SCAR
Standing Committee
on Agricultural Research

The Agroecology Partnership's SRIA

The Strategic Research and Innovation Agenda for the candidate European partnership "Accelerating Farming Systems Transition: Agroecology Living Labs and Research Infrastructures''

Version 23.02.2023

List of abbreviations

AC: Associated Country
AE: Agroecology
AELL: Agroecology Living Lab
AKIS: Agricultural Knowledge and Innovation Systems
ALL: Agroecosystems Living Labs
AWP: Annual Work Plan
CAP: Common Agricultural Policy
CSA: Coordination and Support Action
CT: Core Theme
DG: Directorate General
DG AGRI: Directorate-General for Agriculture and Rural Development
DG CLIMA: Directorate-General for Climate Action
DG ENV: Directorate-General for Environment
DG RTD: Directorate-General for Research and Innovation
EC: European Commission
EIP-Agri: European Innovation Partnership for Agricultural Productivity and Sustainability
eLTER: European Long-Term Ecosystem, critical zone and socio-ecological Research
ERIC: European Research Infrastructure Consortium
ESB: Enlarged Stakeholder Board
EU: European Union
FAO: Food and Agriculture Organisation of the United Nations
GB: Governing Board
GO: General Objective
IPR: Intellectual Property Rights
JRC: Joint Research Centre
KPI: Key Performance Indicator
KSO: Key Strategic Orientation
LL: Living Labs
MAA: Multi-actor approach
MS: Member State
OG: Operational Group (EIP-Agri)
OIA: Open Innovation Arrangement
OO: Operational Objective
RI: Research Infrastructure
R&I: Research and Innovation
SCAR: Standing Committee on Agricultural Research[1]
SCAR-AE: SCAR Strategic Working Group on Agroecology
SCAR-AE TST: Thematic Support Team of SCAR-AE
SDG: Sustainable Development Goal
SO: Specific Objective
SRIA: Strategic Research and Innovation Agenda
SSAB: Scientific and Stakeholder Advisory Board
TF: Task Force

[1] https://scar-europe.org/

Content

"Let me say this clearly: fundamentally, the transition to sustainable agriculture, as envisaged in the Green Deal and Farm to Fork, is our only path to food security. This is strongly recognised and reinforced in our Communication.
We must also ensure that our food system is resilient to external shocks, like the one we are now experiencing.
That is why the Farm to Fork Strategy is an important part of our response.
It sets the path to reducing our dependence on inputs like fertilisers, without undermining productivity.
This will require a greater use of knowledge-sharing and innovation in areas like precision farming, organic farming, nutrient management and agro-ecology, which must be facilitated through CAP Strategic Plans."

Address by Mr Janusz Wojciechowski on the adoption of the European Commission Communication "Safeguarding food security and reinforcing the resilience of food systems".

"We want this to be science based! There is a lot of insecurity about food security. We want to dig deeper and understand all the underlying problems for shortages and understand what the real and long term solutions are for productive and sustainable farming in the EU. (…) It has to be science based and if this study would compel us to look again at the proposals we've made we will be open to that. The whole idea behind this is to have solid scientific backing for choices we will have to make also in the future. The college is very supportive of this idea because it will give us the arguments we need to argue in a very complex political environment and with emotions going in every direction. The more science we have, the stronger we are in our argumentation".

Quote from Commissioner Timmermans on occasion of the publication of the Nature Restoration Package

Executive summary

The overall purpose of this Strategic Research and Innovation Agenda (SRIA) is to define the general framework for strategic research and innovation activities to be undertaken under the future partnership "Accelerating Farming Systems Transition: Agroecology Living Labs and Research Infrastructures'' ("the Agroecology Partnership" hereafter). The partnership aims to promote a European large-scale endeavour for an agricultural sector that is fit to meet the targets and challenges in relation to climate change, biodiversity loss, food security and sovereignty and the environment, while ensuring a profitable and attractive activity for farmers.

It has been developed upon the mandate of the Standing Committee on Agricultural Research (SCAR) through its Strategic Working Group on Agroecology (SCAR-AE)[2] which delivered at first a "partnership dossier"[3]. This consolidated SRIA is the outcome of two years of work involving over 300 professionals from different domains, and building on the efforts of the 160 participants in the seven tasks forces defined by SCAR-AE in 2021, the comments provided by different observers of the SCAR-AE, European initiatives, the European Commission, and other experts through dedicated meetings or consultations. A consolidated draft was submitted for public consultation from July to October 2022, and the comments received were incorporated into this version of the SRIA.

