LEAP-Agri

A Long-term EU-Africa research and innovation Partnership on food and nutrition security and sustainable Agriculture

LEAP-Agri funded projects

Projects' Information Booklet

October 2018

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LEAP-Agri : A long term EU-Africa research and innovation partnership on food and nutrition security and sustainable agriculture

Global context

Despite a slight improvement in recent years, about 800 million people are still starving worldwide, and around 2 billion are suffering from "hidden hunger", i.e. a vitamin and mineral deficiency, while 1.9 billion are overweighed and 600 million are obese. At the same time, the world population continues to grow, thus increasing the demand for food.

Within the next three decades more than two third of this population growth will take place in Africa. Agriculture is still the basis of African economies and societies supporting more than half a billion Africans. In line with the demographic dynamics in Africa, the role of agriculture, food processing and food trade will remain crucial for many African countries and for jobs creation. A large proportion of African farm labour is provided by women and youths, who often lack access to land, resources and education. While most agricultural actors are involved in primary production, the demand for value addition is rising, but many African countries largely depend on food imports making the population more vulnerable to food price volatility. The SSA's incipient economic transition makes it necessary to keep workers in agriculture and food transformation, and to think cropping systems innovations taking into account the ASS's job equation.

To improve the food situation, sustainable food-systems must be developed and implemented. African-European research on agriculture and food plays a key role in improving food-systems and nutrition. Last but not least, agriculture is both part of the problem and of the solution to climate change mitigation and adaptation, and increasingly unpredicted climate patterns lead to crop failures and land degradation.

The LEAP-Agri project

The African European High level Policy Dialogue on Science, Technology and Innovation decided to give priority to Food and Nutrition Security and Sustainable Agriculture (FNSSA) and build a "Road map" in order to implement its strategy.

The LEAP-Agri project is part of this Road map implementation. LEAP-Agri is built as an "ERANET Cofund project", and join forces from 30 European and African partners (*including 24 Funding Agencies from 18 countries*) based on shared responsibilities and duties, with the financial support of the European Commission. 33 million € has been jointly committed to support this project.

Africa: Algeria, Burkina Faso, Cameroun, Egypt, Ghana, Kenya, Senegal, South Africa, and Uganda;

Europe and associated partners: Belgium, Finland, France, Germany, The Netherlands, Norway, Portugal, Spain, and Turkey

International organisation : CIHEAM-IAM (*based in Italy*)

The primary objective of LEAP-AGRI is to establish a long term EU-Africa Research and Innovation flagship partnership on food and nutrition security and sustainable agriculture. LEAP-Agri is about building an ambitious initiative, built and brought jointly by a large number of African and European partners, dedicated to Food security and nutrition challenges, with a major change in scale compared to already existing initiatives.
LEAP-Agri is also about bringing accurate and scientifically validated information to decision makers in order for them to elaborate appropriate proposition relevant to the still critical food security and nutrition situation faced by hundreds of millions of people in various African countries.
The LEAP-Agri mechanism is based on two complementary approaches:
- The preparation and implementation of a joint call for proposals for collaborative R&I projects between European and African partners, and the joint funding of the selected projects;
- Feeding the EU AU partnership on FNSSA, with a focus on identification of innovative instruments, on communication and dissemination of results emerging from LEAP-Agri activities. Contributing to definition of a joint Strategic R&I Agenda in the FNSSA domain, and liaison with relevant public and private stakeholder in Europe and Africa are also key expectation from LEAP-Agri.
LEAP-Agri started on December 1st 2016, with a Kick off meeting in Pretoria (South Africa) in December 2016.

The LEAP-Agri R&I projects

The Call for Proposal was launched on 15 March 2017, with a two-step procedure. Each proposal include at least four teams from two African and two European LEAP-Agri countries. 200 preproposal (*involving more than 1000 teams from Europe and Africa*) have been submitted. The independent "International Review Panel" on behalf the Call Secretariat responsibility conducted preproposal evaluation and ranking. The IRP ranked 94 Preproposal as eligible for the Full Proposal step, based on H2020 criteria with priority given to both high scientific quality, EU AU partnership, relevance for FNSSA and Impact pathway analysis.
The Group of Funders meets on 20 April 2018 in The Hague and selected for funding 27 first class full proposals, based on the IRP ranking and on the 24 Funding Agencies and EC financial commitments.
These 27 projects involves more than 160 African and European teams from 20 countries and cover the whole range of Food System topics. The projects relates in priority to sustainable agriculture, then to food and nutrition, and to trade and markets in FNSSA. Projects start activities on 1st September 2018 for a three years duration, with a Kick Off meeting organized in Bari, Italy, on 9 and 10 October 2018.
LEAP-Agri is then evolving from a EU AU "Funders Alliance for FNSSA" towards a "Research and Funders Alliance for FNSSA". These projects will then contribute to the enforcement of knowledge-based system on Food and Nutrition Security and Sustainable Agriculture (FNSSA), and should support the EU AU High Level Policy Dialogue (HLPD) on R&I on FNSSA.

Cluster 1: Sustainable Intensification

1.1. Agroforestry systems
1.2. Sustainable water management
1.3. Sustainable food security
1.4. Soil science and remote sensing
1.5. Plant sciences
1.6. Animal sciences

WAGRINNOVA

Co-innovations across scales to enhance sustainable intensification, resilience, and food and nutritional security in water-managed agricultural systems in West Africa

1. Project's summary/abstract:

The development of irrigated and improved lowland agriculture in Western Africa (WA) has not resulted in a significant increase in food security or in a motor for economic growth, in spite of its large potential and the great benefits observed in other regions of the world. When successful, irrigated agriculture reduces crop failure, increases cropping diversity and land productivity, contributes to balanced nutrition and to develop food markets and agroindustry, and generates employment; conversely, it has environmental implications. WAGRINNOVA aims at deepening on why irrigated agriculture has not resulted in the expected impact in Western Sahel, and at setting the basis for changing this, particularly now that there is a revival of investment in rehabilitating abandoned or degraded irrigated land. We use a multiscale approach and participatory action research for characterising and benchmarking current conditions, and for co-designing innovations and developing environmentally-friendly and economically-viable systems adapted to local conditions in innovation hubs. These activities are accompanied by the required capacity building with special attention to the participation of youth and women in the opportunities brought by crop diversification and ICT tools. The consortium, integrated by five African institutions, five European, and five associate partners, aspires to change the development paradigm for irrigated and other water-managed agricultures in WA and identify environmental-friendly systems in WA and Spain.

2. Project's main objective (s):

The research objective is a systemic multidiscipline multiscale evaluation of water-managed systems to identify their constraints, potential and enabling environment that leads to sustainable intensification through appropriate technical and governance solutions, and market-oriented crops.

The innovation objectives are:

- Simultaneous multiscale interventions based on participatory approaches, to override production, organizational, environmental and socio economic constraints.
- Strengthening collective capabilities to improve governance and sustainable water use.
- Empowering women and youth by bringing opportunities derived from new crops and ICT tools.
- Strengthening West African research and technical potential by boosting researchers and graduate's capacities and by enriching existing partnerships.
- Fostering win-win situations between the agricultural sector and irrigation developers.
- Providing essential information for policy orientation and formulating relevant related recommendations.

Consortium

Five African Partners

- **UGB** (Université Gaston Berger, Senegal; 74,700€): S Seck (sidysecksn@yahoo.fr), I Diatta, SM Fall, L Diop, MD Diallo
- **ISRA** (Institut Sénégalais de Recherches Agricoles, Senegal; 75,700€): D Dia (djibydia@gmail.com), CS Fall, AB Bocar, M Cisse.
- **SARI** (Savannah Agricultural Research Institute, Ghana; 74,470€): W Dogbe (wilsondogbe@yahoo.com), IY Baba, M Mawunya, R Adombila, E Martey
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- **INERA** (Institut de l'Environnement et de Recherches Agricoles, Burkina Faso ; 121,535€): K Ouattara (korodjouma_ouattara@hotmail.com), I Ouedraogo, I Serme, LP Yameogo, E Sauret, AN Bama

Five European Partners

- **IRD** (Institut de recherche pour le développement, France; 101,696€): JC Poussin (poussin@ird.fr), G Serpantié, A Ogilvie, D Martin.
- **CIRAD** (Centre de coopération internationale en recherche agronomique pour le développement, France ; 98,279€): S Marlet (serge.marlet@cirad.fr), B Barbier and JL Fusillier, A Adamczewski.
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- **CIHEAM-Bari** (Mediterranean Agronomic Institute of Bari; 90,000€): N Lamaddalena (lamaddalena@iamb.it)
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Five Associate Partners

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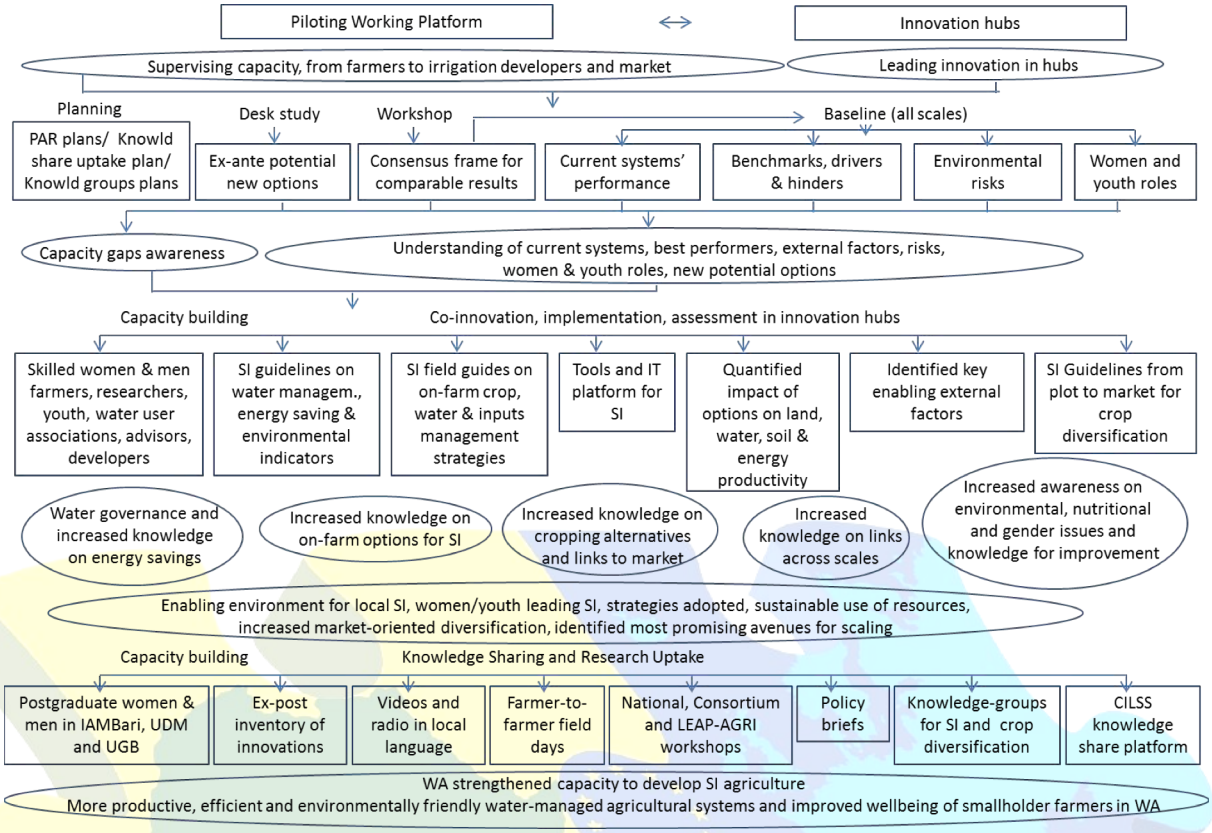
Sub-themes:

- Sustainable water management
- Sustainable food security

3. Theory of Change and Impact Pathway



Main assumptions are that stakeholders will be fully involved in the project, and that new strategies will result in quantifiable improvements. Scheme leaders and farmers are also expected to understand long-term environmental benefits of planned interventions and will be willing to adopt proposed strategies. We also assume that there are opportunities for market-oriented products.

4. Expected outcomes and impact

Expected outcomes are:

- Enabling environment for SI (# policy/decision makers sharing outcome; performance gaps map; # enterprises for SI);
- Women and young practitioners leading the SI process (# women and young practitioners involved in the SI process);
- Adopted on-farm technologies for SI (# new technologies adopted in innovation hubs; multiplier factor);
- Sustainable use of agricultural water, energy, land and inputs (increment in productivities in hubs; multiplier factor);
- Increased productivity, diversification, market-oriented ag production (increment of production, products and income in hubs; multiplier factor);
- Irrigation scheme/lowland valley organizational models in place (adoption of improved organizational models in hubs);
- Network to support upscaling through an ICT platform (accesses and use from hubs and elsewhere).

Expected impacts include:
a) Improved wellbeing and more resilient small farmer households and communities by identifying the enabling environment, training and adopting technologies leading to SI, and by women and youth profiting from new opportunities offered by SI, including market-oriented crop diversification and use of ICT tools;
b) Improved sustainable use of agricultural water and soil resources, and increased awareness of environmental issues, by improving organizational models in irrigation schemes and lowland production groups, applying tools to improve crop, nitrogen and water management, capacity building and adopting technologies leading to SI;
c) Enhanced capacity for SI by on-site training, short specialized training and postgraduate education, tested guidelines and tools to support SI, network to support upscaling through an ICT platform and knowledge-based policy recommendations.

This research is funded as a part of the ERA-Net Cofund LEAP-Agri (grant no. 727715) through a virtual common pot model with EU top-up.

PASUSI

Participatory Pathways to Sustainable Intensification. Innovation platforms to integrate leguminous crops and inoculants into small-scale agriculture and local value chain

1. Project's summary/abstract:

Feeding the world's population in an environmentally and socially sustainable way is a major challenge for the future. Farmland should be used productively without compromising the environment. Sustainable intensification can contribute to this goal by mitigating climate change, creating better soil fertility and health and improving resilience, while providing nutritious food to humans and feed to cattle. Legumes have the capacity to fix nitrogen, when inoculated with rhizobia, which can be used as biofertilizers. PASUSI will develop ways to integrate this technology in local farming systems, evaluate the economically viability and risks connected with these crops, and support local biofertilizer production. The target crops are cowpea, soybean, groundnut and Bambara groundnut which form an important dietary basis in Ghana and Uganda, and are commonly grown by women. For a lasting impact, farmers need to be actively involved in developing sustainable intensification models. Therefore, we take a participatory approach, involving both farmers and other relevant stakeholders through establishing Innovation Platforms. We aim at a holistic approach to find integrated, lasting solutions for both production, environment and for the rural community. Producing high quality biofertilizers requires knowledge and skills about rhizobium bacteria isolation and characterization, carrier material, quality control, proper storage and distribution. Current rhizobia inoculant production chains in Ghana and Uganda will be developed in collaboration with a skilled Finnish inoculant producer and scientific partners in Norway and Finland. The laboratories in Ghana and Uganda will be equipped for the purposes and scientists trained. The expected impact is improved food security, livelihoods and economic improved income generation for small-scale farmers, increased capacity of scientific and technical staff as well as positiveenvironmental effects and improvements in community resilience.

2. Project's main objective (s):

The overall aim of the project is to improve productivity, livelihoods, nutrition and household wellbeing in Ghana and Uganda, while counteracting environmental degradation and mineral depletion caused by monocultures. The study will address both the individual farm level and the rural community level. Introducing the use of biofertilizers through a participatory process can highlight the potential of location-based resources, and empower the community more widely. This will be achieved by supporting the capacity of local stakeholders to transform their farming systems towards sustainable intensification (SI) and climate-smart agricultural practices

Consortium

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Sub themes:

- Sustainable food security
- Soil sciences and remote sensing
- Plant sciences

3. Theory of Change and Impact Pathway

3.1 Summary ToC with assumptions

The expected impact is improved food security, nutritional capacity of women and households, economic outcome and livelihoods for small-scale farmers and for the rural community This will be achieved through capacity building of different stakeholder groups, from scientific and technical capacity in producing quality biofertilizers, to supporting the actors of the Innovation System to integrate the technology in a sustainable way. Participatory methods, will include IPs, trainings, seminars and ongoing dialogue with stakeholders, including local agricultural extension offices and policy makers, as well as farmers, women's groups, local youth in agribusiness, agro-input dealers, FBOs and agri-based NGOs.

