraxess (e.g. mailing lists, websites). Dedicated section on the Hub for scientists and key sector events at key sector events such as the Federation of European Microbiology society and FoodMicro conferences will promote results. Open access to FFDb will support further research developments. Establish an industrial-academic cluster will boost collaborations opportunities and knowledge transfers for the next decade.

Target: SMEs and industry. Key messages: There is a growing consumer demand for both local and healthy foods products, including FF. Market opportunities will, therefore, grow in the coming years, but only if we can pave the way for responsible and sustainable productions. We can support SMEs providing training and resources in FF safety, health demonstration properties, regulatory aspects, technical issues etc... We should define together the targets and milestones of the collective action to be done to set the industrial Cluster and its priorities for the three to five years post COST Action. Means of delivery: Dedicated section on the Hub for SMEs providing resources (capacity building material) and information (relevant project results). A new academic-industry cluster will be established to propose training session(s) to SMEs and start-up by communicating via federations/associations, other economic clusters, professional events at national and EU level and their networks. Contribute to technology transfers, innovation growing and collaborative actions to launch the next generation of FF to the market.

Target: Public health and regulatory bodies. Key messages: There is scientific evidence that FF have nutritional and health benefits and public health guidelines need to cover FF. Bottlenecks to innovation need to be addressed at the policy/regulatory level. It is essential to further identify health benefits and risks of FF and national/EU research funding is required. Means of delivery: Representatives will be invited as a network participant so as to create a climate of trust and exchange about FF. Send to representatives the overview of innovation bottlenecks, strategies for health benefits and safety demonstrations, results of health benefits and risks assessments. Solicit their feedback one to one or at

a dedicated workshop to collectively contribute to the implementation of regulatory drafts that can pave the way and secure the development process needed for innovation.

Target: Food and nutrition information councils and professional associations. Key messages: Health professionals need to be aware of the health benefits and risks of FF. Means of delivery: Representatives of the main bodies will be invited to the Kick off and/or to be involved in the network. Invitation to contribute to project workshops. A position paper (from draft format) will be sent to representatives for feedback/validation/dissemination.

Target: Consumers, Media, Chefs and culinary schools. Key messages: What FF are and how they differ from other foods? In addition to their attractive taste FF have nutritional and health benefits and risks. FF can easily be prepared at home. Means of delivery: Information campaigns about nutritional benefits of food fermented products first in participating Countries and then in other European Countries via consumers associations and social media; via also the EUFIC (European Food Information Council) and via the Hub. Articles in consumer, culinary and health magazines and blogs by participating journalists

Exploitation planning: Plans for exploitation will be addressed within the management structure of PIMENTO from project start. Key exploitation issues will be how to maintain the hub post project and how also to ensure that all project results, notably the research roadmap and guidelines are adopted by the relevant stakeholders to ensure maximum impact. PIMENTO partners aim to maintain the network post-funded phase, in order to ensure such a continuation and options for creating a self-sustaining community will therefore be explored both within management meetings (SC and MC) but also in consultation with all participating stakeholders.

IPR Management: All PIMENTO members will collaborate closely with the technology transfer units of their respective institutions or with private patent offices. The key objective of PIMENTO is to integrate and add value to existing results that, in some cases, may already have IP constraints. The Dissemination coordinator will be in charge of overseeing the correct handling of existing IP as well as ensuring that no dissemination activity could potentially harm any potential for new IP either by partners or participants to the WGs.

4. IMPLEMENTATION

4.1. COHERENCE AND EFFECTIVENESS OF THE WORK PLAN

4.1.1. DESCRIPTION OF WORKING GROUPS, TASKS AND ACTIVITIES

The work plan is structured in 5 WGs. Contribution of actors is indicated in 2.2.2 & deliverables in 4.1.2

WG1 Build a multi-actor operational network: An operational and dynamic network of varied type of actors is the first key to fulfilling the objectives of the Action. For that purpose, WG1 will be in charge of building human connections, collective engagement of the objectives (common vision), improved relevance of the network coverage, and efficient tools for communication/co-working to maintain a dynamic beyond regular meetings.