Its intended target groups encompass all the actors interested or involved in and impacted by farming activities and their relationships with the overall agri-food value chain. This includes individual farmers and their organisations, research performing organisations and research funding organisations, businesses related to the supply chain, consumers and citizens, and relevant local, regional, national, and European authorities.

Current agricultural production systems have achieved an increase in the productivity per land area relying on intensive practices and high input of agrochemicals and antibiotics that have often had negative impacts on the environment and on human and animal health. Value chains associated to these intensive modes of agricultural production depend on the specialisation of its actors and the delivery of a limited number of products. These highly intensive and input-dependent systems have driven the degradation of land productivity, water resources and soil health, biodiversity loss at multiple spatial scales, and made farming less resilient, while increasing its contribution to the emission of greenhouse gases. These adverse impacts have compromised the sustainability of food production systems, with associated social and economic implications.

At the same time, farmers are increasingly confronted with the uncertainty and consequences of climate change and must adapt to its diverse effects, while still ensuring the provision of food for an increasing world population. High temperatures, longer periods of drought and heat, increased late frost risks, pest outbreaks, increased heavy rainfall and extreme weather events jeopardise entire agricultural production systems. The current global context after the COVID19 pandemic and the Russian invasion of Ukraine have raised awareness on the relationships between health, food security, ecosystems, supply chains, consumption patterns and planetary

[2] scar-europe.org
[3] https://research-and-innovation.ec.europa.eu/system/files/2022-04/european_partnership_for_accelerating_farming_systems_transition_march_2022.pdf

boundaries, and the importance of locally and regionally produced and sourced food that decrease the dependence on non-EU imports, including agrochemicals.

In the current context, farming systems are called to respond to the needs for affordable, sufficient, healthy and safe food, and other high-quality raw materials, as well as conserving resources and the environment, promoting biodiversity and increasing the provision of ecosystem services from farming activities, while ensuring a decent living for farmers.

There is increasing recognition that a major change is needed that would make the agricultural sector more sustainable, resilient, and responsive to societal and policy demands. This is highlighted in many policy documents and initiatives, ranging from the EU Environment Action Programme to 2030, the UN Sustainable Development Goals (SDGs) to the ambitious European Green Deal and the underlying strategies - Farm to Fork and the EU Biodiversity Strategy 2030, and the Common Agricultural Policy (CAP), among others. The latter documents highlight agroecology (AE) as a promising approach to support the transition towards more sustainable agriculture and it has become a priority for research under the EU's Research and Innovation Programmes Horizon 2020 (2014-2020) and Horizon Europe (2021-2027).

Agroecology (AE) is considered as the science of ecological processes applied to farming production systems, benefiting from the interplay of science, technology and traditional knowledge by farmers and stakeholders in value chains. It has the potential to contribute to environmental protection, healthier and more sustainable diets and a just distribution of benefits and burdens. Being based on a systemic understanding of farming which relies on learning from nature and ecology and using integrated principles, it has the potential to help address the above-mentioned demands. The full adoption of AE principles requires the implementation of incremental and transformational pathways involving agroecosystems and the entire food system, and encompasses economic, social, and environmental dimensions.