The use of nitrogen-fixing rhizobium bacteria has positive environmental impact in the long-term, through improved soil structure, increased soil organic matter and nutrient content and sequestration of carbon dioxide, which increases productivity and contributes to soil and plant health. These positive impacts and related cost will be evaluated in the cost-benefit analysis to obtain estimates of the net value on societal level. The expected impact will be that decision makers on household, community, FBO and Ministry level will understand the social, environmental, nutritional benefits and costs related to intercropping, use of inoculants and new cultivation and nutritional activities.

Farm level technical efficiency and gross margin calculations will show economic outcomes for stakeholder groups on how to improve economic outcomes. Small- scale farmers and women-farmers will be able to assess and improve economic outcomes of alternative crops and crop rotations as well as use of rhizobium bacteria. Cost benefit analysis will give an overall estimate of the net social benefits for following up actions.

The expected outcome of nutrition educational activities will be improved household and community capacity to preserve and process legumes and cereal, better postharvest handling, food diversification, infant and young child feeding and better capabilities of women and youth to address nutrition, processing and trading.

The expected outcome is increased capacity of farmers as well as local models and solutions for integrating the technology in a sustainable way. Especially for women farmers, who are the main producers of legumes, PASUSI is expected to improve income, livelihoods and economic independence. In addition, PASUSI will strengthen the resilience of the whole rural community by addressing its own resources in their fields and among the people.

Through training of FBOs R&I impacts will be scaled up on regional level to hundreds of farmers. This implies engaging FBOs from the beginning, in cooperation with Ministries of Agriculture. The expected impact will contribute to nine of the Sustainable Development Goals (no. 1, 2, 3, 4, 5, 12, 13, 15 and 17).

The expected outcome of the laboratory trainings is high level skills in pure-culture technique, strain identification and classification using molecular and bioinformatics tools, phenotypic testing (effectiveness, denitrification), strain preservation, inoculant production and quality control, which is the prerequisite for quality local production.

In addition to the IP and training activity, a larger group of stakeholders will be reached through extension material (communication strategy). The materials will target extension agents, agro-dealers, farmers, technicians and scientists. Printed materials include handbooks, leaflets, posters, one-page instructions, policy-briefs and production guides for the legumes and inoculants use. Results will be published in high-impact scientific journals. Local and international conferences, workshops, symposia will disseminate knowledge and information to both the local and international communities.

3.2 Expected outcomes and impact:

The expected impact of the project is improved food security and livelihoods for small-scale farmers. This will be achieved through capacity building of different stakeholder groups, from scientific and technical capacity in producing quality biofertilizers, to supporting the actors of the Innovation System to integrate the technology in a sustainable way. Participatory methods, trainings and communication will play key roles in achieving this. The methods will include IPs, trainings, seminars and ongoing dialogue with stakeholders, including local agricultural extension offices and policy makers, as well as farmers, women's groups, local youth in agribusiness, agro-input dealers, farmer-based organizations and agri-based NGOs.

PASUSI

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This research is funded as a part of the ERA-Net Cofund LEAP-Agri (grant no. 727715) through a virtual common pot model with EU top-up.

AFRICA

On-site air-to-fertilizer mini-plants relegated by sensor-based ICT technology to foster African agriculture

1. Project's summary/abstract:

The project is to develop a green-energy driven technology solution to support the on-site fertiliser production in Africa, providing cost-affordable fertilisers to local small-scale farms. This will contribute to the development of sustainable agriculture and food systems in Africa. The proposed research is based on nitrogen fixation with non-thermal plasma technology, which has been intensively developed in the applicant's research group. Using nothing else than air or N2/O2 (air with additional oxygen) as raw material, NOx is produced through the chemical reaction in plasma which is generated from a variety of renewable energy sources such solar, wind and biomass. This research will enable the production of liquid fertilisers on demand to be applied directly to the soil, dissolved into irrigation water for foliar application. Test plants will be built in Uganda, South Africa and Ghana with a practical study of the soil and crops' conditions. The use of sensor technology attached to mobile devices will be explored to enhance the quality of soil and food. Even more, it is meant to provide rural farmers with the necessary knowledge and insights. It is the medium to allow relegation of process monitoring to central computer systems (Chemical Internet of Things) to achieve maximum results. An environmental and economical assessment will be provided to achieve a comprehensive understanding of the sustainability impact brought by the new technology and processes.The success of this project will open a new window of opportunity in the development of sustainable agriculture in Africa as well as other regions in the world.

2. Project's main objective (s):

The ultimate goal of this research is to improve sustainable small-scale farming in Africa. To achieve this, three goals are planned to reach in this proposed research: (1) provide a green fertiliser production process for sustainable agriculture; (2) reduce the yield gap in African agriculture using a cost-affordable fertiliser; (3) improve farmer's knowledge and awareness of agriculture by training and online chat centre. The main objective of this project is to develop on-site fertiliser production mini-plants to provide cost-affordable fertiliser, and combining with the development of sensors and ICT technology to enhance the quality of soil and food production. This research will include:

- Lab scale development of fertilizer mini-plant
- Development of sensors and ICT enables process control and provide information (soil, weather, liquid fertilizer, market price etc)
- Agronomic/soil research based on liquid fertilizer and local farming situation.
- Implementation of mini-plant in Africa.
- Evaluate sustainability and economic impact.
- Training and education provided (especially to local female and youth)

Consortium

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Sub themes:

- Sustainable food security
- Soil sciences and remote sensing
- Plant sciences

AFRICA

3. Theory of Change and Impact Pathway

3.1 Summary ToC with assumptions

It is expected to develop advanced plasma based N-fixation technology and related fertiliser production plant for the agriculture in Africa. The test plant will be able to produce low cost fertilisers a least 40% cheaper than the existing price (~1 dollar/kg). The capacity of the test plant should reach 2 mo of NO3- /day, enough to produce 1.24 kg of liquid solution with 10% KNO^3 Concentration for distributior and dilution. Considering the average fertiliser (Urea) usage of 13 kg/ha over a year, the test plant will be enough to supply more than 1.5 hectare of farmland. A better understanding of the agronomic and environmental aspect will be gained. A better management of resources for both the fertiliser productior and local farming can be achieved through ICT/mobile technology. Training and education will be provided through the research to support local farmers with their farming activities.

3.2 Expected outcomes and impact:

Outcomes:

- Costaffordable liquid fertiliser
- Improvement of fertilising local small-scale farms
- Educated and trained farmers
- Sustainable fertiliser production process
- Narrow the gender gap in agriculture
- Employment of youth in agriculture

Impact:

Success of this proposed research will generate outcomes such as a sustainable onsite fertiliser production process which providing cost-affordable liquid fertiliser and improvement of fertilising local small-scale farms. Farmers will be trained and educated, the gender gap in Africa agriculture will be narrowed and emplyment of youth in farming will be increased. Finally, a series of impact can be made which largely benefit the famers, enviroment, agriculture and society. This research project could help establish sustainable agriculture and its stimulate grow, Improve the life, wealth and well-being of farmers, including financial condition and level of education, provide a green process for sustainable agriculture and Promote youth and women's role in agriculture

This research is funded as a part of the ERA-Net Cofund LEAP-Agri (grant no. 727715) through a virtual common pot model with EU top-up.

Pest-Free-Fruit

Sustainable intensification of fruit production systems through innovative pest bio-control technologies

1. Project's summary/abstract:

In sub-Saharan Africa, sustainable intensification of fruit production is affected by pests that strongly impact food and nutrition security. The invasive fruit fly, Bactrocera dorsalis, is a permanent threat to fruit crops, particularly mango. Direct loss is caused by larval feeding in the fruit, but significant indirect loss results when market opportunities are inaccessible due to quarantine restrictions. Another key pest is anthracnose, the most serious disease of mango worldwide. The combined effect of these pests threatens the sustainability of mango production systems, as current pest control methods are insufficient to minimize crop losses.

Main objectives of the present project include (i) developing transformative pest control based on the use of insects as smart and reliable conveyors of biopesticides (entomovectoring), and (ii) co-designing with stakeholders biocontrol strategies as part of an integrated pest management framework. High-quality basic and applied research including lab and semi-field tests and small-scale field trials will be performed in Senegal and Kenya to optimize the interactions between insect conveyors (particularly sterile male fruit flies), entomopathogens, and target pests, assess environmental risk, and co-design pilot implementation with stakeholders. Expected results include the design of a two-in-one technology to control mango fruit flies and anthracnose.

A key innovation of the project is the coordinated, preventive and area-wide approach, which ensures that all habitats of the target pest are treated, thus limiting re-invasion, as opposed to conventional strategies that focus on independent and often reactive grower interventions at the orchard scale.

2. Project's main objective (s):

The proposed Project aims to develop and promote novel, cost-effective and system-wide biocontrol technologies that contribute to the sustainable intensification of fruit production, particularly for small-scale growers in Africa.

Consortium

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Sub themes:

- Sustainable food security
- Pest and disease control

3. Theory of Change and Impact Pathway

3.1 Summary ToC with assumptions

Evidence indicates that invasive fruit flies and anthracnose cause significant fruit losses in sub-Saharan Africa (SSA) because of lack of effective control strategies and resistance to insecticides. The Project is championing research to develop a transformative biocontrol system to control both B. dorsalis fruit flies and mango anthracnose. The control approach will be promoted in targeted areas in Kenya and Senegal in collaboration with local stakeholders, and also through awareness creation about the use of SIT. Adoption of the control strategies is expected to reduce significantly fruit losses in the targeted areas. This will lead to increased fruit production and quality, increased income for smallholders, improvement of food and nutrition security, and better health. The subsequent reduction of pesticide use should benefit the environment, including the restoration of biodiversity and its ecological functions such as natural pest control.

Central to the theory of change (ToC) is the assertion that household-level outcomes of food security, resilience and poverty reduction will not arise from the sole availability of component solutions, policies and improved farming and food practices. Developing context-specific institutional solutions, new market opportunities for agricultural products (here export and organic markets, or transformation), small local units for biopesticide production, new regulatory framework for SIT and biopesticides, will be critical to enabling change agrifood systems and the livelihoods. The emergence of organizational capital (e.g. farmer cooperatives) will be also expected through capacity building, strengthened assistance from extension services and governmental bodies, and support by public policies, for better access to and use of biopesticides and collective pest management.

3.2 Expected outcomes and impact:

Project is expected to contribute to initiation and execution of collaborative research, including public and private sector, academia, civil society and farming communities that will also contribute to promotion of the improved insect pest control methods. Gender sensitive and inclusive approaches will be followed in the Project intervention strategies to ensure gender equality and equity in the Project, including balanced selection of women and men farmers in participatory field experiments. In addition, capacity building component of this Project will pay attention to vulnerable and less advantageous groups (women and youth) including engaging qualified female candidates for postgraduate level training. The results achieved through the innovative biocontrol technologies will be tracked and their outcomes and impacts on mango productivity, income and food security documented and shared with wider stakeholders for further scale up and sustainability. This will be achieved through a workable Monitoring and Evaluation (M&E) and impact assessment approach. A M&E team will be in charge of the extensive collection of primary data in the experimental sites and in a control area of comparable ecological conditions among different categories of stakeholders that will benchmark end of Project data to assess the progress towards impacts. The M&E will inform the Project on whether targets have been met or not, identify areas for improvement and suggest changes. Information gathered, lessons learned and way forward will be shared with the stakeholder platform in the form of workshops and bilateral meetings.

This research is funded as a part of the ERA-Net Cofund LEAP-Agri (grant no. 727715) through a virtual common pot model with EU top-up.

AFRICA-MILK

Promote ecological intensification and inclusive value chains fo sustainable African milk sourcing

1. Project's summary/abstract:

Today in Africa, demand for dairy products is rising. However, dairies have difficulties to source local milk in terms of volume, regularity and quality. Sustainability of dairy production, contribution of dairy to food security, and inclusion of producers in value chains (i.e. women and youth) are becoming major stakes.

Africa-Milk supports co-design and implementation of technical, organizational and institutional innovations to increase and secure local milk sourcing, considering the potential of ecological intensification of milk production and the development of inclusive milksheds to reach this objective.

The overall consortium includes African research organizations (ISRA, INERA, UoN, FIFAMANOR), WUR and CIRAD in Europe, all with strong experience on African milk production and sustainable development, and nine processors in four countries (Senegal, Burkina Faso, Kenya, Madagascar), covering a variety of agro-climatic and production contexts.

The project is organized in four tasks:
1. Baseline studies, establishment of local dairy innovation platforms (DIPs)
2. Co-design of efficient and inclusive milk collection systems
3. Co-design of intensive and ecological dairy farming systems
4. Monitoring, evaluation and learning

Expected results: researchers have delivered a support approach to co-design innovation; engaged stakeholders have established DIPs; DIPs have tested and, where possible, implemented organizational and institutional innovations in milksheds; engaged producers have tested and implemented technical innovations at farm level.

2. Project's main objective (s):

- Co-design and implementation of efficient and inclusive milk collection systems through organizational innovations (optimized collection routes, functional collection centers, use of cooling systems), and institutional innovations (contractual arrangements between dairies and producers through milk delivery contracts, including seasonality-based and/or quality-based milk payments)
- Co-design and implementation of intensive and ecological dairy farming systems based on improvement of cow feeding systems using local resources, and simple practices to improve milk hygiene (technical innovations)

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Sub themes:

- Animal science

3. Theory of Change and Impact Pathway

3.1 Summary ToC with assumptions

Co-design of innovations runs with local dairy innovation platforms (DIPs) will boost results, outcomes, and impacts of the project:

(1) Goals of the DIP's stakeholders taken into account with the results of the baseline studies to identify best-fitted potential innovations;

(2) Involvement of DIP's stakeholders all along the co-design and implementation process for tuning, and adaptation of innovation to the needs;

(3) Involvement of DIP's stakeholders in the training sessions to boost the scaling out of the results inside the national dairy sector networks;

(4) Establishment of a result exploitation plan to spread the highlights of the project trough Africa dairy policy research and development networks (findings, scientific papers, leaflets, policy briefs).

3.2 Expected outcomes and impact:

Expected outcomes outcomes: stakeholders have increased innovation capacity; stakeholders have implemented efficient and inclusive milk collection systems; and producers have implemented intensive and ecological dairy farming systems.

Expected impacts: (1) better profitability for stakeholders, based on increase in the amount of milk produced, processed and marketed; (2) job opportunities along the value chain and better consumer access to dairy products; (3) more intensive and ecological farming systems thanks to reduced use of synthetic inputs.

This research is funded as a part of the ERA-Net Cofund LEAP-Agri (grant no. 727715) through a virtual common pot model with EU top-up.

RAMSES II

Roles of Agroforestry in sustainable intensification of small farMs and food SEcurity for SocIetIes in West Africa

1. Project's summary/abstract:

Agroforestry is a form of agriculture "alternative" to conventional one, which provides multi-functional environmental, agronomic, economic and social benefits able to support sustainable improvement of food, nutrition and economic security of small farmers in West Africa. Locally, the woody cover constitutes fertility islands able, if suitably managed, to improve crop yields and provides complementary food and income to producers while mitigating climate change effects by buffering micro-climate variations and water and wind erosions. Globally, woody cover contribute to reduce greenhouse gases through carbon sequestration and regulation of water and nutriments cycles, a starting point to design more resilient and climate-smart farming systems from millennia practices in Africa.

However, tree density in parklands depends on balancing crop yield decline, due to competition with trees for vital resources, with advantages provided by trees according to the social, economic and environmental priority ranking that farmers give to parklands. Parkland management depends also on the user access facilities that are under the control of State and customary land and territorial rights on land and natural resources. In addition, Sudano-Sahelian parklands are located on a continuum of population density and depend on the duration of fallows between successive cropping cycles. Fallows must be long enough to support regeneration of woody species, biodiversity, and soil fertility. With current population increase (about 3%/yr), food crop production is currently improved by increasing cultivated land areas, since yields are still stable or decline, and by agricultural mechanization. The effects and impacts of these practices are variable on fallow dynamics, clearing, and woody species regeneration, consequently on parkland sustainability.

RAMSES II seeks to diagnose most of the aspects of the current drivers of the studied parklands trajectories and to quantify and model processes involved in crop-trees interactions. Results will be used in a participative modeling at farm and territory scales to simulate impacts of intensification scenarios chosen by stakeholders on economic, agronomic and environmental performances at the plot, farm, territory, and landscape scales.

2. Project's main objective (s):

To maximize their adoption, RAMSES II aims at providing Innovative Scenarios for Managing Sustainable Intensification (ISMSI) that will be co-built with all the stakeholders involved in the four most common Sudano-Sahelian agroforestry parklands based on cereals food crops : *Piliostigma* and shea (*Vitellaria paradoxa*) parklands in Burkina Faso; *Guiera seneglensis* and *Faidherbia albida* in Senegal.