Task 1.1 Kick off, annual meetings and workshops: co-working place and active expansion of the network. Meetings and workshops will contribute to structure the active co-working environment and expand of the network including academic researchers, FF producers (mainly SMEs and start-up, further involved in WG2 and WG4 but also in the industrial cluster, in WG4), and other key stakeholders from media to regulatory bodies. They will also contribute and pave the way for establishing the first interactive European web platform (Hub) on FF (WG5). Milestone: Kick-off meeting, nominations of the MC and setting of appropriate tools [M3], extension of the network by integrating at least 30 new partners every year for the first three years, representative of every COST country and SMEs in priority.
Task 1.2 Virtual co-working place of the Pimento project on the intranet European web platform (Hub). An intranet application will be implemented to facilitate the daily co-working, knowledge

exchange but also share internally the scientific production of the network. Milestone: Specifications of an integrative European HUB on food fermentation with both intranet and internet places (the actual development of the platform is then under the responsibility of Task 5.1) [M6].
Task 1.3 Collective selection of parameters and data to be recorded for FF cartography. To actively federate the PIMENTO network, the crucial task of selecting the type of data and parameters to be recorded in the Fermented food database (FFDb), as well as to define the strategy to collect it, will be collectively performed. Data management processing and format contents to be disseminated will be set as well. It will federate the network by involving all the stakeholders in a founding task.

WG2 Cartography of the current place of FF in the diet of COST Action Countries: The role of FF in the diet of the participating COST members, from North to South and from East to West is enormously variable and has been shaped through centuries, upon geographical, climate, historical, social and religious elements. Such a rich diversity has never been assembled so far into one interactive cartography. WG2 will make use of different sources of existing data, such as historical and scientific literature, relevant internet sources, official FAO, EU and national statistics, nutrition/diet surveys, food production and consumption patterns, as well as personal communications with the main actors in the field in order to perform quantitative analyses and assessments as well as sociological overviews. The knowledge assembled in WG2 is an important input to WG3, WG4 and WG5 and will serve beyond the present Action for any upcoming EU project concerning FF.

Task 2.1 Implementation of Types and volumes of FF mainly produced and consumed per COST Action country. Each partner will contribute to the detailed database fingerprinting types of FF, production as well as consumption volumes along with ways of consumption in each COST Action country. Moreover, the legal status (i.e. PDO, non-PDO, artisanal versus industrial, functional etc.) of FF will be depicted as well as any existing nutrition or health related surveys and claims [M12]. (CC: connected to WG3).
Task 2.2 Implementation of data Producers of FF and food-related research and education units per COST Action country. Using a well-designed questionnaire along with personal meetings, a catalogue of producers will be created, including small, individual producers, SMEs, big companies, and multi-national companies active in the field of FF. Moreover, current and future challenges in FF production, as well as innovation trends along with evolution and perspectives in 2030 and 10 years after will be considered. Furthermore, limitations at the level of raw material availability, natural resources, technology, and financing will also be taken into account. Similarly, active research units in each COST Action country will be considered focusing on current and near-future research/education priorities, funding availability as well as collaboration possibilities with the FF production sector [M18].
Task 2.3 Validation and collective analysis. The FF cartography is validated by the COST action members in order to open the online interactive FF cartography and present the fermented food database (FFDb) with scientific extensions and purposes. Milestone: Publications of the FFDb and a multi-disciplinary opinion paper about the cartography of current FF status in European Diet [M30].

WG3 Health benefits and risks of fermented foods. WG3 aims to answer the following questions: i) What is the most recent state-of-the-art in terms of scientific evidence of nutritional and health benefits conferred by FF? ii) How can safety aspects be integrated into risk/benefit analyses of FF? iii) How can research data on the health risks/benefits of FF be aligned with the consumption of FF across PIMENTO countries to foster the integration of fermented foods in nutritional public health strategies?