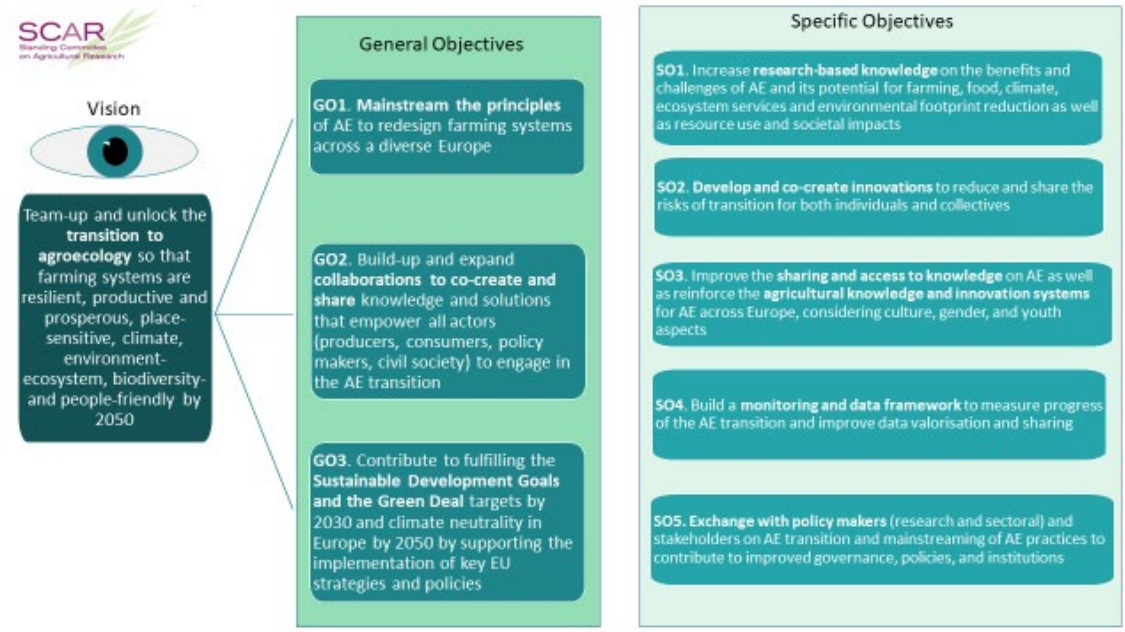
Achieving AE transition requires overcoming a series of bottlenecks and lock-ins related to R&I, policy, social and cultural, and economic domains, beyond the purely agronomic aspects. Accelerating AE transition requires a multi-actor approach to co-develop solutions and activities, design policies, and extend skills and capacities for the transformation of the overall agroecosystem. In the context of land-based primary production, increased attention to the context-specificity (spatial-bio-geographic, economic, and social) associated with agroecological practices is needed, which implies the search for knowledge-intensive solutions as standard agricultural solutions are inadequate. Increasing the spread of this type of approach poses challenges to the existing socio-technical aspects of our agricultural systems that need to be transformed through the implementation of a broad spectrum of innovations.

Living Labs (LLs) emerge in this context as an instrument providing the adequate long-term and user-centred framework for facilitating the co-design, co-development and rapid uptake of innovations tailored to specific locations (from practice to policies). The partnership will promote the establishment of a network of agroecology LLs across Europe to benefit from their particular experiences. Research Infrastructures (RIs) provide an appropriate environment for multidisciplinary research while helping to develop and implement relevant services and tools. They encompass the monitoring of pertinent biotic and abiotic variables, and the evaluation of different scenarios of AE transition. Interdisciplinary and transdisciplinary training and innovation are also prominent activities of RIs. Matching RIs and AE LLs therefore has a great

potential to enhance the creation and adoption of innovations, enabling their fast evaluation and their re-consideration whenever needed.

The Agroecology Partnership aims to coordinate and pool resources to lift lock-ins and enable and steer AE transition by integrating all relevant actors. It will provide the long-term and landscape perspectives needed to perform and test AE transition, by designing and implementing place-based innovations, setting the appropriate framework for improving knowledge on agricultural transition processes, and providing appropriate methodologies to steer, monitor and evaluate co-creation practices, transition outcomes, and their impacts. The Agroecology Partnership will also put in place mechanisms for science-policy dialogue in support of the establishment, implementation, and evaluation of evidence-based policies (research and sectoral) endorsing AE transition, including long-term funding for AE R&I.