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Sub themes:

- Agroforestry
- Soil sciences and remote sensing
- Plant science
- Animal science

3. Theory of Change and Impact Pathway

3.1 Summary ToC with assumptions

Assumptions are: *Short term yields undermine long-term agricultural productivity factors ; *Other ecosystem services are under pressure (health, food, incomes) and maintaining natural resource base *Climate change exacerbates causes ; *Insufficient knowledge of what works in sustainably intensifying parklands on farm and landscape level ; *Disenabling environment to support change towards sustainable intensified agroforestry parklands ; *Specific stakeholder groups often excluded from decision- making in agroforestry/agricultural innovations (e.g. women and youths) and traditional knowledge from elders often not incorporated.

Research Questions are: *Identify and quantify social, economic and environmental factors that drive priorities of farmers and communities; *Identify and quantify trade-offs between ecosystem services provided by trees/shrubs ; *Identify innovative scenarios for managing sustainable intensification of agroforestry parklands that sustain food and income security ; *Identify with farmers modalities for out-scaling and upscaling successful innovative practices.

3.2 Expected outcomes and impact:

Outcomes: *Sustainable intensification of agroforestry products that are part of the resilient farm, territory and landscape systems ; *More resilient agroforestry landscapes; *Collaborative parklands intensification management involving key stakeholders and new institutional governance arrangements ; *Increased contribution of parklands to food and income security.

Our dream (impacts): *Agroforestry landscapes prosper and regenerate ecologically ; *Food security is improved ; *Poverty is significantly reduced amongst farmers in the selected project areas ; *Migration trends are slowed down (rural – urban and regional).

This research is funded as a part of the ERA-Net Cofund LEAP-Agri (grant no. 727715) through a virtual common pot model with EU top-up.

CLISMABAN

Phenotyping the banana biodiversity to identify climate smart varieties with optimal market potential in Africa and Europe

1. Project's summary/abstract:

Banana (Musa spp.) is the fourth most important crop in the Least Developed Countries, providing a staple food for more than 400 million people on the planet. It is an important source of income for many small and medium-scale producers that needs only limited inputs to ensure harvest. However, harvest yield is still far below its potential for many small holder farmers. In Africa, a high diversity of highland, plantain and dessert bananas is cultivated and the production is mainly aimed at local markets. In contrast, the banana production and import in Europe is limited to only a few varieties. Belgium hosts the world banana collection and has a long history of scientific research and partnerships with European and African scientists. The CLISMABAN (CLImate SMArt BANana) project aims to exploit the existing genetic resources and diversity of banana to select with input from all actors of the banana value chain (consumers, farmers, processors…) the varieties that will be resilient to the constraints that are threatening production because of climate change. To address the increasing demand for food, this project will investigate the potential of some microorganisms to be beneficial for the soil and the productivity of the banana plant. The project will combine top-notch phenotyping technologies to identify the varieties from the collection that fit the established "cahier des charges" and to test the potential benefits of microorganisms on growth of the banana plant. The laboratory obtained results will be brought to the field in different agro-ecological zones of Kenya, Uganda and Canary Islands for evaluation. Producers and researchers will be trained in different aspects of the banana research to market pipeline to stimulate a better utilization of scientific results in the development of agricultural systems that will meet both the increasing demand for food and the requirement for a sustainable use of land and water that can challenge the climatic evolutions.

2. Project's main objective (s):

This project aims to improve the exploitation of the already existing and available genetic resources of banana, including newly developed elite hybrids and farmer's favorite accessions. This work will be done by including all stakeholders of the banana value chain through consultation but also towards a more inclusive approach where stakeholders can follow the ongoing research that will bring the products of tomorrow. **The selected banana varieties need to be resilient to water availability constraints that hamper production** and have to address the **qualitative and quantitative** increasing demand for food. This project additionally aims to strengthen the partnerships between scientists, farmers and consumers and in general all stakeholders of the banana value chain. This will facilitate the different stages of product development towards a more effective and sustainable banana production. The information and products generated will respond to stakeholders' demands and made suitable for field use, in two different agro-ecosystems and crop conditions representative of intensive and self-consumption conditions respectively, with a high impact on yields.

Consortium

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Sub themes:

- Plant science

3. Theory of Change and Impact Pathway

3.1 Summary ToC with assumptions

This project aims to use a multi-stakeholder driven approach where stakeholders are involved in the research and selection of future banana varieties to improve resilience in the sector. The project will thus not only influence the outcome (rapid adoption of climate smart banana varieties) but will also positively influence future research initiatives as the cost efficiency and impact of this approach will be higher and thus welcomed by the society and reproduced for future research initiatives. Indeed, a stronger involvement of the civil society and a better interaction with the scientific world will have long term positive impact and resilience on the sector and can create new opportunities for developing the private sector along the research pipeline and the product value chain.

The implemented activities will lead to a better water use efficiency by irrigation and use of growth stimulating bacteria. This will increase the productive life span of banana stands and reduce production costs, and yields and income will increase and stabilize. Adoption of drought tolerant banana varieties will result in the expansion of banana production in the arid and semi-arid agro-ecological zones of Africa ultimately leading to increased national and regional productivity.

Finally, the adoption of best practices for a sustainable agriculture will not only benefit the yields in banana production but will allow a better land and resource use which in turn will have a positive effect on agriculture in general and improve livelihoods.

3.2 Expected outcomes and impact:

By associating multiple stakeholders from the initial steps, this project wants to bridge the gap between research and stakeholder preferences. This more inclusive research pipeline will have bigger potential to bring a successful product adoption on the market. We expect through this project to get a better buy-in from farmers to adopt best farming practices and thus better yields. By using a multi-stakeholder approach and comparative demonstration plots this project aims to show to rural communities the essence of using scientific research and development. By creating awareness through a concrete project on how science can improve livelihoods on the long term. Finally the banana varieties selected along this project for their resilience to climate change can potentially enlarge the banana growing area and thus allow new farmers to cultivate this major staple crop for East Africa.

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OPTIBOV

Genetic characterization of cattle populations for optimized performance in African ecosystems.

1. Project's summary/abstract:

A large variety of local indigenous and commercial cattle breeds has been produced as a result of domestication and selection. This variety ensures the capability and adaptability of livestock to fulfil its role in food production under different circumstances, now and in the future. Local breeds exhibit unique adaptive features to harsh environments, which can be useful for adjusting mainstream breeds to climate change. Simply transferring high producing commercial animals to the African continent, will not be the solution due to low performance and even low survival under these harsh environments (ecosystems). The aim of this project is to identify markers for the (positive) adaptation traits as well as the (negative) traits to be improved by studying bovine population from 6 different regions across the world from north to south in Europe and Africa. In order to investigate genetic mechanisms underlying a trait it is important to make sure the correct phenotype(s) is (are) collected uniformly for the animal. We will use the Food and Agriculture Organization of The United Nations recommendations for phenotyping animals to create the basic phenotype trait list and include preferences of local breeders. Another important goal is to collect animal biological material and to measure phenotypes on the animals of the selected breeds very accurately. For each individual animal, the ecotype where this animal is living needs to be described with clear reproducible settings. To analyse the architecture of the genetic material we use whole genome sequencing to detect the variants present within an animal. With this information we will study inbreeding in detail and more specifically, study regions in the genome, which have been under natural (environmental adaptation) as well as artificial (human mediated) selection. An important deliverable of the project is a new genotyping assay specific for African cattle breeds which will include markers associated with specific traits.

2. Project's main objective (s):

The aim of the project is to improve production and survival of traditional/indigenous breeds adapted to the local environments in Africa. This will allow us to secure the future of these well-adapted traditional/indigenous local breeds.

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OPTIBOV

Sub themes:

- Sustainable food security
- Animal science

3. Theory of Change and Impact Pathway

3.1 Summary ToC with assumptions

Within each country involved we will study several traditional/local cattle breeds and its relation to adaptation traits. By this we want to focus on the strength of the adapted breeds in the different ecotypes We will characterize the breeds phenotypically and molecular in order to find markers for the adaptation traits. Moreover we will also monitor biodiversity with we want to utilize and maintain. We hope to prevent extinction of local adapted African cattle breeds by using their strength (adaptation) and improving performance and longevity by selective breeding in a changing world to decrease poverty in rural areas. An improvement in breeding strategy is a long-term investment and will give final results in the near future.

3.2 Expected outcomes and impact:

1. An uniform bovine phenotype scoring list for adaptation traits.
2. Genome wide information of the traditional breeds. Giving knowledge on the amount of diversity but also on the amount of inbreeding, detection of potential genetic defects and selective sweeps related to adaptation to a specific environment.
3. The obtained information can be used to improve traits by selection of animals within or over breeds such as longevity, production and resistance to diseases. This will increase production longevity and reduces cost for medical treatments with will result in breed performance in the next generations.
4. Training. Training of young researchers will be conducted to use the latest technology and techniques and how to implement the findings in breeding.
5. Involvement of all stakeholders up to farmers by creating an APP, database and website to submit data and actively participate within the research.

This research is funded as a part of the ERA-Net Cofund LEAP-Agri (grant no. 727715) through a virtual common pot model with EU top-up.

SESASA

A Social-Ecological System Approach towards a Sustainable Intensification of Agricultural Production in Sub-Saharan Africa

1. Project's summary/abstract:

SESASA aims at developing a "system of systems (SoS)" for assessing agricultural land-use-and-management-change scenarios and provide adaptive feed-back. SESASA will connect farmer responses to social, economic and climate changes at local scale with planning and policy instruments at national scale. SESASA will explore spatio-temporal opportunities to harmonize conflicts between arable farming, grazing and pastoralism. Our theoretical framework builds on social-ecological systems and considers systemic properties such as emergence effects that arise from a non-predictable amplification of management impacts on the availability of natural resources.

Research/ innovation questions the project intends to address:

1. How can social-ecological-systems be operationalized in terms of smart modelling approaches and architectures to enable a highly flexible and low-data demanding assessment of the performance of agro-ecological systems?

2. Which adaptation opportunities for arable farming, grazing and pastoralism – using scenarios – are most recommendable in different agro-ecological zones to minder food and water insecurity?

3. How can we transfer such an approach into decision making and consulting?

Accounting local land-management practices in large-scale simulations is indispensable for understanding complex social-ecological interactions and requires a highly integrative knowledge processing approach based, for instance, on graph-node theories to reflect the complexity of drivers, agents and nature-human interactions of agro-ecosystems. We suggest implementing a multi-disciplinary SoS including the models ECOSERV (France), GISCAME (Germany) and MOWASIA (Burkina Faso) + research on planning and management practices (Burkina Faso, Ghana), environmental assessment (Ghana, Germany) and perceptions of local experts and actors (Burkina Faso, Ghana). This ensemble will be implemented to explore multiple trajectories of agro-ecosystems at nested scales.

2. Project's main objective (s):

1. Bottom-up building of the "System of Systems": The "System of Systems" approach forms the basis for integrating qualitative and quantitative knowledge. Different modelling concepts will be used to simulate social-ecological processes and interactions at different scales and regions.

2. Developing and assessing land-use and management change scenarios: Based on existing agricultural practices and pastoralism, scenarios will be developed. These scenarios include results from previous projects (WASCAL or BiomassWeb) and observed drivers (cultural norms, trends of land-use and management practices or local side conditions) at different scales.

3. Develop and implement recommendations: Scenario-simulations will deliver bundles of strategies with the potential to improve food and water security incorporating trade-offs in resource access for socially-relevant ecosystem services. The modelling process will result in agricultural policy guidelines and field-scale handbooks for agricultural consultations.

4. Learning approach for assessing and consulting agricultural strategies in West Africa: The model ensemble approach will be used to incorporate a variety of different knowledge sources for an exemplary transfer to other agro-ecological zones, relying on literature data and expert input. The "System of System" approach will be transformed into a generalized guideline how-to manage the process of building systematic architectures.

Consortium

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Sub themes:

- Sustainable food security
- Animal science

3. Theory of Change and Impact Pathway

3.1 Summary ToC with assumptions

Theory of change: a participatory approach connects actors at multiple scales through the "System of Systems" concept to support, in short-and intermediate-term, the building of capacities for improved land-use and land management. By partnering micro-ateliers for local participation with expert-ateliers, we involve experiences knowledge and value systems relevant for decisions in a moderated feed-back process.

Impact pathway: recommendations how policy interventions and governance approaches trigger land-use and land management changes and what kind of impacts arise for food and water securities form the basis for revising agricultural policies at national scale and provide an approach to test the coherence with other policy sectors (environment, economy / trade, education). Improved combinations of policy and governance instruments will give better support to local actors and communities in co-adapting their land-management practices. The software ensemble and the description of its development process and how this can be implemented in training and education will increase the analytical power and science-service provisioning capacities for all partners.

3.2 Expected outcomes and impact:

1. SESASA will contribute to conceptual and instrumental changes how policies and governance processes (awareness-raising, information, capacity-building, financial improvements, community-based actions) can be tailored for supporting land-use/management adaptation more efficiently.

2. The "System of Systems" approach will be used to train local stakeholders, researchers and students as well as to communicate potential management instruments such as policy guidelines or field handbooks.

3. The project will provide information on land management opportunities and how the developed scenarios can be used to address stakeholder preferences and fears towards future land practice adaptions.

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Cluster 2: Agriculture and Food Syste Nutrition

2.1. Nutritious value chain
2.2. Food and nutrition assessment
2.3. Food technology and safety
2.4. Pest and disease control

EaTSANE

Education and Training for Sustainable Agriculture and Nutrition in East Africa

1. Project's summary/abstract:

Nutrition-sensitive agriculture and diverse diets have been identified as strategies for improving nutrition. Little is known about the interlinkages between consumption and production strategies, and the preconditions and incentives required for farmers to engage in diversified crop production. The proposed project EaTSANE will apply an integrated approach for innovation and capacity strengthening to facilitate systemic change in the food system. It aims to implement sustainable farming practices and improved diets of households in Kenya and Uganda, using a participatory action learning approach. The consortium complements its expertise across multiple research disciplines with extensive experience in communication and learning approaches, and stakeholder engagement for transdisciplinary research. Learning modules on sustainable farming practices and diversified diets will be developed and implemented with schools, young farmer clubs, education experts and national curriculum development centres. The researcher teams, together with farming communities, will co-create knowledge on the use of conservation agriculture practices for sustainable production of nutrient-rich and diverse food, improved soil fertility, on obstacles and opportunities for farmers to engage in diversified production, and improvement of households' food culture. Findings from the studies will lead to scientific publications and build the basis for policy dialogue and knowledge-sharing activities on a national level with a particular focus on women and youth.

2. Project's main objective (s):

EaTSANE's main objectives are (i) identifying and promoting improved farming practices for healthier soils and production of diverse, nutritious crops; (ii) improving access of value chain actors to inputs and services, their links and reducing food losses through improved handling and processing practices; and (iii) enhancing consumers' food culture, resulting in healthier diets and more equitable distribution of food in households.

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Sub themes:

- Nutritious value chain
- Food and nutrition assessment
- Food value-chain
- Food systems governance and farm organizations

3. Theory of Change and Impact Pathway

3.1 Summary ToC with assumptions

The data and experiences from previous research in the EaTSANE study regions indicate that soil fertility is low, farm households lack knowledge on conservation agriculture concepts and better food choices, households food distribution is inequitable, and low-income consumers have limited access to affordable nutritious food Smallholder farmers have witnessed yield reductions due to general decreasing soil fertility, accelerated by inadequate farming practices such as monocropping and low biodiversity. In addition, access to nutrient-dense crops is constrained by a fragmentation of actors in the food system and weak value chain coordination. These aspects result in limited availability, affordability, access and stability of low-income consumers to nutritious foods. In EaTSANE's study areas, less than 45% of women and men eat food from more than five food groups, which is considered as minimum for an adequate diet.

EaTSANE aims at establishing more sustainable farming practices and improved diets in Kenya and Uganda **The project works on three pathways to success: (i) Diversified farming practices for healthier soils and diversified production; (ii) Improved access of value chain actors to inputs and services and creating an enabling environment; (iii) Enhancing consumers' food culture and diversified nutrition**.

Three interlinked science-based WPs facilitate learning along the three pathways through participatory action research. They create outputs in two respects: **Firstly, the activities translate directly into learning and change processes for participating actors in the target region. Secondly, research findings feed into a national communication and dissemination strategy**. A WP on communication and education supports the production of tool kits, learning materials, information campaigns, and contributes to a policy dialogue based on the findings from the science-based WPs.