Task 3.1 Potential health benefits of FF. Making use of published data, the FFDb developed in WG2 will be expanded to provide a structured description of the systems in which evidence for a health benefit is available. In addition to the food matrix (e.g. animal food, dairy, cheese) and the microbes (e.g. bacteria), FFDb will thus list the bioactive compounds (e.g. γ-aminobutyric acid), the organism (e.g. mice), organ (e.g. neurological system) and disease (e.g., post-stroke depression) systems as well as the specific bioactive properties, including the direction of the effect (e.g. mood status, improved). Milestone: Published data on potential health benefits of FF have been integrated into FFDb [M18].
Task 3.2 Safety aspects of FF. FFDb will also be used to build the evaluation of safety aspects of FF. The scientific literature will be screened by experts to identify potential hazards associated with the FF characterised in Task 3.1. The panel of well-recognised hazards (e.g. biogenic amines, aflatoxins, antibiotic resistance) will be complemented with emerging hazards, in particular in light of newly-

developed FF with uncharacterised starters or complex microbiota. These hazards will be integrated into FFDb with an ontological structure together with the classical risks (microbial pathogens) and similar to the beneficial effects. Milestone: Published data on health risks of FF have been integrated into FFDb [M18]

Task 3.3 Health benefit/risk analysis FF. A weighted score that rates the evidence for a health benefit (positive score) and risks (negative score) will be attributed to the various elements of the FFDb. The score will consider the nutritional and clinical relevance and utility based on guidelines published by regulatory authorities and expert bodies. This score will also integrate new scientific evidence, e.g. by taking into account the positive association between microbial diversity and health. The modular structure of FFDb will allow for an additive ranking of each combination of FF and nutritional or clinical indication. High positive scores will identify specific systems with the best potential for a health benefit. Negative scores will point to safety issues. Milestone: The FFDb contains a scoring system quantifying the health risks and benefits of FF derived from published data [M24].

Task 3.4 Roadmap for the integration of fermentation into nutritional optimisation strategies. Promoting the health properties of FF requests that research data, in particular human data almost exclusively derived from intervention studies (Tasks 3.1-3.3), be aligned with consumer data (observational data). To this end, FFDb will be used to identify the most relevant health benefits and risks associated with the consumption of FF across PIMENTO countries. This analysis will include a description of the ingested microbiomes (at the species level) as well as bioactive compounds. Based on this analysis, a research roadmap will be proposed to shift the risk/benefit balance towards health and integrate fermented foods into nutritional public health strategies. Milestone: A health benefit/risk assessment of major FF consumed in PIMENTO countries has been conducted [M36].

WG4 Federating scientists and FF producers to boost innovation for society. Fermentation is a sustainable process which does not require heavy equipment and is thus accessible to SMEs or local producers for innovation. The functional biodiversity of safe microorganisms characterised during the past decades represents a promising basis for products development and innovations in response to consumer's expectations. WG4 will explore how to facilitate and foster these innovations for producers and society.

Task 4.1 Identify generic bottlenecks to innovations in FF by producers (especially SMEs) and remediating measures. SMEs partners will collectively identify, via a dedicated workshop, existing bottlenecks to further innovation in FF and propose actions/measures to alleviate these bottlenecks and promote innovation. This will be consolidated in a draft position paper which will then be shared with a wider group of SMEs and industry actors in Partner countries (one to one contact under the responsibility of a partner per country), refined and then finalised. Milestone: Draft paper about generic bottlenecks to innovation in FF & remediating measures [M15].

Task 4.2 Capacity building of producers to boost knowledge and resources. Based on the outcomes of task 4.1, the needs of producers (mainly SMEs) in terms of capacity building will be identified, and training objectives and modules will be defined by a multi-actor group (scientists, regulatory bodies, professional training organisations) covering technical know-how, such as safety, access to microbial resources, labelling, shelf life. Priority will be first given to non-competitive research such as the management of safety and/or regulatory aspects related to food microbes and microbial diversity (e.g. safety demonstration, compliance to the Nagoya protocol) and of course, the demonstration of fermented foods health benefits to support their spreading to the market and for society. Any other relevant topic will be further considered to support the development of FF according to the needs of society and market. Milestone: Training expectations/needs are defined [M36].

Task 4.3 Establishment of the first industrial cluster on FF to boost innovation beyond the COST initiative. We will set-up the first industrial cluster federating researchers and industrials (mainly SME) about fermented foods. This cluster should contribute the most relevant challenges of the field and revealed in task 4.1 and 4.2. Functional organisation and business model will be collectively set before launching the industrial cluster. It will prolong the collaborative network beyond the cost time plan and target long-term objectives. Milestone: Functional organisation and business model of the industrial cluster is defined [M42].