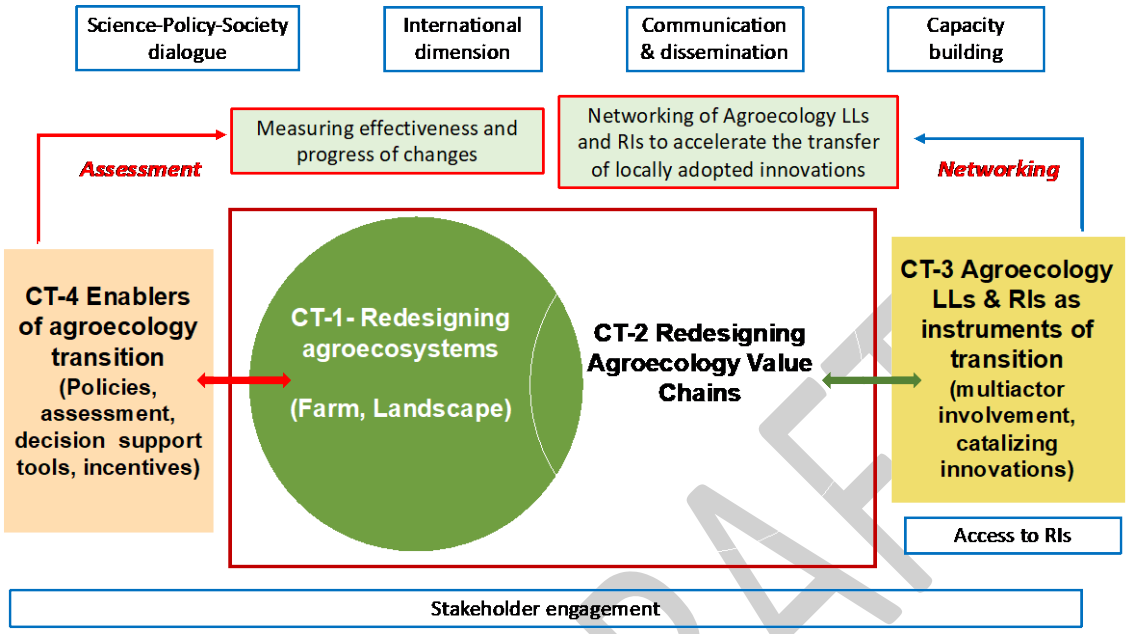
The Agroecology Partnership relies on a common vision to team-up and unlock the transition to agroecology so that farming systems are resilient, productive and prosperous, place-sensitive, as well as climate, environment-ecosystem, biodiversity and people-friendly by 2050. Three General Objectives and their five derived Specific Objectives will contribute to achieving this vision, as shown in the figure below.



The partnership will contribute to filling existing knowledge gaps on AE, promoting more open innovation and user-driven research on AE, addressing the wide geographical/territorial specificities in the EU through place-based approaches with long-term perspectives, and improving the sharing of knowledge within and across EU countries and beyond.

Deriving from the General and Specific Objectives, the following four core themes (CTs) have been identified in this SRIA to accomplish the Agroecology Partnership's vision and objectives, identifying the knowledge and the innovations that are necessary to accelerate AE transition in a consistent way, encompassing local, national and European scales. In addition, various supporting activities are proposed to ensure the impact of the research and innovation

activities. The figure below shows the SRIA conceptual framework encompassing its CTs and supporting activities.



Core Theme 1

Redesigning agroecosystems – Under this core theme, the partnership will identify and test both suitable farming practices adapted to local conditions and appropriate landscape planning approaches aiming to reduce the use of agrochemical inputs through e.g. the closure of nutrient and energy flows, or the development of biological control methods, while enhancing landscape and agroecosystem biodiversity. The final aim of this CT is to increase the resilience of agroecosystems to climate change and extreme climatic events, while increasing the provision of food, feed, fibre, biomass, and ecosystem services from farming. Socioeconomic aspects associated to the redesign of agroecosystems, and the development of decision support tools for farmers and advisors will also be covered by this CT.

Core Theme 2

Redesigning agroecology value chains. Activities under this core theme will focus on the adaptation of territorial/landscape value chains to the transformation of agroecosystems brought by the AE transition, through better understanding of farmer, market, and consumer linkages, with respect to agroecological products. It connotes the involvement of stakeholders, the provision of technological innovations and the construction of appropriate business models. Different scenarios must be constructed and assessed with the participation of the different stakeholders of those European districts/territories/regions engaged in AE transition, defining a common vision of the resulting landscape after the agreed interventions, and considering the potential associated socio-economic and environmental benefits and trade-offs. As is the case for other CTs, CT2 will build on the experience of the organic farming sector and cooperation with the Sustainable Food System candidate partnership is envisaged.