All project outputs contribute to outcomes in form of **behavior change of farmers and other value chain actors who are involved in participatory action research as well as a wider group of people** who will be addressed with the planned communication and education measures.

3.2 Expected outcomes and impact:

In brief, EaTSANE's expected outcomes and impact consist of high-impact presentations at international conferences and scientific publications; capacity building of young academics; improved communication and education material on sustainable agriculture and nutrition; social media addressed to young people; multi-stakeholder innovation platforms; new networks and learning of value chain actors on improved handling and processing; learning on improved kitchen management and feeding practices through tool kits/manuals; school education modules and participatory action learning in rural communities that strengthen households to produce more nutritious crops and healthier diets; policy briefs and dialogue to inform decision-makers on local and national level.

This research is funded as a part of the ERA-Net Cofund LEAP-Agri (grant no. 727715) through a virtual common pot model with EU top-up.

VITAPALM

Improving nutritional quality and stability of palm oil produced by African smallholders to fulfil African consumers' needs

1. Project's summary/abstract:

The VITAPALM project is targeted at laying the foundations for breeding new varieties of African Oil Palm (*Elaeis guineensis*) that produce non-refined crude oil with improved nutritional qualities (lower saturated fat, higher levels of vitamins) and increased stability (low lipase content). For this purpose, we will take advantage of natural variability within oil palm elite genitors to select appropriate trees, and we will also include wild palm trees. We will screen oil palm fruits for total fatty acid composition, free fatty acid content, vitamin E (tocopherol/tocotrienol) and provitamin A (carotenoid) contents. In addition, we will carry out genetic analyses to identify molecular markers for future marker-assisted selection. At last, we will perform an in depth study on the flexibility brought by low-lipase lines to define new harvesting practices compatible with those of smallholders, and leading to oil with lower free fatty acid levels. We expect that more stable crude oil with high levels of vitamins will prove an important asset to reduce vitamin A deficiency in Africa. Also, consumers will pay a premium for improved crude palm oil, leading to increased income for African smallholders.

2. Project's main objective (s):

The aim of this project is to breed new genotypes of oil palm, specifically destined to cultivation by smallholders, and that produce non-refined crude oil with improved qualities so that it fits best with African consumer nutritional needs including low lipase, high provitamin A/vitamin E dietary supply, lower saturated fat, enhanced stability/shelf life and also appetence in line with African traditional eating habits.

Consortium

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Sub themes:

- Nutritious value chain
- Food technology and safety

3. Theory of Change and Impact Pathway

3.1 Summary ToC with assumptions

Crude red palm oil is the most important source of vitamin A and the most important edible oil in Central and Western Africa. It is mostly produced by smallholders and provides millions of jobs in Africa. However smallholder-produced crude palm oil is of poor quality and stability. An important part of the production is not edible according to FAO/WHO standards (because it contains more than 5% free fatty acid due to lipase activity). Concerning lipase inactivation, smallholders frequently lack access to appropriate facilities and/or the knowledge to adequately process fruit bunches. Thus, the oil spoils rapidly and can be consumed locally only, and not transported to areas where vitamin A deficiency occurs. In addition, it contains large amounts of saturated fatty acids which may lead to increased incidences of cardiovascular diseases.

Oil composition and degradation is a consequence of metabolic events in fruits due to the genetic background of cultivars. Little efforts have been brought by breeders to improve crude palm oil dietary and nutritional qualities despite documented variability for these traits. Breeders prefer to increase oil yield to produce refined oil (with much reduced vitamin content) destined for international markets for food industry. In addition, a strong mesocarp lipase activity in fruits leads to oil spoiling if fruit bunches are not boiled within 24 h of harvest decreasing oil quality, stability and market value.

Our project aims at identifying oil palm genitor lines with improved oil composition. These genitor lines will be used for breeding new palm varieties producing crude oil with improved nutritional qualities and increased stability, adapted to production by African smallholders and well-inserted into African traditional diet.

3.2 Expected outcomes and impact:

First output will be identification of appropriate genitor trees after screening. Breeders will cross these to rapidly generate new varieties to be transferred to stakeholders. Also, traits can be introgressed into most appropriate elite trees and use of molecular markers, another output of the project, will tremendously speed up the process. The new flexibility brought about by low-lipase genotypes in harvesting and processing practices and the gains these will bring to oil quality and stability represents another output. The outcome of the project will be adoption of these improved varieties by smallholders together with new harvesting and processing practices. This improved oil produced by smallholders will sell at better prices on local and international markets, allowing increased income. It will be possible to transport this oil and use it as vitamin A dietary supply in regions, which need it. Consumers will benefit from stable supplies and prices, for oil with improved nutritional quality (higher vitamins, lower saturated fat) and greater appetence (deeper red color, increased fluidity). The last output of our project, i.e. genotyping wild accessions, will allow the use of modern genetics for long-term improvement of the crop in a sustainable way. This collection will provide increased variability in cultivated palm, leading to numerous improvements including improved disease resistance. The collection includes trees from most extreme climates so it will prove a great asset to improve palm cultivation in the context of climate change.

This research is funded as a part of the ERA-Net Cofund LEAP-Agri (grant no. 727715) through a virtual common pot model with EU top-up.

MetVAC

Ecosmart Alternative Control Strategies against *T. annulata* and its Tick Vectors

1. Project's summary/abstract:

Domestic livestock play an important economic and cultural role for an enormous number of resource-poor farming communities in tropical and sub-tropical regions of the world. The prosperity of small family-run farms depends on the generation of livestock products such as milk and meat. The most important factor limiting productivity and impacting animal welfare in these regions is infectious disease, which can kill farm animals, reduce growth of the infected animals and inhibit milk production. Improved prevention and control of these diseases would allow local farmers to increase their standard of living. The cattle disease tropical theileriosis is a major constraint to livestock production in northern Africa, Asia and some areas of southern Europe, with approximately 250 million animals at risk. The disease is caused by a parasite called *Theileria annulata* and is transmitted by ticks. Current methods to control or prevent this disease suffer from a number of disadvantages and the aim of the proposed research is to develop eco-smart, region-specific and easy to apply methods. Importantly, scientists in the countries where the disease is common will be trained to develop and implement new techniques to control tropical theileriosis. To control this disease, it is necessary to efficiently identify infected animals and to utilise ecologically-friendly and easy to apply methods to combat the parasite and the ticks that transmit it. This project aims to (a) identify places where disease needs to be controlled, (b) learn which cattle breeds do not get sick, (c) understand why available drugs fail to cure infection in certain animals, (d) develop region-specific vaccines to protect animals and (e) develop ecologically friendly compounds against ticks. To try and achieve these aims, an international collaborative research team has been formed which combines a range of basic and applied research expertise on this parasite.

2. Project's main objective (s):

Aims to: 1) to reduce the impact of the disease on small-holder farmers and 2) to improve quality of life in poor rural communities by improving knowledge and providing access to sustainable, region-specific control strategies.

(a) What are the country-specific risk factors that influence the prevalence of tropical theileriosis and the seasonal activity of ticks in endemic regions?
(b) Is there evidence of geographical sub-structuring of the parasite population between and within countries and can genetic diversity in the parasite population be related to local risk factors?
(c) Can parasite-transmitting tick species be controlled using novel eco-smart approaches, which do not present any food safety concerns?
(d) What is the level of resistance/tolerance of autochthonous cattle breeds in Portugal to tropical theileriosis? Can QTL regions and/or genes putatively associated with resistance to disease be identified and used to guide selective breeding programmes?
(e) Can buparvaquone effectively treat field parasite populations?
(f) Can region-specific live, attenuated vaccines prevent or reduce parasite transmission to cattle in endemic regions?
(g) Is it possible to block transmission of the parasite to ticks using parasite-encoded antigens?

Consortium

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Sub themes:

- Pest and disease control
- Animal science

3. Theory of Change and Impact Pathway

3.1 Summary ToC with assumptions

Development of improved control methods for tropical theileriosis in endemic regions is considered a high priority by the stakeholders such as veterinarians, livestock owners and governmental organisations. The output of research activities will be transformed into practical measures at a variety of levels:

- The proposed field studies will provide epidemiologically defined sites, provide information about parasite diversity and will involve training personnel. The prevalence and spread of buparvaquone-resistant strains will be monitored and end-users will be advised on the use of buparvaquone/parvaquone or alternative control measures. These outputs will also shape national policies regarding appropriate use of the drug.
- In the absence of an effective recombinant molecular vaccine, the attenuated schizont vaccine remains, to date, the only effective and safe measure to control the disease. Despite the first *T. annulata* immunisation studies being conducted in Algeria **(**reviewed in Sergent 1945**),** there is no available attenuated vaccine in this country. While a vaccine will not be available within the time-frame of the project, Algerian attenuated lines obtained by long-term passaging will be established ready to test for their effectiveness as a vaccine in future studies.
- Transmission-blocking vaccine candidate antigens will be identified using state-of-the-art methodology and tested *in vivo* providing a major step forward in the quest for a sub-unit vaccine.
- The resistance/tolerance of autochthonous cattle breeds to *T. annulata* infection will be assessed. Selective breeding programmes based on this data offer the potential to provide a long-term, sustainable method to combat disease.

The outputs of the proposed work will have an impact on human welfare by reducing the economic impact of the disease and will enhance the livelihoods of resource-poor farmers through increased health and productivity of their livestock.

3.2 Expected outcomes and impact:

The most expected outcomes of the project include; increasing the capacity and infrastructure of laboratories development of novel control methodology, sustaining the research activities related to *T. annulata* in endemic region and exploitation of invented compounds and vaccines for commercial purposes by collaborating with industry. In addition, as a result of sharing the research outputs and generating collaborative links among policy-makers, stakeholders and end-users national policies regarding to disease control and local cattle breeding programmes will be defined to reduce the incidence of the disease for each endemic region. The outputs of this work will impact on human and animal welfare at a number of levels. By contributing to the development of improved control methods for tropical theileriosis, the work will enhance the livelihoods of resource-poor farmers through increased health and productivity of their livestock and will eliminate the food safety concerns and environmental pollution. Enhanced potential for access to markets for dairy and crop surpluses and associated increases in household economies will be reflected in downstream benefits such as improved healthcare and education, particularly of female children. Furthermore, increased monetary income to the small-scale farmer will help to reduce unemployment rates in urban populations and will encourage young people to the reverse the trend in migration and to work in agriculture. Thus, family farming and small food businesses will evolve into more industrialised and vertical integrated systems, thereby increasing the economic power of the agricultural base and contributing to food security.

This research is funded as a part of the ERA-Net Cofund LEAP-Agri (grant no. 727715) through a virtual common pot model with EU top-up.

UniCARSSA

University-based Community Action Research for increasing viability of cereal-legume value chains towards improved nutrition and livelihoods in sub-Sahara Africa

1. Project's summary/abstract:

UniCARSSA links smallholders and rural entrepreneurs directly with universities in platforms for action to share currently available technologies, adapt them to local conditions and encourage new research for key constraints. It will build on 2 established community action research platforms (CARPS) at two universities (University of Eldoret, Kenya and Makerere University, Uganda) to address constraints in improving productivity and consumption of under-researched cereals and legumes in Kenya and Uganda to increase food and security nutrition. These crops are widely grown in the focus countries and are especially important for food security in smallholder agricultural communities. The CARPs will be instrumental in developing, adapting and scaling up innovations that improve efficient nutrient use, increase crop yields, improve post-harvest handling and develop nutritious food products that will increase demand and link the farmers in the value chains to increase the economic, environmental and social viability of these commodities. The project will help to reduce hunger and malnutrition, increase rural incomes and support commodities that contribute towards achieving the SDGs and responds to CAADP and national policy targets for stronger agricultural growth. We will use the University's outreach centres to drive community action research in accordance with the communities needs along the cereal-legume value chains. Research into increasing production, reducing post-harvest losses and increasing nutrient use efficiency in millet, sorghum, groundnuts and soybeans will be carried out in collaboration with the farming communities. Using the two universities outreach centers as platforms, we will strengthen the relationship with the farming communities.

2. Project's main objective (s):

Main Objective: To improve sustainable food production while reducing soil degradation, as well as improving FNS at household and community level.

Specific objectives:

1. Increase resilience of farming systems and food production through the rehabilitation of degraded soils and the diversification of cereal-legume cropping systems
2. Development of ready-to-use supplementary foods (RUSFs) from locally available highly nutritious cereal and legume crops
3. Strengthening of local nutrition-sensitive value chains through research and capacity building of rural entrepreneurs
4. Capacity building of local innovation systems through a multi-stakeholder approach (CARPs), and involvement of MSc and PhD students

Consortium

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Sub themes:

- Nutritious value chain

3. Theory of Change and Impact Pathway

3.1 Summary ToC with assumptions

UniCARRSA tackles the problem of food insecurity and malnutrition at household and community level. The underlying causes to this problem are limited utilization of resilient crops such as millet sorghum and grain legumes, poor quality of crops due to low nutrients in the soil, low response of soils to addition of inputs among others. Many technologies have been developed but remain underutilised due to the poor operational framework for engagement between universities (research and technological innovation), the communities and other stakeholders. Thus UniCARSSA aims at improving food and nutrition security by increasing land productivity through sustainable agricultural intensification and diversification and strengthening innovation systems for nutrition-sensitive value chains. Our entry point will be to evaluate organic and inorganic fertilizer materials including micronutrients for rehabilitation of poor responsive soils, develop and evaluate crop diversification strategies, develop innovative crop utilization technologies, strengthen local nutrition-sensitive value chains through research and capacity building of rural entrepreneurs and establish platforms for engagement of universities with communities and value chain actors. This will be achieved on the assumptions that soils tested respond to fertilizer inputs applied and that students involved in the research work remain committed to engagement in the project. Other assumptions are that the value chain actors remain cooperative during the implementation of the project and embrace new technologies and that partnerships are sustained throughout the project to help communicate research results widely to inform policy.

3.2 Expected outcomes and impact:

Through its interventions, UniCARSSA expects the uptake of soil-enhancing technologies (e.g rhizobium inoculants, fertilisation regimes) and diversified and resilient cereal-legume cropping systems by the farming community. Through diversification and the development and use of ready to use supplementary foods (RUSFs), we envisage more nutritious diets for children and households. Further, as capacity building is targeted for the CARPS, we expect that they will be more effective in joint innovation and transdisciplinary research with communities, SMEs, research institutions as well as the universities The linkage of rural entrepreneurs to local markets will be one of key areas of focus with concomitant strengthened capacity of local value chains for nutritious food products. UniCARSSA will go a long way in increasing land productivity through sustainable agricultural intensification and diversification improving nutrition security and strengthening innovation systems for nutrition-sensitive value chains.

This research is funded as a part of the ERA-Net Cofund LEAP-Agri (grant no. 727715) through a virtual common pot model with EU top-up.

SERVInnov

Strengthening innovation support SERVices to enhance INNOVations for sustainable food production, ensuring the well-being of rural populations, and reducing environmental degradation and resource depletion

1. Project's summary/abstract:

The overall aim of SERVInnov is to strengthen, multiply and promulgate innovations which have significant positive impacts on food and nutrition security through improvement of agriculture and agrifood systems. Innovations in agriculture and across food systems are crucial in facilitating the private sectors' (from small holders to big companies) economic growth and inclusive development. To boost agricultural and agrifood innovations, effective Innovation Support Services (ISS) must be developed in an accessible and sustainable way, in collaboration with either public or private service providers. According to the literature, ISS are dominantly immaterial and result from the interactions (activities) between providers and beneficiaries undertaken to solve a problematic situation within the innovation process. The services cover: fostering technical and social design, enabling the appropriation of information and knowledge for innovations, facilitating access to resources, helping to transform the environment and strengthening capacities to innovate. For the moment, these support services are diffuse, not visible, uncoordinated and only partially meet the needs of the innovators. SERVinnov's specific objectives are to assess existing innovation support services (types of providers, services and interventions), to analyze their relevance and efficiency. SERVInnov will characterize ISS in three countries: Burkina Faso, Cameroon and Madagascar, and within innovation case studies related to the improvement of agriculture, sustainable intensification and agrifood systems. The approach that we propose first makes it possible to identify the strengths and weaknesses of innovation support services with respect to innovation challenges in the country concerned and second, in collaboration with ISS providers and policy makers, to explore how gaps in the supply of ISS can be filled by developing new skills or by improving the structure of existing innovation service providers.