WG5 Dissemination, training & events. For long-term impact of the Action, WG5 will support a broad dissemination, training and events.

Task 5.1 Dissemination. Development of an integrative European web platform (Hub) on food fermentation for multi-actor benefits based on the specifications of WG1. Development of the FFDb based on the specifications pf WG2&3. Production of contents to share knowledge on FF to society. Milestone: technical choice among existing platforms [M4].
Task 5.2 Training. Capacity building of Early Career Investigators and Short Term Scientific Mission (STSMs) to support young scientists. Milestones: Involve young scientists in the management of each WG together with the senior WG leader [M3], Organization programme for STSMs of ECI [M6], Organisation/content of one transdisciplinary summer school per year about health benefits of FF derived from state-of-the-art research [M13].
Task 5.3 Events. The aim of this task if to stimulate curiosity and interest of stakeholders, among them citizens, journalists, companies and regulatory bodies, on FF and their health benefits in order to accelerate diffusion of validated knowledge, innovation, and discussions on nutritional policy. We will join fermented foods festivals and scientific congress in different Action member country every year to present the results of the working actions and every key publications and build bridges amongst actors and communities. Three specific events targeting important stakeholders at different step of the project will be also planned: one opening night to share the interactive cartography with citizens showing its interest and how to use it; a scientific meeting targeting regulatory bodies to present the scientific roadmap and a last one targeting SMEs and industries when we will inaugurate the first industrial cluster on FF.

Management: This work plan will be managed according to the "rules and procedures for implementing COST Actions". During the kick-off meeting, the Management Committee (MC) will officially elect the Chair, Vice-Chair, and the WG Leaders of the Action. Each WG will be coordinated by a leader and deputy leader involving at least one ITC member or ECI per WG taking into consideration a good gender balance. In addition, there will be two transversal leaders to ensure the successful impact of the Action: An Event coordinator (EvC) and a Strategic intelligence advisor (SIA). The Chair, Vice-Chair, WG leaders and deputies as well as the EvC and SIA will form the Core Group (CG). The MC will meet once a year in order to, scientifically, administratively and financially oversee and manage the Action, ensuring that outcomes are delivered in due time and within the budget. The CG will meet at least twice a year, as far as possible jointly with the MC annual meeting and in-between times by videoconferences. The GC will follow precisely the implementation plan, associated risks and oversee contingency plans and actions. The SC will also ensure collaboration and communication a cross WGs and prepare the agenda of the MC meeting and any associated material for decision-making. The CG will be supported by a Secretariat from the Grant Holder Institution . The WG leaders and deputies will be responsible for the management of their WG and the achievement of the objectives and deliverables scheduled and validated by the SC. **Dissemination** being a core part of PIMENTO the WG5 leader (Dissemination coordinator) will be supported by a dissemination focus group drawn up from ECIs as well as volunteers from partner SME teams. This focus group will be responsible for identifying the best dissemination channels for communicating PIMENTO results for the different target stakeholder groups so as to maximise the Action impact. A webmaster as part of the Secretariat will be a key person for the internal dissemination of information between members will maintain up to date the Hub. The EvC is in charge of overseeing the organisation of all events (PIMENTO annual meeting, workshops etc...) and in ensuring that the expected impact of each event is maximised and correctly evaluated (via feedback questionnaire and subsequent analysis). **The SIA is in charge of the strategic intelligence** related to PIMENTO key challenge including emerging state-of-art, policy, initiatives and actors. The SIA will also inform and advise the SC & MC as regards the key stakeholders to be integrated as well as potential barriers to reaching impacts. By creating connections, the SIA will ensure the relevance and impact of the COST Action.

4.1.2. DESCRIPTION OF DELIVERABLES AND TIMEFRAME

- D1.1: Annual meetings involving all Action members [M12-24-36-48].
- D1.2: The intranet application of the European Food Fermentation Hub platform for virtual co-working and exchanges of the network [M6].
- D1.3: The content and strategy to collect the data of the FFDb are collectively set [M12].
- D2.1: Table of types of FF as well as production and consumption volumes in Partner countries

[M24].