Core Theme 3

Agroecology Living Labs (LLs) and Research Infrastructures (RIs) as instruments enhancing multi-actor involvement for AE transition and the acceleration of creation and adoption of innovations. Activities deployed under CT3 will increase knowledge and understanding on the criteria the AE LLs and RIs should meet to accelerate AE transition and the methodologies, tools, governance, and organisational aspects supporting their operation. LL indicators need to be defined both for assessing their impact on AE transition and their individual performance. Research under this CT will also identify the enablers and drivers promoting the participation of the different stakeholders in LLs and RIs, and subsequently propose sound incentives to enhance their cooperation.

Core Theme 4

Enablers of agroecology transition. Activities under this core theme will address the research needs related to the enabling environment needed to accelerate the AE transition, such as the enhancement of coherence across sectoral policies and instruments, the development and implementation of decision support tools for policy- and decision makers, and the incentives to engage stakeholders in long-term initiatives. The development and assessment of conceptual frameworks, methodologies, and tools will also be carried out under CT4.

These four core themes are interconnected through cross-cutting activities aiming to provide a European perspective by capitalising on local experiences and outcomes. These actions involve the networking of AE LLs and RIs to accelerate the dissemination of locally adopted agroecology innovations to other areas, and the monitoring of effectiveness and progress of changes at the European level.

A series of supporting activities have been identified to inform, consult, advise, and involve different stakeholders to create capacity, raise awareness, and manage and exchange the knowledge and data created in the partnership's framework. These activities are related to stakeholder engagement, capacity building actions targeted to various actors, access to RIs, communication and dissemination, science-policy dialogue, and the partnership's international dimension. Mechanisms for science-policy dialogue in support of the establishment and implementation of evidence-based policies (research and sectoral) endorsing AE transition will also be developed.

The implementation of the partnership's activities should be facilitated by establishing synergies with other EU programmes and policies such as the Common Agricultural Policy, European Regional Development Fund, LIFE, and initiatives framed under Horizon Europe, such as missions, other partnerships, and EU and national research projects.

Given the global dimension of agroecology, the SRIA also considers the international context. Activities will promote dialogue at international level with the dual aim of gaining knowledge from useful experiences stemming from other continents and having an impact on the global scene. Potential cooperation opportunities with relevant platforms and initiatives have been identified. These include the FAO, the EU-African Union Research and Innovation Partnerships on Food and Nutrition Security and Sustainable Agriculture, the Latin-American Scientific Society on Agroecology (SOCLA), or the Transformative Partnership Platform on Agroecology. A mapping of potential international partners with the aim to add value to the partnership's activities will be performed.

This SRIA must be considered as a framework of agreed high-level ideas for thematic partnership priorities. It will be implemented through Annual Work Plans.

1.Introduction

1.1 The challenge

1.1.1 Problems

The production of food, feed and biomass for other uses largely depends on farmers, who manage almost half EU land[4], making them central stewards of Europe's natural resources and key strategic actors in the bioeconomy. The COVID-19 pandemic and the increasingly frequent occurrence of extreme climate events have underlined the fragility of current production systems. This has been exacerbated by the Russian invasion of Ukraine. A recent Communication[5] from the European Commission points out its heavy consequences and calls "to take urgent action to present options to address rising food prices and the issue of global food security as soon as possible".

The need to move towards robust and resilient food systems that are capable of ensuring access to sufficient, affordable and healthy food for citizens at all times and of reducing Europe's dependence on imports of crops and agricultural inputs, such as fertilisers and protein crops[6], is perhaps more important than ever. These events have also raised awareness on the relationships between health, food security, ecosystems, supply chains, consumption patterns and planetary boundaries, and the importance of locally and regionally produced and sourced food that decreases the dependence on non-EU imports. Besides food and feed, also fibre, fuel and other types of biomass are of major importance to the EU's economy and trade. Last but not least, farming is an important part of the EU's rural economy and culture, as well as a major source of employment, despite farmers' ever-decreasing share of the EU[7] workforce and population.

The current agricultural production systems benefit from several decades of scientific and technological innovation, which in the post-World War II period is associated with the Green Revolution. Through mechanisation, crop and livestock breeding, and the use of chemical inputs such as fertilisers and pesticides, monocultures and productivity per land area have increased, reducing the need for labour on the farm, thereby compensating for the outflow of labour from farming to industry and services. Value chain structuring and technological development have favoured the specialisation of farmers and the production of a limited number of products, with supplies, processing and marketing being delegated to cooperatives, industry and retail.