2. Project's main objective (s):

The overall aim of SERVInnov is to strengthen, multiply and promulgate innovations, which have significant positive impacts on food and nutrition security through improvement of agriculture and agrifood systems. Innovations in agriculture and across food systems are crucial in facilitating the private sectors' (from small holders to big companies) economic growth and inclusive development.

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Sub themes:

- Nutritious value chain
- Agroforestry systems
- Sustainable food security

3. Theory of Change and Impact Pathway

3.1 Summary ToC with assumptions

SERVInnov intends to substantially increase the effectiveness of innovation support services at al levels of Agricultural Innovation Systems across food systems and along value chains which have impacts on FNSSA. SERVInnov is based on the theory of voluntary modification of behaviour and relatec concepts from agricultural extension, which define advisory services such as the co-production o knowledge and skills to enhance clients' self-determined problem-solving capacities. Mid-term impacts will be generated at three decision making and governance levels: (i) within cooperating ISS providers, (ii among the ISS system actors involved in the case studies and (iii) in the respective national AIS networks In particular, SERVInnov consortium partners will cooperate in a way that enhances their diagnosis implementation and training capacities with regard to effective ISS. Through the use of participatory diagnosis and assessment tools for effective ISS, SERVInnov partners will raise the awareness of thei case study partners and improve their capacities through training.

3.2 Expected outcomes and impact:

In concrete terms, we have identified four main situations in which capacities are improved. The first is during the co-design of the frameworks. Researchers and practitioners learn about the empirical and theoretical frameworks from each other. At the same time, researchers from the EU and African countries will learn from each other and together identify conditions in which the use of European frameworks wil be useful in Africa. The second situation is during case assessment, when the actors involved in the case acquire an analytical appreciation of their cases, particularly service providers, who acquire capacities to better design their intervention in the case concerned. The third situation occurs during the nationa workshops: these interactive workshops and proactive dissemination and awareness raising strategies developed at national and international levels represent highly effective learning processes for both projec partners and external stakeholders. The fourth situation concerns exchanges between practitioners during the national workshops. The service providers learn from each other and from the different suppor systems in which they are involved. Long-term impacts will be ensured because the results delivered wil be based on cases of innovation that are relevant for the sustainable intensification of agriculture at field farm and regional scales, and contribute to FNSSA.

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CASSANDRA

CASsava Sustainable Advancement & Nurturing by discovery of Disease Resistance Alleles

1. Project's summary/abstract:

Cassava is the most important staple root crop in the world, providing food energy intake for nearly a billion people and supplying raw material for diverse industrial purposes worldwide. In several regions of Africa, cassava is also considered as a food security crop because of its relatively good performance in adverse environments and flexible harvest period. However, cassava production is largely constrained by viral diseases, the most damaging biotic stress in cassava fields in Africa. In particular cassava mosaic disease (CMD) and cassava brown streak disease (CBSD) causes yield losses estimated at 24% and 90%, respectively. Cassava brown streak disease (CBSD) often leads to necrosis of storage roots making them unfit for consumption and unsuitable for industrial processing.

In order to limit the impact of cassava viral diseases, a multipronged approach will be taken:

A) SOURCING SUSTAINABLE AND ROBUST VIRUS RESISTANCE

We will investigate natural resistance against cassava viral diseases as follows: 1) identification of resistance gene(s) underlying the reported CMD2- and CMD3-based resistance/tolerance against CMD in cassava, 2) identification and characterization of recessive resistance alleles against CBSD and, 3) analysis of cassava allelic forms from elongation factor genes known to confer recessive resistance against viruses causing CBSD

B) BUILDING STRATEGIES FOR CONTINUOUS SUPPLY OF DISEASE-FREE PLANTING MATERIAL TO FARMERS

Distribution of virus resistant cassava (identified and developed in A) to local farmers should be part of a sustainable cassava seed system. The consortium in collaboration with the National Agricultural Research Systems (NARS) and Community Based Organizations (CBOs) will develop novel and locally adapted solutions to produce virus-free planting material.

2. Project's main objective (s):

The CASSANDRA proposal intends 1) to identify and characterize natural virus genetic resistances in the cassava germplasm for rapid introgression in farmer-preferred varieties and 2) to develop methods for on-field sanitation of planting material.

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Sub themes:

- Pest and disease control
- Sustainable food security
- Plant science

3. Theory of Change and Impact Pathway

3.1 Summary ToC with assumptions

Cassava is an important food security and industrial crop in Sub-Saharan Africa. Viral diseases are the most important biological constraint to cassava production in Africa. Cassava mosaic disease (CMD) and cassava brown streak disease (CBSD) causes yield losses estimated at 24% and 90%, respectively Cassava brown streak disease (CBSD) often leads to necrosis of storage roots making them unfit for consumption and unsuitable for industrial processing. The problem of cassava viral diseases is exacerbated by the propagation method used by farmers. The vegetative multiplication of stem (stem cuttings) is the most common practice for propagation and promotes the dissemination and maintenance of viral diseases in the field. Current methods to mitigate cassava viral diseases includes the breeding and distribution of virus resistant cassava varieties as well as the large scale in vitro multiplication of disease-free cassava planting material. The in vitro multiplication is not cost-effective and therefore not affordable to small scale farmers. Two promising options to reduce the impact of viral diseases in cassava production include 1) identification and characterization of natural resistance (against CMD and CBSD) for rapid combined introgression into farmer-preferred varieties (middle to long term impact) and 2) development of easy and cost-effective methods to reduce viral loads in cassava planting material that can be readily used by farmers and seed multipliers.

3.2 Expected outcomes and impact:

The implementation of innovative research programs aiming at identifying or creating natural recessive resistance against CBSD in the cassava germplasm is an essential step to provide durable resistance to farmers. The complete characterization of genes involved in natural resistance against CMD is also key to advance breeding lines combining resistances against both viruses. In parallel, the development, in close collaboration with NARS and CBOs, of simple and cost-effective methods to reduce viral loads in cassava seeds (stem cuttings) will serve as an immediate action plan to mitigate the impact of viral diseases in Africa. Our consortium includes key stakeholders (national research centers (KALRO and ARC) as well as CBOs) to ensure impact for resource poor small-scale farmers. Since smallholders account for 100 percent of cassava producers in Kenya, increasing cassava production through sustainable management of virus diseases will increase income of the resource poor farmers. The greater productivity of the superior, disease resistant varieties will also result in less land utilization, hence reduced land degradation. In addition, due to the use of virus resistant, superior cultivars, there will be reduced application of seed dressing and foliar insecticides, hence a safer environment.

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Ento-Economy

Enhancing food and nutrition security through promotion of edible insects value chain in Eastern Africa

1. Project's summary/abstract:

This project aims to contribute to addressing malnutrition in general through 'developing sustainable insect-based value chains for improved food and nutrition security in Kenya and Uganda. Insects contribute to the human food chain either by direct consumption or indirectly as feed for domestic animals when farmed as mini-livestock. Cricket and grasshopper farming models have been successfully established in Kenya and Uganda with farmers being trained and supported to take up the venture as a business. Grasshopper rearing protocols were developed through the INSFEED project and a standard for "Dry insect products for compounding animal feeds' was developed and approved in Kenya and Uganda as proof of concept. Crickets and grasshoppers rearing models and nutritious, safe insect-based products have been developed and tested locally satisfactorily. Therefore subsequent work is required to prove commercial viability and up-scale them for commercialization of the innovations in order to satisfy the projected high demand for insect-based foods. In Uganda, for instance, Makerere University market tested a ready-to-eat grasshopper product and the results demonstrated enormous demand while demand for cricket based bread in Kenya was high. However, edible insect value chains remain under-developed, therefore limiting their contribution to food and income security in the region. Ento-Economy project aims to unlock the potential of edible insect value chains in Kenya and Uganda. Lessons learnt from ongoing and previous research initiatives in the Eastern African region on mass production and processing of insects will be harnessed to guarantee success.

2. Project's main objective (s):

- Establishing a multi-stakeholder alliance for improving and strengthening insect value chains;
- Evaluating and disseminating models for mass production of crickets and grasshoppers by women and youth MSME's to create a sustainable input supply system for insect value chains;
- Enhancing commercialization of insect value chains by youth and women managed micro, small and medium enterprises (MSMEs);
- Enhancing utilization and consumption of insects, insect-based products and products of animals raised on insect-based feed; and
- Enhancing the social, policy and regulatory environment for use of insects as food and feed in Uganda and Kenya.

Consortium

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Sub themes:

- Nutritious value chain

3. Theory of Change and Impact Pathway

3.1 Summary ToC with assumptions

The conventional agricultural development model, especially in Africa is based on agricultural intensification (i.e proper crop and livestock husbandry, proper use of inorganic fertilizers, chemicals, improved seeds, etc.) of a few common staples and large livestock. However, increasing yields through agricultural intensification (for instance increased use of inorganic fertilizers and non-selective chemicals) pollute the environment and in the long run reduce food production because they are not sustainable [26]. Moreover, in the face of climate change, the reliance on a few common staples and livestock enterprises have exacerbated food insecurity – often as a result of crop or livestock failure Therefore, innovative ways of producing more food are required and re-emerging foods that increase dietary diversity become very important. Among the re-emerging foods, insects are a rich source of protein and micro-nutrients that can improve human diet, especially for individuals suffering from poor nutrition due to protein and micronutrient deficiencies But the insect value-chains are under-developed for the envisaged role of supporting food and nutritional security and livelihoods. The Ento-Economy project theory of change is thus based on the idea that edible insects' value chains can enhance food and nutritional security and support livelihoods through a two-pronged approach – push and pull. On the one hand, it requires a push effect including providing insect mass production technologies, the knowledge on production o insects, and inputs use (WP 2 and 4). On the other hand, considering that the insect value chains are only starting to emerge, the pull approach is to stimulate, understand and respond to consumer demand (WP 3), set up a governance structure for strengthening the linkages between the actors in the value chain (WP 1), increasing access to markets through change of entrepreneurial behavior (WP 3) and supporting the development of supportive policies (WP 5). The pathway o impact is based on the fact that under the push effect, value chain actors will be strengthened to upscale the production o insects leading to a more competitive and productive value chain. The pull effect on the other hand will create market oriented value chains. In addition to conducive policies for insect value chains, it is expected that a more organized insect value chain would emerge which will have the potential to increase food and nutritional security of rural and urban households and livelihoods by providing high quality protein food and feed.

3.2 Expected outcomes and impact:

Outcomes

- Governance of value chain established and strengthened
- Knowledge on insect farmers increased to 2000 farmers
- Uptake of insect farming as an enterprise by 40 MSMEs
- Increased production of edible insects among 40 farmer groups
- Increased mass production of insect colonies
- Develop at least 2000 farmers and 40 MSMEs in insect related businesses
- Policies in support of insect integration in the food and feed industry are put in place
- Insects are integrated in food and feed value chains
- Farmers linkages to markets are developed and sustained
- Increased utilization of insects and insect foods by 2000 households;
- Increased knowledge of preparation, and storage of insects
- Insects are integrated in the food and feed industry
- Improved enabling environment for insect production and marketing

Impact

- Organized and strengthened Insect value chain
- Increased food security for 2000 households
- Enhanced livelihoods for 200 households through commercialization of insect value chains
- Environment for insect value chains enhanced

This research is funded as a part of the ERA-Net Cofund LEAP-Agri (grant no. 727715) through a virtual common pot model with EU top-up.

MycoSafe-South

The European–African partnership for safe and efficient use of mycotoxin-mitigation strategies in sub-Saharan Africa

1. Project's summary/abstract:

MycoSafe-South, the "European–African partnership for safe and efficient use of mycotoxin-mitigation strategies in sub-Saharan Africa", intends to harness the expertise and infrastructure available in Europe by strengthening the capacity of the Southern partners to tackle the mycotoxin problem and the associated food safety issues. This project will identify safe and efficient mitigation strategies to reduce aflatoxins (AFs) and fumonisins (FBs) exposure in Africa, with special focus on children.

2. Project's main objective (s):

This project aims (1) to provide safe-use options for AFs and/or FBs-contaminated food for children and adults through means of safe and efficient post-harvest intervention strategies, including nixtamalization, dehulling, fermentation and the usage of mycotoxin binders and/or modifiers investigated via *in vitro* and *in vivo* studies, (2) to develop intervention strategies to reduce human (paediatric) exposure to AFs through animal products (*i.e.* milk, meat and eggs), and (3) to improve sustainability of the acquired results by organizing education programmes and awareness campaigns that will facilitate best practices, transfer the acquired knowledge and help stakeholders to understand mycotoxin-associated health risks.

Consortium

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Sub themes:

- Food technology and safety
- Pest and disease control

3. Theory of Change and Impact Pathway

3.1 Summary ToC with assumptions

(1) Safe and efficient post-harvest food processing and detoxification protocols to decrease the negative effects of aflatoxins (AFs) and fumonisins (FBs) on human health (incl. children), resulting in less children and adults suffering from the negative health impact of AFs and FBs, and less children with mycotoxin-induced stunting.

(2) Human capacity and awareness building on mycotoxins risks and mitigation strategies through on-site training of community (families), nutritionists, veterinarians and farmers (small-scale subsistence farming and commercial farming).

(3) Biomarkers to assess AFs and FBs exposure and effect in human and animals (dairy cattle, laying hens and broiler chickens), and efficient mitigation programs in human and animals.

(4) Human and infrastructural capacity building and implementation of suitable models for efficacy testing of detoxification methods in humans (a.o. surrogate paediatric piglet model for children), by stakeholders (a.o. food and feed sector) and governments (via PACA).

(5) Increased food safety with respect to AFs and FBs contamination.

(6) Suitable models for efficacy testing of detoxification methods in dairy cattle and poultry, and stimulating ruminal AFs degradation, both leading to safe and efficient AFs detoxification in dairy and poultry (lower level of AFM1 in milk and of AFs and metabolites in poultry products).

(7) Improved animal health and efficiency of livestock production.

(8) Promoting trade opportunities for crops and animal products (i.e. milk, meat and eggs).

(9) Further development of African centres of excellence and point of contact for service to society, education and research on the topic of mycotoxins and their mitigation.

3.2 Expected outcomes and impact:

Important MycoSafe-South project outcomes include:

(1) Safe and efficient food-processing techniques that will be distributed to stakeholders, by a.o. the Kenyan Cereal Miller Association and the iZindaba Zokudla project (an isiZulu phrase for 'Conversations about food', which aims to creat opportunities for urban agriculture in a sustainable food system);

(2) Reliable information and training sessions to African families on the health risks associated with mycotoxins and how to use the mitigation methods;

(3) Reliable information on how AFs and FBs in feed contribute to negative animal health and production effects i African dairy cattle, laying hens and broiler chickens;

(4) Safe and efficient mycotoxin detoxifiers for African dairy cattle that will be distributed to stakeholders, by a.o. th Kenyan Cereal Millers Association, the iZindaba Zokudla Farmers' Lab and BIOMIN;

(5) Safe and efficient mycotoxin detoxifiers for African laying hens and broiler chickens that will be distributed t stakeholders, by a.o. the Kenyan Cereal Millers Association, the iZindaba Zokudla Farmers' Lab and BIOMIN;

(6) Reliable analytical methods (SOPs) to assess mycotoxins in food and feed, and their relevant biomarkers in human an food-producing animals.

This research is funded as a part of the ERA-Net Cofund LEAP-Agri (grant no. 727715) through a virtual common pot model with EU top-up.

Cluster 3: Expansion and Improvement Agricultural markets and trade

3.1. Post-harvest innovations
3.2. Food value-chain
3.3. Rural development and agricultural economy
3.4. Food systems governance and farmers organizations

SPEAR

Empowering small-scale farmers towards the SDGs through participative, innovative and sustainable livestock and poultry value chains (LPVCs)

1. Project's summary/abstract:

The overall objective of SPEAR is to improve the livelihoods of small-scale livestock and poultry farmers by improving the productivity and quality of local livestock and poultry value chains (LPVCs) in Senegal, Ghana, and Kenya through *research* (e.g., identifying constraints and opportunities for sustainable production and consumption) and *innovation* (e.g., insect meals as an animal feed and new livestock and poultry based products with long shelf life) that will contribute to *policy*. SPEAR is mainly articulated around five work packages: (i) Management and Coordination Platform; (ii) Investigation of constraints and opportunities for improving productivity and quality of local LPVCs; (iii) Development of participatory value chain modeling framework; (iv) Participatory research on LPVCs – "from the lab to the mud" focusing on developing low cost- and nutrient-rich food supplements from local cereals and insects and new livestock and poultry based products, and (v) Outreach and Learning to enhance innovation capacity. The novelty of our research lies in the combination of two approaches: (i) value chain analysis and (ii) participatory modeling, to create a participatory value chain modelling (PVCM) approach. Various stakeholders will be involved to integrate scientific knowledge with indigenous and local knowledge, which is often disregarded but can provide valuable insights, in the value chain analysis. SPEAR will bring stakeholders more inclusively into the planning and decision-making process that can (i) strengthen stakeholders' capacity to make informed decisions, (ii) enhance stakeholders' sense of ownership and implementation success, (iii) build sustainable business links for different LPVC actors, and (iv) increase policy uptake. A virtual leaning lab (VLL) for knowledge exchange, which can be an important information resource for LPVC stakeholders, will also be established.