- D2.2: Qualitative multi-dimensional report of the production sector and research activities on FF in the Action countries [M24].
- D2.3: An open interactive cartography of FF per country is available, with quantitative and qualitative data accessible on the Hub (D5.1) and continuously incremented by each new COST Action entering partner [M30-M48]. The scientific extension od the cartography dedicated to research and scientific purposes (FFdB) is available as well.
- D3.1: Qualitative review article on the scientific evidence of the health benefits of FF, including open- source publication of FFdB database [M24].
- D3.2: Quantitative review articles (e.g. systematic literature review, scoping paper and meta-analysis) on the scientific evidence of the nutritional and health benefits and risks of FF [M30].
- D3.3: (qualitative/quantitative) review articles of the scientific evidence of the nutritional and health risks and benefits of major FF consumed in at least 4 partner countries [M36].
- D3.4: Publication of a research roadmap to shift the health benefits/risks balance of FF towards health and integrate fermented foods into nutritional public health strategies [M44].
- D4.1: Final validated position paper about generic bottlenecks to innovation and remediating measures [M18].
- D4.2: The working priorities of the first industrial cluster are set [M36].
- D4.3: Establish and inaugurate the first industrial cluster on FF to boost innovation and place EU SMEs/industries ahead [M48].
- D5.1: The European web platform (Hub) on food fermentation for multi-actor benefits based on the specifications is on line [M12].
- D5.2: Annual summer school for Early Career Investigators and Short Term Scientific Mission (STSMs) to support young scientists [M13-M25-M37].
- D5.3: Three flagship events focusing on the main outcomes of the COST initiative and targetting different stakeholders [M24, M44 M48].

4.1.3. RISK ANALYSIS AND CONTINGENCY PLANS

As part of the Management activities in PIMENTO a risk management plan will be drawn up at project start. This plan will outline a simple procedure for managing risks in the project and contain a risk register (based on the initial one outlined below) so that the CG can monitor and act upon the risks. For each risk identified, a PIMENTO member will be responsible for following the risk and advising the SC of the appropriate contingency action to put in place. Members will be asked to identify new risks on a regular basis in the project reports and at project meetings.

WG	Risk description	P*	I*	Contingency plan
2	Lack of heterogeneous data available at national level, thus insufficient data to carry out a complete cartography, difficulties to involve stakeholders to enrich the FFDb.	M	L	Several countries and stakeholders certainly have available data which will make the WG still feasible; Use of data from EU cohorts. Personal communications with the actors involved will also be employed. Attention will be paid on the return of structured data to all stakeholders and beyond
3	Absence of consensus within experts of health benefits/risks as outlined in literature and on a future common analytical strategy/methodology.	L	M	Agree on methodology at start to avoid later disagreements—Plan sufficient time and opportunities of co-working between experts. Invite external independent experts to give an opinion if consensus is lacking.
4	Insufficient involvement ofSMEs/industrials to identify bottlenecks or the establishment of the academic/industrial cluster	L	M	13 SMEs are actually members and 8 others SMEs showed a clear interest in the industrial cluster, which is enough to build a critical mass.

				Possible dropouts will be compensated actively by engaging new SMEs into the Action.
1,5	Difficulty in collaboration between scientists and non-scientists	L	L	Collaborative activities (project-related and social) will be planned during project meetings and via the hub throughout the project. The quality of the collaboration within WPs will be assessed during the MC meeting.
5	Difficulty engaging with regulatory bodies / Lack of interest/dialogue	L	M	Invite regulatory bodies very early in the project (kick-off) a n d f o r scientific workshops during the whole project to promote regular exchanges and mutual consideration.
1	Difficulty to organise kick off meeting and workshops and/or to contribute to festivals and scientific symposia due to the Covid-19 crisis.	H	H	Collaborative activities, including the kick-off meeting, will be virtually delocalised according to the sanitary situation.

P = Probability* I= Impact H=High M= Medium, L= Low

4.1.4. GANTT DIAGRAM