These changes and high specialisation have contributed to ensuring food security in Europe, although the recent and ongoing crisis is putting this at risk, but have come at the cost of a series of environmental, socio-economic and cultural degradations. IPCC[8] (2019) and IPBES[9] (2019) assessments have concluded that "many aspects of current food production systems drive

[4] https://ec.europa.eu/agriculture/cap-indicators/context_en
[5] https://ec.europa.eu/info/sites/default/files/food-farming-fisheries/key_policies/documents/safeguarding-food-security-reinforcing-resilience-food-systems.pdf
[6] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52018DC0757
[7] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0381
[8] IPCC 2019 Summary for Policymakers. In: Climate Change and Land: an IPCC special report on cli-mate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems
[9] IPBES 2019 Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services

degradation of land productivity, water resources and soil health, as well as biodiversity loss at multiple spatial scales, ultimately compromising the sustainability of food production systems"[10]. Indeed, the intensification of agricultural systems and land use have had adverse impacts on the environment and the preservation of natural resources, such as soil and water, and are among the causes of habitat fragmentation/loss and biodiversity loss. Moreover, the agricultural sector is responsible for 10.3% of the total EU's GHG emissions[11].

Animal-based food production is a significant contributor to GHG emissions. Moreover, the intensification of livestock farming on large farms with excessive use of antibiotics that increase the risk of resistance of some pathogens has negative impacts on animal and human health. Moreover, the decoupling of animal husbandry and crop production leads to imbalances between availability and need for nutrients locally and regionally. At the same time, animal-based production has a potential to play a positive role in the transition and its future systems by providing services (e.g. well-managed manure on soil fertility and health).

Furthermore, farmers are increasingly confronted with the consequences of climate change and must adapt to its diverse effects. High temperatures, longer and harsher periods of drought and heat, increased late frost risks, pest outbreaks, increased heavy rainfall and extreme weather events jeopardise entire agricultural production systems. At the same time, the environmental impact and carbon footprint of currently prevailing farming practices are more susceptible to changes and are also increasingly criticised by the public and the media.

Farmers can play a vital role in preserving biodiversity, since they are the guardians of the land. They are also among the first to feel the consequences when biodiversity is lost but also among the first to reap the benefits when it is restored. In conclusion, *European farmers are an essential part of the EU's future and must continue to be the social and economic hub of many communities across our Union*[12].

Despite this, many farmers do not draw a sufficient income from their farming activity. In 2018, while 5 % of farms had a Farm Net Value Added (FNVA) per Annual Work Unit (AWU), a measure of a farmer's income per year, of more than EUR 70 000, 50 % had a FNVA per AWU below EUR 10 000[13]. Factors such as fragile incomes, volatile food prices, extreme weather events, new pests and diseases, and imbalances in the food chain leave farmers in vulnerable positions compared to other actors in the value chain and constrain their long-term investments/projects, leading to lock-ins. This tends to lead not only to risk averse behaviour, but also challenges in terms of generation renewal (32% of European farmers were over 65 years old, and only 11% of EU farmers were under 40 years of age in 2016[14]), exacerbated in areas facing rural decline and limited access to land. At the same time there is an increasing number of young, first generation farmers who are committed to implementing agroecological practices. Their contribution to food system renewal is however hampered by high land prices and short-term rental contracts that discourage careful planning and long-term investment.

[10] Hodson et al. 2021 (UNFSS Science Group Track 3)
[11] EEA (2019), Annual European Union greenhouse gas inventory 1990-2017 and Inventory report 2019. These figures do not include CO_2 emissions from land use and land use change, nor emissions from energy use and the production of chemical fertiliser.
[12] EU Biodiversity Strategy 2030
[13] EU Farm Economics Overview FADN 2018: https://agriculture.ec.europa.eu/system/files/2021-11/eu-farm-econ-overview-2018_en_0.pdf
[14] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2021%3A815%3AFIN

There is a growing expectation of a resource-conserving or even resource-improving agriculture based on a systemic understanding of farming relying on nature-based solutions scientific standards [15]. That is, learning from nature and ecology and using integrated principles while considering appropriate geographical scales, resulting in a net gain of biodiversity and ecosystem integrity and a just distribution of benefits and burdens supported by inclusive, transparent and empowering governance processes. The application of those standards facilitate agricultural production systems' provision of affordable, sufficient, healthy and safe food and other high-quality raw materials, as well as preserving resources and the environment, promoting biodiversity and increasing the provision of ecosystem services from farming activities. Since they imply moving beyond the 'business as usual', increasing the spread of those approaches poses challenges to the existing socio-technical aspects of our agricultural systems, thereby calling for a broad spectrum of innovations in order to be transformed.