2. Project's main objective (s):

SPEAR's overall objective is **to improve productivity and quality on local livestock and poultry value chains (LPVCs)**.
Specifically, the project seeks to:
(i) Research-focused: develop and test a Participatory Value Chain Modelling approach for the analysis of local livestock and poultry value chains together with partner African countries to identify with a collective effort, evidence-based challenges and opportunities related to production and marketing of livestock and poultry products by small-scale farmers, especially women and youth;
(ii) Innovation-focused: provide small-scale farmers with evidence-based tools and practices to empower them with knowledge and technologies to raise productivity and meet quality and sanitary standards; and
(iii) Policy-focused: provide policymakers with evidence-based strategies to enhance the smallholders' ability to compete in the livestock markets.

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Sub themes:

- Food value chain
- Rural development and agricultural economy
- Sustainable food security
- Animal Science

3. Theory of Change and Impact Pathway

3.1 Summary ToC with assumptions

SPEAR is designed based on the following assumptions: (i) small-scale producers are interested to increase their productivity and quality of their products and are actively trying to do so, and (ii) the institutional setup to establish and promote quality standards in LPVCs exists. Farmers are often unable to increase production and mee quality standards by adopting productivity- and quality-enhancing technologies unless the value chains for thei products are sufficiently developed and dynamic. SPEAR will enhance the contribution of agriculture researcl outputs to food and nutrition security through three major impact pathways: (i) research linking supply and demanc issues to understand LPVCs & identify the interventions required , (ii) innovation activities strengthening farmer ability to participate in LPVCs, and (iii) policy/ies promoting sustainable LPVCs. The research and innovatior component of the project is divided into four task groups: (i) assessing farm level performance, (ii) taking a systen perspective of the value chain; (iii) identify high leverage points that can register large effects at minimum effort and (iv) address the innovation needs that can arise in the process. SPEAR's multidisciplinary team will work together with different stakeholders to identify and address challenges and opportunities in LPVCs. To maximize the synergy effect, the VLL will serve as a platform for interaction among and beyond the project framework.

3.2 Expected outcomes and impact:

IMPACT: Smallholder farmers have improved livelihoods in Senegal, Ghana, and Kenya (Sustainable Developmen Goals on No Poverty (1), Zero Hunger (2), and Responsible Production and Consumption (12)).

Outcome 1: Improved livestock and poultry productivity and product quality of smallholders

SPEAR will improve smallholders' livelihood through the (i) development of innovative outcomes, (ii) provision o technical information and knowledge on meeting livestock-poultry quality standards and challenges, and (iii country-specific participatory learning approach among LPVCs actors. By focusing on participatory approaches SPEAR can bring smallholders more inclusively into the policy decision-making process and allow them to communicate their demands more effectively. By also engaging women and youth in forums and developmen activities, policymakers can be more sensitive in formulating policies that position women and youth as central to food and nutrition security.

Outcome 2: Improved coordination along the value chain

SPEAR country assessment reports will include identified technological and institutional entry points in the valu chain improving the livestock-poultry productivity and product quality, and exit points where production losses and low-quality outputs can be prevented. Also, SPEAR's systems planning tools and metrics for quantifying LPVC performance can improve assessment of causal value chain mechanisms/policies. By using systems modelling SPEAR can evaluate and prioritize between different policy choices and help policymakers make better decisions.

Outcome 3: Improved uptake of innovation

Building smallholders' technical and managerial skills in a manner that complements their indigenous knowledge and capacity needs will likely increase the speed of innovation adoption and strengthen their engagement in the LPVCs. **SPEAR** will conduct farmers' training and provide training modules for best practices in livestock-poultry production and quality management.

This research is funded as a part of the ERA-Net Cofund LEAP-Agri (grant no. 727715) through a virtual common pot model with EU top-up.

STEP-UP

Sustainable Transition to Entrepreneurial Production in Agriculture trough Upgrading

1. Project's summary/abstract:

Rural food value chains (FVC) in sub-Saharan Africa experience various challenges to implement food securing innovations. Through sustainable intensification (SI) and market linkage (ML) strategies STEP-UP will enable small farm enterprises (SFEs) to step up towards food and nutrition security, sustainable development and income generation at farm and community levels. In mango and banana FVC in Kenya and Uganda new technologies in breeding, processing, packaging and conversion will be implemented and assessed through a participatory multi-stakeholder approach.

The core STEP-UP activities are

1. Screening the banana and mango FVC with consortium experts and stakeholders
2. Participatory development of food system transition pathways and entry points for SFEs with high potential to create added value via knowledge, labor and monetary (re-) investments
3. Selection and adaptation of effective SI and ML strategies, based on a multi-criteria, participatory assessment of their impact using indicators developed by experts and multi-level stakeholders
4. Delivering evidence-based advice and decision support tools for out-scaling of SI and ML strategies to other regions and food systems
5. Knowledge exchange and capacity building of FVC stakeholders.

In Uganda we focus on SI strategies to increase crop production and evaluate how markets can best respond. In Kenya we focus on ML strategies to pull (re-) investment in SI to a higher level. Across the study sites and FVCs, a dynamic monitoring system will enable co-learning and adaptive project management. Understanding the dynamics between SI and ML in different food systems will result in standards and procedures to reduce farmers´ and entrepreneurs´ risks. SFEs and FVC intermediaries in the case study areas will benefit from improved knowledge, skills and capacities to sustainably upgrade their activities. Decision makers will have a clear view about desired transitions and how to enable them.

2. Project's main objective (s):

The overall aim is to contribute to food security and sustainable development in sub-Saharan Africa through equitable commercial relationships between SFEs and markets within the frame of sustainable agricultural production. We focus on the heterogeneous groups of smallholder farmers with an entrepreneurial ambition. STEP-UP will support smallholder producers to access relevant technologies, innovations and management practices for the transition to commercialized production. Specific objectives are:

1. Achieve sustainable intensification of SFEs and the transition of diverse farms to commercial enterprises that contribute to food and nutrition security while minimizing trade-offs in other sustainability dimensions;

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Sub themes:

- Post-harvest innovations
- Food value-chain
- Rural development and agricultura economy.
- Food systems governance and farmers organizations

2. Project's main objective (s): Cont'd

1. Provide key actor groups, local authorities and decision-makers with instruments and information for discussion and decision support based on participatory ex-ante and ex-post impact assessments;
2. Inform policy implementation towards a supportive public-policy environment based on locally-relevant sustainability principles, criteria and indicators.

STEP-UP will work with multi-stakeholder groups (including women groups) to scale up activities for farmers to meet the market demand and scale out to farmers outside their localities. The linkage to diverse and emerging "Small Farm Enterprises" (SFEs) will enable STEP-UP to achieve a major milestone in converting research outputs into commercial products and supporting SFEs to access markets.

Across countries and FVCs the project will investigate the strengths and weaknesses of the push (starting from SI) and the pull (starting from ML) approach and derive which elements to combine where and how. With the aim to out-scale approaches, tools and SI/ML strategies, the project seeks to answer and decide:

1. What are effective SI and ML strategies for stepping up in banana and mango FVCs that maximize multiple stakeholders aspirations and minimize tradeoffs in the sustainable development domains?
2. Which standards and procedures will support pro-poor, gender-inclusive and youth's livelihoods and reduce farmers' and other entrepreneurs' risks?
3. Which mechanisms of knowledge exchange and stakeholder participation guarantee a balance between diverging interests?
4. What information is needed for effective and efficient scaling up and scaling out of SI and ML strategies?

3. Theory of Change and Impact Pathway

3.1 Summary ToC with assumptions

STEP-UP framed its theory of change upon the agro-food system concept. It considers the agro-food system by its activities (producing, processing, distributing), its output related to food and nutrition security (availability, access, utilization, stability) and its impact on social and environmental welfare. A supportive public-policy environment was added as an additional impact to this concept. STEP-UP intends to convert its scientific outputs into locally-relevant outcomes and impacts by engaging different types of key stakeholders that have a direct and/or indirect relation with or influence on the local food systems.

The main objectives of STEP-UP correspond with the objectives of the call by addressing all three focal areas. To create significant impact within the three year horizon of the project, STEP-UP seeks for incorporation of research achievements of all partners from the recent past. The STEP-UP approach will include all dimensions of sustainability (economic, social and environmental) as well as short, mid and long term impacts using participative scenarios. By the participatory development of tools for decision support STEP-UP will ensure the applicability of the science-based benchmarks and procedures.

Addressing high postharvest losses in SSA this project will contribute to limiting food waste. STEP-UP will link traders and middlemen to producers groups and organize joint learning sessions between farmers, traders, field

and postharvest management experts (for both local and export markets). These sessions will enable the traders to share the market requirements with the farmers, the experts to demonstrate good practice of production and handling of the fruit crops for higher market prices and the farmers to indicate their farm level constraints and options. Together this will lead to development options adapted to the local conditions and opportunities. STEP-UP is focusing on SFEs with entrepreneurial ambition and sense of ownership to ensure a detectable development, e.g. becoming a member of introduced multi-stakeholder platforms being one of the entry-points for stepping up.

A major pathway towards impact is the co-learning activities in all steps of the project. Starting from scoping studies, stakeholders and scientists jointly agree on methods, assessment criteria and finally on effective climate smart and food and nutrition securing SI and ML strategies. Achievements, challenges and adjustments of SI and ML strategies are jointly discussed and decided across the diverse range of SFEs and across both genders and youth. This participative approach aligns stakeholders to understand methods, tools, training procedures and materials used during implementation. The iterative and continued adaptation of SI and ML strategies to needs of different social groups and the integration of their knowledge and skills across multi-stakeholder groups enable identification of well-tuned development options. This will impact SFEs' livelihoods on short term and well beyond the project lifetime.

For capacity building STEP-UP aims at young scientists as well as stakeholders at the community, regional and national level across the banana and mango FVC to serve as multipliers in the future. Trainings will be tailored to meet the stakeholders' needs identified during participatory baseline and feasibility studies in the beginning of the project. The capacity (knowledge, skills, and tools) built will be sustained by training materials and modules addressing upgrading of the banana and mango FVC.

STEP-UP targets participation of SFEs, other local actors in the FVC (intermediaries, small food processors, suppliers of seed, fertilizers and equipment, retailers), and key stakeholders further along the banana and mango FVC (experts, authorities) and policy makers. Participative co-learning being the STEP-UP principle, different communication and training formats will be designed for each stakeholder group.

3.2 Expected outcomes and impact:

Since the new SI and ML strategies, the associated learning methods and tools, and the new knowledge will be jointly generated with stakeholders engaged in securing the mango and banana FVCs, we expect a high level of implementation and continuation beyond the project. The tools for identifying and assessing stakeholder involvement (Net-Map) and for multi-criteria assessment (Scala; FoPIA) will be used by decision makers and within stakeholder networks. A close involvement of the national Food Security programs is aimed for to secure compliance with national networks, regulations and standards. Enhanced agricultural transformation pathways will be used as a basis for policy making at local and higher levels.

The SI and ML strategies established together with all stakeholders will be common good. In line with the Research Impact Pathway the project results expect to sustainably stabilize and upgrade banana value chains in Uganda (harvesting technics, improved storage, propagation, peeling, marketing) and the mango FVCs in Kenya (harvesting techniques, improved storage, peeling, drying, marketing) and through multi-stakeholder platforms, involved NGOs, and better market link-ages reach more than 10.000 households. The capacities built through the project will continue shaping R&D in food systems of Uganda and Kenya. Possible foreground knowledge linked to the SI and ML strategies will be identified and accessed to enable its diffusion and encourage exploitation and transfer of research results to foster their rapid uptake. Intellectual property as related to scientific publications will be managed according to good scientific practice. Results will continue to be disseminated through multiple press releases launched for instance by Paepard and the German, Kenyan, Ugandan, Dutch or international TV.

The Kenya partners will increase experience in the commercial farmer based networks through the use of information technology especially mobiles apps for marketing of bananas: e.g. the farmers voice radio programs and "mkulima" young networks - a tweeter based knowledge sharing platform. The Uganda counterpart will benefit from the Kenyans lessons on the use of clean planting materials developed through tissue culture technology.

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NOURICITY

Partnerships For Healthy Diets And Nutrition In Urban African Food Systems – Evidence And Strategies

1. Project's summary/abstract:

Africa's cities are expanding, with adverse consequences for food and nutrition security of an increasing share of their population. In urban Africa, malnutrition is a complex issue related to factors including the middle class' growing purchasing power, but also poverty, poor health environments and insufficient access to safe, quality food. African urban food systems and their rural-urban value chains are characterized by the intersecting formal and informal food sectors: small scale producers, transporters, processors and retailers provide a multitude of food products, the composition, quality and final destination of which is largely undocumented. This project aims at investigating the structure and dynamics of urban food systems in Africa (including rural-urban food value chains), to reveal the co-existence of different facets of malnutrition and their drivers, for a transect of poor to moderately wealthy countries, settlements and neighborhoods, and to develop partnerships for coherent, nutrition-sensitive policies. To that end, the project will rely on participatory research with stakeholders of the food system in selected urban study sites in Ghana, South Africa and Uganda. In particular, the project will describe the systemic drivers of food choices, by mapping the formal and informal urban food sectors, their interactions and rural linkages, and by tracking urban food sources and their characteristics. Second, the project will examine individual drivers of food choices: income, access to nutrition-related knowledge, or food tastes, habits and culture. Finally, researchers will assess the impacts of systemic and individual drivers of food choices on people's actual consumption and nutrition outcomes. Together with nutrition and public health practitioners and the identified actors of the three local food systems, they will devise and test policy scenarios to develop a blueprint for partnerships seeking improved urban nutrition in Africa.

2. Project's main objective (s):

This project aims to impact the nutrition of the urban poor in Africa. This is achieved by gathering and analyzing missing evidence on African urban food systems (UFS) to outline a partnership concept for effective interventions in the food environment of the urban poor in a participatory process.

The research will investigate: a) urban food sources, characteristics and rural-urban linkages as "systemic" drivers of food choices and nutrition, b) people's access to nutrition-related knowledge (formal and informal, indigenous and Western), income, food tastes, habits and culture, as "individual" drivers of food choices, c) how systemic and individual drivers combine to determine people's food consumption and nutrition status.

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NOURICITY

Sub themes:

- Food value chain
- Food and nutrition assesment

3. Theory of Change and Impact Pathway

3.1 Summary ToC with assumptions

This project aims at improving urban nutrition in Africa by bridging key knowledge gaps about its systemic and individual drivers. The assumption is that co-describing the urban food systems with its stakeholders will facilitate the participatory delivery of a partnership concept for improved policy interventions based on our analytical results. The evidence-based partnership concept is the project's main contribution to foreseen impacts. Their scalability is assumed to be enhanced by the analytical design based on (i) new surveys conducted at the project's study sites in South Africa, Ghana and Uganda, and (ii) a national level analysis of the nutrition transition across major and secondary cities (where the urbanization push largely takes place) designed around existing, nationally representative data.

By engaging the stakeholders (including decision-makers and implementing actors in the spheres of urban public health or food safety) in a collective reflection towards a concept for common action and impact, we hope to deliver a blueprint for future impacts beyond the project lifespan.

3.2 Expected outcomes and impact:

Consumption and food / dietary habits are too difficult to influence or change in the short / medium term for the project to bring a sizeable change in nutrition (security) indicators over its lifespan or soon thereafter. Nonetheless, the project can realistically expect to lead to recommendations for safe pathways toward improved delivery of nutritious food for the urban "at-risk" groups. Notably, a clearer understanding of the interlinkages between over- and under-nutrition will help creating future impacts by identifying (a blue print for the involvement of) the necessary actors for a more beneficial urban nutrition transition, as well as helping change resulting in new, coherent, and interactive policies.

This research is funded as a part of the ERA-Net Cofund LEAP-Agri (grant no. 727715) through a virtual common pot model with EU top-up.

Food4Cities

Exploring food system transformations in rapidly changing African cities

1. Project's summary/abstract:

Food insecurity and malnutrition, once restricted mainly to rural areas, are spreading rapidly in Africa's expanding cities. Conventional production-based responses from the agricultural sector will not ensure nutrition security in these cities, without also considering drivers that affect food access, affordability and stability. A much more systemic perspective of city food systems is needed, from sustainable production through to consumption, and understanding functional cross-scale linkages along this pathway. Appropriate city planning and policy can play a major role in this endeavour, driving more sustainable and resilient food systems across the urban, peri-urban and rural food landscape. Yet food systems and nutrition security are distinctly lacking in most African city planning and policy. To address this gap, this project aims to promote sustainable and nutrition-secure city food systems by developing knowledge and tools for local and national development planning. The project focuses on two African cities (Kampala and Cape Town), and is built around four objectives: knowledge co-production and participatory planning, characterising city food systems, modelling current food system dynamics and exploring alternative futures, and collaborative planning. The project has a strong conceptual foundation in food systems analysis and modelling. It employs a range of scientific methodologies such as spatial analysis, systems-dynamics and value-chain modelling, trade-offs in bundles of ecosystem services, integrated social, economic and ecological assessment, scenario planning, and transformative pathways analysis. Importantly, the technical science is embedded in a knowledge co-production and participatory planning process to promote uptake of the information by end users and scale impact of the science.

2. Project's main objective (s):

The project aims to promote sustainable, inclusive and nutrition-secure city food systems by developing knowledge and tools for local and national development planning. It accomplishes this through the following objectives:

1. Develop model(s) to link within-city food systems to the broader landscape
2. Co-develop alternative food scenarios
3. Evaluate scenarios in terms of food and nutrition outcomes + equitable ecosystem benefit flows and economies
4. Design interventions for local and national development planning, which highlight multiple co-benefits
5. Reflect on case study lessons for scaling impact elsewhere

Consortium

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Sub themes:

- Food value chain
- Nutritious value chain
- Food and nutrition assessment

3. Theory of Change and Impact Pathway

3.1 Summary ToC with assumptions

Based on existing knowledge, challenges that this project need to influence to achieve its aim include:

- Weak cross-sector, collaborative planning for city food systems at local government level.
- Limited spatial data on food systems dynamics within cities, and its interlinkages to the broader system. This extends to measuring food and nutrition outcomes in marginalised groups.
- Insufficient capacity to understand and apply planning approaches that recognise the complexity of city food systems.
- Lack of awareness of socio-economic segregations and linkages within city food systems and beyond, and how these influence city food and nutrition outcomes.

We identified four impact pathways to address these challenges and effect change:

- Cross-sector planning and decision-making for city food systems to promote collective action across scales and sectors
- Science, data and decision-support tools for advancing city food and nutrition security, targeting end users in Cape Town and Kampala, and broader communities around the world
- Human capacity development for enhancing food and nutrition security in city planning by empowering individuals and institutions to plan for food and nutrition secure cities
- Communication materials for policy makers, planners and civil society to expand the project's influence at local, national and international levels

3.2 Expected outcomes and impact:

Impact:
Sustainable, inclusive and nutrition-secure city food systems are enhanced through local planning that is informed by a systems perspective, and supported by national policy

Outcomes:

- A systemic approach to planning for city food systems is adopted, which sees multiple sectors and levels of governance cooperating around response strategies developed in this project to support sustainable, resilient and nutrition-secure city futures
- City planning and decision making is supported by science-based decision-support tools that consider city food dynamics, feedbacks to and from the broader environment, and the trade-offs and synergies of different development options on different social groups within the food system
- Human capacity development and communication materials support city food planning beyond the lifespan of the project

This research is funded as a part of the ERA-Net Cofund LEAP-Agri (grant no. 727715) through a virtual common pot model with EU top-up.

SmallFishFood

Small Fish and Food Security: Towards innovative integration of fish in African food systems to improve nutrition

1. Project's summary/abstract:

The SmallFishFood consortium is a multidisciplinary research team from Norway, the Netherlands, Germany, Ghana, Kenya and Uganda, covering the fields of fish stock assessment, processing, marketing, nutrition, risk assessment and governance. We provide innovative rethinking of the food security discourse by focusing on the nutritional value of small fish (e.g. sardines). We aim for transformation to ecological sustainability and food security by asking: How can socio-cultural, economic and institutional transformations of the fish value chain, as well as technical and infrastructural innovations, contribute to improved, sustainable utilization of small fish resources for Africa's low-income population? The fact that the nutrients in fish can play a significant role in combating the triple burden of hunger, micronutrient deficiencies and non-communicable diseases is the starting point of the project. However, the unique qualities of fish are seldom recognized in the global food security discourse, and fish is strikingly missing from nutrient deficiency strategies among disadvantaged groups. Small fish are ubiquitous in all aquatic environments from large marine ecosystems to seasonal ponds, as well as in market places and low-income household diets, but their significance is underrated and little understood as they are consumed locally and often go unrecorded in catch statistics. In fact, fisheries are the most energy efficient producers in comparison to other food production systems and have the least environmental impact in terms of greenhouse gases and use of freshwater, fertilizers, insecticides/herbicides. Catching small fish, which are simply sun-dried and consumed whole, is the most high-yielding, eco-friendly, low CO2-emission and nourishing way of utilizing aquatic resources. However, a range of social, technical, economic and legal barriers inhibit the full potential of utilizing small fish and it is the aim of this project to contribute to solving these.

2. Project's main objective (s):

- Identify, quantify and map current patterns of production and distribution of small fish for food and feed, with particular reference to Ghana, Kenya and Uganda;
- Identify and describe the harvesting, marketing and utilization patterns of small fish and how they contribute to food and nutritional security in these countries;
- Improve the production processes to achieve better quality and longer shelf life;
- Disseminate the nutritious value of small fish to stakeholders and governance agencies and analyse how barriers to sustainable utilization can be resolved.

Consortium

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Sub themes:

- Post harvest innovations
- Food value chain
- Rural development and agricultura economy
- Food systems governance and farm organizations

3. Theory of Change and Impact Pathway

3.1 Summary ToC with assumptions

Nutritional qualities of (small)fish are not appreciated in the global food security discourse, and fish is strikingly missing from strategies for nutrient deficiency reduction. This leads to misrepresentations in policy attention, limited recognition of the ubiquitous and abundant resources; lack of innovation to improve nutritional qualities, processing and marketing; and low awareness of the potential dietary and economic importance. Causes are manifold but include i) a biased focus on the less abundant large fish, ii) a large and widely distributed small-scale fisheries sector involving numerous actors in catch, processing and trade, and iii) a general belief that the fisheries sector is overexploited (although this is rarely the case for small fish). In addition, the value of micronutrients in 'low-value' small fish is high but not well known. While small fish has always been part of the diet in African societies, they have received little focus from local or international development interventions. With few exceptions, fishing, processing and trade institutions have rarely addressed the large quantities of small fish that are produced and processed by mainly the small-scale artisanal, and often part-time sector, many of whom are women. All this reflects the current neglect and resulting knowledge gaps with regard to local importance, the natural production potential, as well as possibilities for improvements and innovations in catches (volumes, technologies information), processing (nutritional value, products, safety, losses) and trade (losses, diversification consumer awareness). The overall objective of the SmallFishFood project is to contribute to improved sustainable utilisation of highly productive resources of small fish for Africa's low-income population in order to alleviate hunger, micronutrient deficiencies and non-communicable diseases. Our assumptions and aspirations are that by systematically addressing the constraints, knowledge gaps and policy issues throughout the whole production and value chain, in a comprehensive way, will help highlighting the importance of the resource to obtain the required necessary policy attention, as well as the technical institutional and socio-cultural transitions needed for this sector to contribute to the SDGs.

This research is funded as a part of the ERA-Net Cofund LEAP-Agri (grant no. 727715) through a virtual common pot model with EU top-up.

3.2 Expected outcomes and impact:

Research outputs	Indicators	Research outcomes	Indicators	Impact
WP1: Improved catch statistics of small fish and assessment of harvest	Catch assessment (electronic) implemented. Report/article by end of project	Sustainable management of small fish species stocks by local and government institutions	Small fish stocks included in fisheries management plans. Sustainable harvesting techniques of small fish.	More balanced harvest of the aquatic food chain leading to increased production of fish and less harvest induced distortion of the aquatic ecosystem structure.
WP1/2: Improved quantification of biomass (and value) flows of small fish from landing to end consumer (food or feed)	Biomass flows quantified and mapped. Losses in value chains quantified. Report/article socio-ecological system analysis by end of project			
WP2: Mapping dried fish marketing constraints	Stakeholder workshop. Report/article by end of project			
WP2: Techniques developed for reduced post-harvest losses	Training on drying fish using solar dryers in 20 pilot fish landing sites. Improved product quality.	Fish processors produce higher quality products Dried fish products are viewed as healthy, attractive and affordable Nutrient supplement product innovation by SMEs	Reduced post-harvest losses and higher incomes New (urban) consumer groups buy high quality products based on small fish. Increased usage of dried fish as nutrient supplements	Higher income to producers. Increased consumption of high quality fish. Reduced malnutrition and micronutrient deficiency. Improved cognitive development and immune systems for infants. Improved public health for pregnant women and low-income population.
WP2: Novel processing measures developed.	Guideline/training/implementation of hammer mill processing			
WP2/3: Measures for value addition and longer shelf life of dried fish	Guideline, transfer workshop on hygienic packaging and labelling			
WP3: Map contribution of small fish in local diets.	Database on small fish consumption patterns.			
WP3: Detailed nutrient analysis and safety of small fish	Results published in articles 1) Nutrients declarations, 2) Food safety protocols, 3) FAO database	Better risk assessment and safety awareness of traders and consumers	Product declarations. Databases on consumption patterns and nutritional -> quality/safety of processed fish. Improved quality of products, hygienic packing,	
WP4: understanding and improving SIS value chain governance	- Report on SIS value chain governance obstacles in Ghana, Uganda and Kenya. - Scientific article by end of project			
WP4: Understanding impact of fishmeal value chains on SIS based food security	- Scientific article by end of project on fishmeal supply chains. - Short film produced.	Value of small fish for human consumption is recognised	Dependence of small fish in animal feed quantified and considered in policies	Knowledge on sustainable utilisation of small fish for food security and nutrition is up-scaled to Africa and worldwide
WP4: Awareness raising of small fish potential for reducing malnutrition	- Stakeholder workshops. - Policy brief - Social media coverage - Public media coverage	Stronger public awareness of importance of small fish for food security and nutrition	Fisheries management, food producers and health policies prioritize nutrition potential of fish	

ATMA4FS

Agricultural Trade and Market Access for Food Security: Micro- and Macro-level Insights for Africa

1. Project's summary/abstract:

Agri-food markets in Africa are not well integrated at the local, regional an international level, with trade barriers hampering exports/imports as well as the value chain development. Trade via better market access has the potential to create income and welfare, while improving the food security situation, i.e. providing people in Africa with sufficient food of an acceptable quality level at fair prices. We will look into opportunities and challenges for expanding local, regional and international trade and market access, while considering supply chains from the African importer/exporter perspective. Specifically, we address trade and market access issues in three African countries (Senegal, Ghana and South Africa) and two African trade regions (Economic Community of West African States, ECOWAS, and Southern Africa, SADC) and EU-Africa trade relations. The focus is on three product categories that are important for current and potential African trade: fresh fruits and vegetables, grain products as well as meat. For the countries/regions and products, we investigate how trade and market access is influenced by trade agreements, non-tariff measures, e.g. sanitary and phytosanitary measures, technical barrier to trade and customs procedures and private standards, price trends and volatility, market logistics/infrastructure and institutions. For the analysis, we apply quantitative and qualitative methods to look into the effects on local, regional and international trade, at both the macro- and micro-level. This includes obtaining first-hand information on the trade and market access issues from key stakeholders.

2. Project's main objective (s):

We will generate more integrated and comparative evidence on the multiple dimensions of trade – including local, regional and international trade, and export as well as import flows – and evidence from West Africa/ECOWAS. We investigate trade and market access issues our target areas for three product categories that are important for current and potential African trade: fresh fruits and vegetables (FFVs), grain products as well as red meat and poultry. Our multi-country, multi-market, and multi-scale research approach extends standard case-study approaches in a number of dimensions. First, we add cross-county comparisons along a gradient of market integration. Second, we analyse the functioning of markets both at the micro- and at the macro-level, in order to combine an improved understanding of the local mechanisms at work for individual decision makers with the consequences at the politically relevant levels of the countries/regions. Third, we take into account interactions between local, regional and international markets.

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Sub themes:

- Nutritious value chain

2. Project's main objective (s): Cont'd

Our methodological approach takes into account three dimensions of trade of market access: (1) local regional and international trade; (2) exports and imports; and (3) micro and macro-level effects. The combination o these three dimensions allows us to look at both imports and exports in a comparative approach. The combinec macro- and micro-economic analyses are innovative since the results shed light on the implications at both country and firm levels, while exploiting methodological advances in new trade theory with a micro-level underpinning anc application. Simultaneous analyses of down- and up-stream links help to understand trickle-down effects within supply chains and to explore network structures.

3. Theory of Change and Impact Pathway

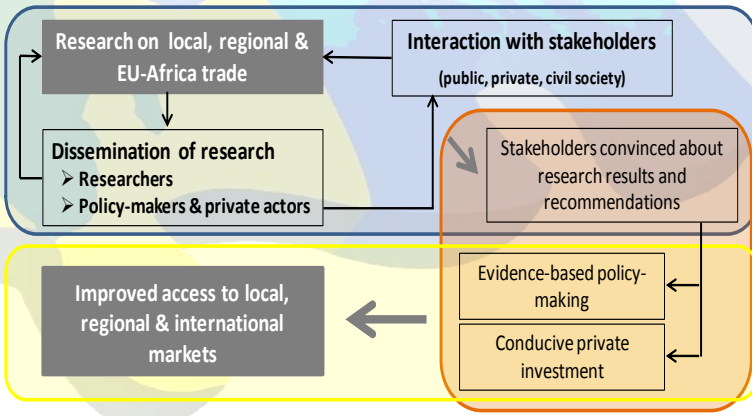
3.1 Summary ToC with assumptions

Our dissemination strategy emphasizes the knowledge generation and sharing with specific stakeholde groups: business, policy-makers and researchers. We will gear the project output towards them by involving them right from the beginning of the project. Furthermore, we will make the research results accessible/available fo uptake beyond the project. The different means of conveying our results are part of our communication strategy tha will be developed in detail at the kick-off meeting and validated at stakeholders meetings. For each group, we use specific dissemination strategies:

Researchers: high-quality scientific contributions, user-friendly databases that can be readily applied (online tools), training/webinar;

Policy-makers: country-specific conclusions and present them in policy briefs but also via the project website (blog), dialogue meetings to present/discuss our research results;

Business: insights on requirements and standards, thereby extending beyond the international effort of transparency about NTMs since we will generate and transfer knowledge about such measures in Africa and Europe, via dialogue and exchange at meetings but also briefs and messages via the project website (blog), and via interactive online tools (apps) for knowledge transfer that will comply to business needs.



3.2 Expected outcomes and impact:

The results of our analyses provide evidence that supports the formulation of targeted policies anc programmes. Furthermore, they will point out how to improve market access by identifying which actors along the supply chain should be targeted. Our findings will help to minimize the downsides of existing trade barriers, thereby having an impact on the prevalent realities when producing/selling the respective products at the local, regiona and/or international market. Furthermore, the results will generate insights into opportunities and challenges fo expanding local, regional and international trade and for improving access to agri-food markets for different types o actors. Better trade conditions, in particular for agricultural products, constitute a key component for a viable fooc security strategy in Africa. Ultimately, this proposal will identify policy and investment priorities in order to make agricultural trade work for improved food security.

This research is funded as a part of the ERA-Net Cofund LEAP-Agri (grant no. 727715) through a virtual common pot model with EU top-up.