A description of the main problems encountered by the EU farming sector, including the drivers and opportunities, is provided in the partnership's dossier (see footnote 3 on page 6).

1.1.2 Strategic opportunities

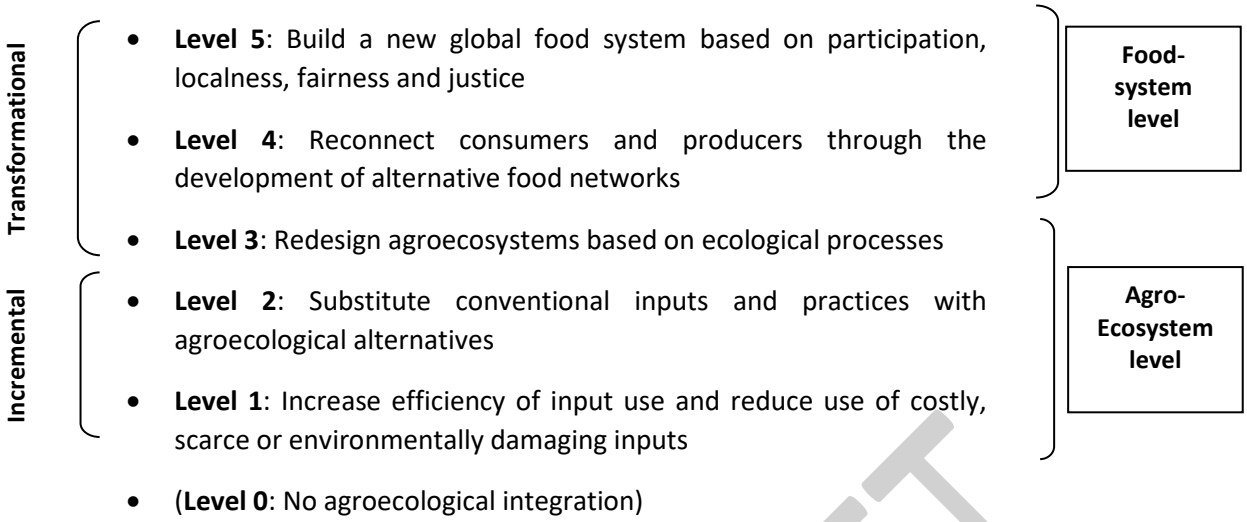
The assumption of this partnership is that we can address these challenges through agroecology (AE hereafter), which is an approach that builds on natural, biological interactions while using state-of-the-art science and technology, and innovation based on farmers' knowledge and tested best practices.

There is increasing recognition that a major change is needed that would make the agricultural sector more sustainable, resilient and responsive to societal and policy demands. This is highlighted in a large number of policy documents and initiatives, ranging from the EU Environment Action Programme to 2030[16], the UN Sustainable Development Goals (SDGs) to the ambitious European Green Deal and the underlying strategies - Farm to Fork and the EU Biodiversity Strategy 2030 - as well as the new Common Agricultural Policy (CAP), among others (see partnership dossier, footnote 3 this document). Also the Standing Committee on Agricultural Research (SCAR) and its 5th Foresight Study[17] have highlighted the need for this transition.

This calls for the definition of approaches and steps for AE transition to be undertaken within the EU. This partnership offers the opportunity to address the ambitious challenge of redesigning agricultural systems accordingly and feeding positively into the transformation of food systems in cooperation with a landscape of Horizon Europe partnerships and missions.

Five levels of agroecology transition have been widely adopted based on Gliessman (2016) [18]:

[15] Global Standard for Nature-Based Solutions of the International Union for Conservation of Nature (IUCN). https://portals.iucn.org/library/sites/library/files/documents/2020-020-En.pdf
[16] 8th Environment Action Programme
[17] https://scar-europe.org/images/FORESIGHT/FINAL-REPORT-5th-SCAR-Foresight-Exercise.pdf
[18] Gliessman, S. (2016) Transforming food systems with agroecology. Agroecology and Sustainable Food Systems, 40(3), 187-189. https://doi.org/10.1080/21683565.2015.1130765



A full transition to AE entails a transformative change of the entire food system. The proposed partnership has its main focus on fostering AE transition at the primary production level. Nevertheless, to achieve the ambition of an in-depth transformation of the system, the links between primary production and the entire food system context described in the figure are acknowledged.