Multi-Sectorial Projects

MUSBCEA

Multi-sectoral strategy for brucellosis control in Eastern Africa

1. Project's summary/abstract:

Brucellosis is a key zoonotic disease affecting the livelihoods of many poor resource people particularly Sub Saharan Africa. It's constraining the health and productivity of livestock leading to reduced incomes and food insecurity and places barrier to marketing of livestock and their products. Among people, the burden of the disease remains high globally with over 500,000 new human infections annually. Spread to humans is often through consumption of contaminated dairy products and contact with diseased animals. Infected people suffer debilitating illness often with complications and death. Most developed countries have eradicated or severely controlled brucellosis in animals through application of diagnostic tools and vaccines and this has led to its elimination in human populations. Use of these technologies for livestock brucellosis control in developing countries is jeopardized by multiple technical, economic, social and knowledge factors e.g. lack of reliable diagnostics, training as well as unrecognized / underappreciated burden of the disease in animals and humans. Uganda and Kenya are greatly affected but don't have control programs against this disease. This project will be on the pastoralist and agro-pastoralist livestock systems in these Eastern African countries. A multi-sectorial strategy linking academia, private sector and other partners is proposed to provide institutional, technical, biological and social answers to the effective control of brucellosis through vaccination in these contiguous countries. Provision of requisite equipment and supplies and training of professionals in animal and human health practices will build capacity for diagnosis, surveillance as well as research on the disease. The project will identify the different Brucellas infecting livestock and hence appropriate vaccines, raise awareness, biosafety and biosecurity & determine modalities for and start control.

2. Project's main objective (s):

1. Develop capacity at Makerere and University of Nairobi to diagnose and conduct local research on brucellosis.
2. Build capacity and train local veterinarians, doctors and laboratory technicians to diagnose and conduct surveillance of brucellosis using applied diagnostics.
3. Isolate, characterize and map brucella infecting wildlife, domestic ruminants and humans.
4. Raise awareness, Biosafety and Biosecurity and pilot vaccinations to reduce domestic ruminants' brucellosis to pre-eradication levels in the study countries

Consortium

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Sub themes:

- Sustainable food security
- Pest and disease control

3. Theory of Change and Impact Pathway

3.1 Summary ToC with assumptions

This project if supported, funds availed timely and research environment conducive, will reduce prevalence of livestock brucellosis in Eastern Africa to pre-eradication levels. Activities are (1) Build capacity of universities and local veterinary and medical labs on brucellosis diagnostics and training of young researchers, local veterinarians, medical practitioners and technicians, (2) Field sampling to isolate type and map *Brucella* infecting wildlife, domestic ruminants and humans, (3) Conduct stakeholder dissemination workshops and develop control protocols, and (4) Pilot mass vaccination of livestock. Impacts are improved capacity for research and surveillance, adoption of mass vaccination of livestock and reduction of human brucellosis cases.

Our project aligns with thematic areas: 1. Sustainable Intensification specific area 1.3, Sustainable food security and thematic area 2: Agriculture and Food Systems for Nutrition, specific area 2.4, Pest and disease control.

Our project contributes to sustainable food security through enhanced capacity for diagnosis, surveillance and control of brucellosis in livestock. The effect of this is improved survival, health and productivity of the livestock hence availability of more animal source foods to feed the people.

Our project also contributes to pest and disease control since it will lead to identification of the brucella species involved in the causation of brucellosis in livestock, wildlife and humans in East Africa. This information will inform on the brucella vaccine(s) to be employed for the control of this disease in livestock by vaccination. We will contribute further on this through piloting of mass vaccination of livestock using identified vaccines. Thus we will contribute to minimization of production losses and avoid geographical spreading of this disease.

3.2 Expected outcomes and impact:

(1) Diagnostics acquired by universities and field labs actively utilized by local staff for brucellosis investigations. (2) The trainees, i.e. university staff and field veterinarians, medical personnel and technicians, utilize acquired skills for brucellosis research and/or surveillance. (3) Masters and PhD students acquire degrees. (4) Brucella species identified utilized to identify vaccines for deployment in East Africa. (5) Women and youth groups, community leaders and other stakeholders sensitized and educated about brucellosis and given project feed-back, utilize this knowledge to mitigate brucellosis in their communities/countries. (6) Women groups, youth groups, farmers, veterinarians &medics, utilize developed brucellosis control protocols to start vaccinating livestock against brucellosis. (7) Publications of the findings in peer reviewed journals for utilization by wider audience. The contribution to impact the project aims at is the reduction of human brucellosis cases in East Africa.

This research is funded as a part of the ERA-Net Cofund LEAP-Agri (grant no. 727715) through a virtual common pot model with EU top-up.

LEARN | Long-term Europe-Africa Research Network

1. Project's summary/abstract:

Sustainable intensification of livestock systems is essential to feed the rapidly growing world population. One of the key principles of sustainable intensification is "resilience to future shocks and stresses of disease, pests, and climate change". A major threat to livestock and/or human health in both Africa and Europe is posed by viruses that are transmitted by arthropods, mostly mosquitoes and midges. The Long-term Europe-African Research Network (LEARN) project will contribute to the preparedness of Europe and Africa for (re)emerging arboviruses through the development and implementation of serological tools for diagnoses and epidemiological investigations of neglected African arboviruses. Specifically, we will develop diagnostic assays to detect neglected arboviruses and use these assays to determine the distribution and impact of these arboviral threats. The latter will be facilitated by veterinary surveillance networks previously established by the LEARN partners in Africa. The knowledge that results from the project will be used to increase awareness of stakeholders and to provide incentives to develop vaccines.

2. Project's main objective (s):

In the LEARN project, scientists from Africa will fill knowledge gaps that exist in Europe on the epidemiology and pathology of neglected arboviruses, whereas scientist from Europe will share their expertise on innovative technologies that can be used to develop diagnostic tools. The project will initiate with strengthening existing veterinary surveillance networks in Cameroon and South Africa. Novel serological assays will be developed and used for diagnoses and serosurveys of specimens collected in these networks. Newly developed diagnostic assays may be commercialized by Deltamune, the associated private partner. An additional objective of the project will be to teach and train students through exchange of MSc and PhD students between labs. We will organize lectures and workshops for students, scientists, farmers and policy makers to raise awareness for the diseases.

Consortium

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Funder: National Research Foundation (NRF)

Sub themes:

- Sustainable food security
- Animal science
- Pest and disease control

3. Theory of Change and Impact Pathway

3.1 Summary ToC with assumptions

Recent outbreaks of arboviral diseases in both Europe and Africa have demonstrated that both continents are poorly equipped to respond to arbovirus outbreaks. Diagnostic tests and vaccines are generally developed in *response* to outbreaks, explaining why these monitoring and control tools generally come too late. The LEARN consortium will increase the awareness of students, young scientists and policy makers about the threat that arboviruses pose to human and veterinary health. Using priorized arboviruses that belong to the three most important arbovirus families as models, we will train young scientists in detecting and controlling arboviruses using state of the art technologies. Thereby, the LEARN project will contribute to changing the way we control arbovirus outbreaks from reactive to proactive.

3.2 Expected outcomes and impact:

The LEARN project will improve the preparedness of Europe and Africa for neglected arbovira diseases that compromise the sustainable intensification of livestock systems. Veterinarian networks in Africa will be strengthened, through which animal samples will be collected. Novel diagnostic assays will be developed and used to LEARN about the distribution of neglected arboviruses in the field. The resulting knowledge will be transferred back to the veterinarians and will furthermore be shared with students and researchers as well as with other stakeholders both in Africa and Europe. At the end of the project, both continents will be better prepared for arboviral diseases that are currently being neglected.

This research is funded as a part of the ERA-Net Cofund LEAP-Agri (grant no. 727715) through a virtual common pot model with EU top-up.

MuVHA | Multivalent inactivated Vaccine against Heartwater in Africa

1. Project's summary/abstract:

Heartwater, caused by *Ehrlichia ruminantium* (ER) constitute a major threat to ruminant production in Africa, affecting mainly small ruminants. Although a commercial vaccine is available, it presents so many drawbacks that its use is limited. An efficient, cost-effective and safe vaccine against heartwater to alleviate poverty of smallholder farmers and contribute to a sustainable agriculture in Africa is needed. The inactivated vaccine constitutes the most advanced experimental vaccine against heartwater. The main drawback of any experimental vaccine is the high antigenic diversity of ER strains, limiting its efficacy under field conditions. Our consortium composed of 2 European and 4 African partners propose to tackle this limitation by including a cocktail of strains of different regional genotypes newly isolated within the project. The genetic diversity of ER strains from Benin, Burkina Faso, Niger and South Africa, will be analyzed and ER strains will be isolated from West African and Southern Africa countries to allow the design of regional vaccines. The efficacy of the inactivated vaccines will be improved by including several ER strains selected depending on their genotypes. The vaccines will be tested in field conditions in Burkina Faso and South Africa, with a new promising oil adjuvant and with a single injection, and protective biomarkers will be identified to minimize the need for challenges after any new vaccine trials. Process of production of improved vaccine formulations at industrial level will be available at the end of the project. The current project will also allow increasing regional heartwater diagnostic and research capacities. Special efforts will be done to share the research products with stakeholders such as farmers and local manufacturers.

2. Project's main objective (s):

The main objective of the MuVHA project is to prove the ability to define and to develop an efficient inactivated vaccine against HW, adapted to a specific geographical region and based on a cocktail of ER strains, easy to produce by regional manufacturers and easy to use by veterinary services and farmers.

Scientific objectives are: (i) evaluate the efficacy of the inactivated regional cocktail vaccine in field trials both in Western and Southern Africa after characterization of ER genetic diversity and isolation of current main regional strains (ii) identify and validate biomarkers associated to protection and/or vaccination and (iii) design a rapid test to differentiate vaccinated/protected animals from naïve animals. The novelty relies on the definition of the multivalent inactivated vaccine targeting the regional ER strains together with the identification of vaccination efficiency markers and the promotion of regional manufacturing with regular updating of the vaccine.

Consortium

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Sub themes:

- Sustainable food security
- Animal science
- Pest and disease control

3. Theory of Change and Impact Pathway

3.1 Summary ToC with assumptions

The main objective of the MuVHA project is to obtain a high-quality, heat-stable, affordable multivalent inactivated vaccine against heartwater (HW), transferable to partner countries for a facilitated mass use, taking into account the specific contexts of the targeted regions of Africa. The project integrates research and development activities to set up and validate the multivalent vaccine, together with capacity building and communication activities to ensure both a sustainable local expertise on the control of HW and the adoption of the vaccine by farmers for widespread use. Current barriers to the use of the vaccine against heartwater (cold chain, infectious risk, ...) are integrated into the theory of change of the projec with the definition of standardized methods of production and quality control, all taking into accoun farmers' expectations.

3.2 Expected outcomes and impact:

The context-adapted expected outcomes of the MuVHA project are:

- Strengthened capacity of regional partners for *Ehrlichia ruminantium* (ER) diagnostic and researcl through the creation of an experts network shared between South and West Africa and Europe;
- Transdisciplinary communication strategy and capacity building (scientists and students, farmers associations, regional vaccine manufacturers, policy makers, …) to achieve both scientific and technical knowledge on the vaccine production and adoption of its use;
- Definition of ER current genetic diversity in West and South Africa and isolation of up to date ER strains to be targeted by the vaccine;
- Establishment of standardised protocol and conditions for production of the emulsified vaccine and an efficient quality control protocol, with scale-up consideration for further industrial production by regional manufacturers;
- An efficient improved (geographically adapted) inactivated multivalent vaccine against HW;
- Identification of biomarkers associated with protective immune responses for vaccine efficacy follow-up.

This research is funded as a part of the ERA-Net Cofund LEAP-Agri (grant no. 727715) through a virtual common pot model with EU top-up.

NUTRIFOODS

Innovative approaches to value addition and commercialization of climate smart crops for enhanced food security and nutrition in Africa and beyond

1. Project's summary/abstract:

NUTRIFOODS seeks solutions on how to increase the use of Climate Smart Food Crops (CSFC) in baked products to provide nutritionally-rich food that meets consumer needs while favouring local economies. In Africa, rural communities traditionally prepare meals from locally grown crops like cassava, sorghum and pulses. However, with fast population growth, massive urbanization, and increasing disposable incomes, consumption of wheat breads is increasing rapidly and displacing traditional meals. The bread products available to consumers, though tasty, are not nutritionally balanced.

A major economic and food security problem resulting from this transition is that Africa now imports nearly 60% of its wheat requirements. Hence, the baking industry in Africa requires functional, nutritious flour from locally available crops to replace wheat in breads. Conversely, in Europe, increased prevalence of coeliac disease, gluten-sensitivity and irritable bowel syndrome have created a growing demand for high quality gluten-free products. However, many current gluten-free products are low in dietary fiber, protein, micronutrients and phytochemicals and high in starches, sugars, fats and food additives

NUTRIFOODS will address the technological and human skills issues to enable the successful manufacture and uptake of nutritious, wheat-reduced and gluten-free breads in Africa and Europe.

2. Project's main objective (s):

NUTRIFOODS aims to enhance food and nutrition security and improve livelihoods of stakeholders in the CSFC value chain.

Consortium

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Sub themes:

- Nutritious value chain
- Food Value chain

3. Theory of Change and Impact Pathway

3.1 Summary ToC with assumptions

NUTRIFOODS purposes to build a value chain for the CSFC in SSA, (cassava, sorghum, finger millet, amaranth and cowpeas) that contributes to ending food and nutrition insecurity and improved livelihoods of local communities. This will be reached through a market-driven approach enabling demand for the locally produced CSFC. The key strategies to achieve this are: i) using CSFC to develop functional ingredients with properties that allow partial or total replacement of wheat in bread products; ii) understanding the supply and market chain of CSFC with the aim of addressing their limitations; iii) using markets as key incentivizing drivers of value chains; iv) engaging commercial partners to enhance technology uptake and commercialization.

The focal point will be the development of commercially viable processes and systems to produce nutritionally-rich and functional ingredients from CSFC, for the partial or complete replacement of wheat in breads without compromising product sensory qualities. This will be based on a precise analysis of bottlenecks and business opportunities including the different consumer preferences. NUTRIFOODS has engaged several commercial partners in different partner countries to actively participate in and direct the project. The engagement of commercial partners will continue through piloting and commercialization of the project outputs.

3.2 Expected outcomes and impact:

Out comes:

- Increased acceptance of gluten-free and wheat reduced breads from CSFC
- Commercial production of functional bread ingredients from CSFC

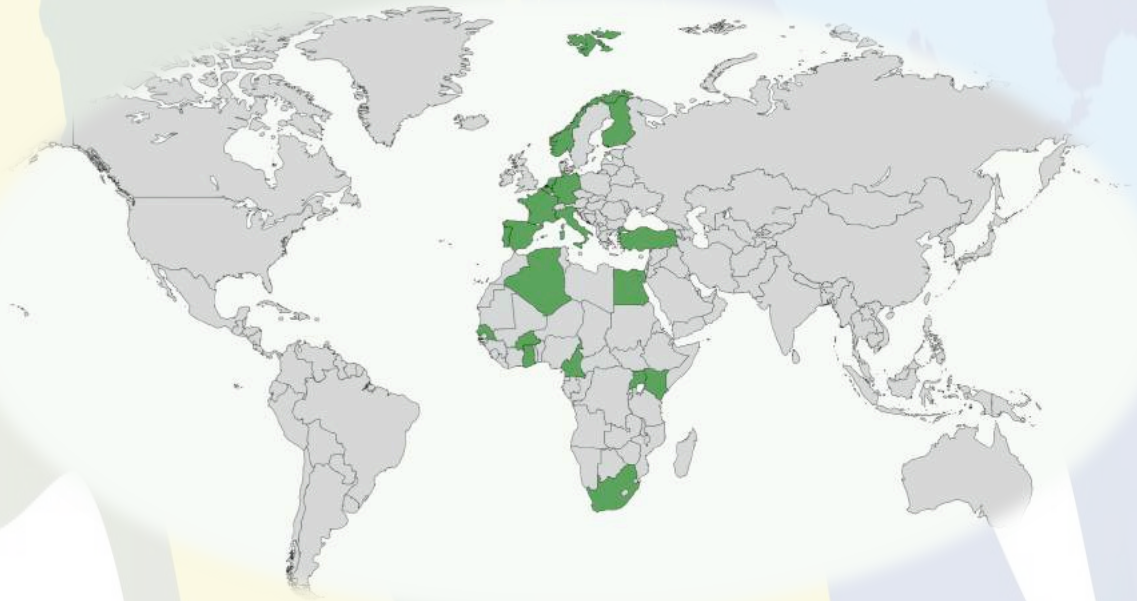
Impact:

- Increased market opportunities for CSFC with benefits accruing to small holder farmers.
- Increased business and job opportunities in the CSFC value chain.
- Effective and sustainable CSFC value chain that benefits the various stakeholders.

This research is funded as a part of the ERA-Net Cofund LEAP-Agri (grant no. 727715) through a virtual common pot model with EU top-up.

LEAP-Agri

A Long-term EU-Africa research and innovation Partnership on food and nutrition security and sustainable Agriculture



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