With this perspective, synergies with the candidate European partnership for Sustainable Food System for People, Planet & Climate will ensure coherence across the entire value chain and an increased engagement at consumer level to support the AE transition.

1.1.3 R&I bottlenecks and lock-ins

Conventional agricultural systems rely on the use of external inputs (e.g. fertilisers and pesticides) with increasing costs, supply uncertainty and potential negative impact on the three dimensions of sustainability (economic, social and environmental). In contrast, AE-based systems maximise the use of ecological processes and rely on increased diversity. The factors that hinder the transition to more sustainable farming practices and systems such as AE include:

R&I related:

i) Insufficient and scattered education, data and knowledge on agroecosystems, AE farming practices and the benefits and costs of AE transition measures, including: (a) insufficient knowledge on ecological processes and dynamics at the appropriate spatial level to address the relevant biophysical and socio-economic challenges; (b) lack of experimental and long-term data series on agro-ecosystems' functioning; (c) lack of sound indicators, tools and methodologies to quantify ecosystem services at various spatial scales; (d) lack of robust data on the context-specific positive effects of combinations of AE management practices and systems on climate change mitigation and adaptation, on biodiversity and on circularity; (e) insufficient use and availability of AE-specific evaluation systems at the right scales to allow for a fair comparison with conventional agriculture; (f) insufficient consideration of ethical, political, social, legal, public health and power issues when evaluating success of and interests in agriculture.

ii) Lock-ins in the research and innovation system: (a) lack of incentives and recognition for researchers involved in systems thinking and transdisciplinary approaches, lack of adapted funding opportunities (e.g. due to longer approval times because of the number of people that have to be consulted) and career opportunities; (b) the limited number of structures/mechanisms at the relevant level to facilitate the co-creation and uptake of innovative solutions to the local challenges of the farming sector and to ensure the involvement of all relevant stakeholders, including farmers, researchers, advisors, companies, consumers and public authorities; (c) the absence of a specific, harmonised mechanism that allows the sharing of experience and best practices and communication among different actors across Europe on the adoption of AE approaches; (d) lack of funding schemes that promote AE as a holistic and transformational approach; (e) insufficient research about motivations, capabilities, opportunities and behaviour that promote or hinder AE uptake and development.

iii) The diversity of local conditions, and of the local impact of climate change, which prevent the development of standard solutions, leading to the need to design new knowledge management systems, allowing for both down- and upscaling of information and solutions, new tools to capture and aggregate place-specific data, and ways to address the trade-offs between specificity of place-based knowledge and innovation and genericity for knowledge exchange at EU level.

Related to policy:

i) The lack of a common understanding and ownership of the AE concept at relevant levels (policy, stakeholders, science community) and lack of recognition of its potential to deliver economic, social, climate and environmental sustainability, together with food security and increased resilience, and hence be a credible alternative to more conventional farming approaches and productivist[19] paradigms.

ii) The lack/narrow focus of strategic and long-term thinking that impairs the planning and organisation of farming systems' transition to AE, and the lack of policy coherence at national and European level to support this transition, including the true pricing of environmental and social effects of agriculture, and the removal (phase out) of any barriers to the adoption and development of AE, and AE's recognition by society and integration into society.

iii) The lack of adapted policy 'drivers' and regulatory aspects (for example land use-planning of green infrastructures without integrative criteria, lack of countries' and farmers' uptake of practices conducive to sustainable management of natural resources) which do not stimulate the adoption of AE innovation and production practices with respect to nutrient inputs, agricultural emissions, multifunctional agriculture, agroforestry, organic production, etc.

[19] "Productivism" is defined as "a discourse of agricultural organisation in which the function of farming was singularly conceived as the production of food and fibre, and which prioritised increasing agricultural production over all other considerations" (Woods, 2011. Rural. London, UK: Routledge, p. 67).

Linked to deployment, business models, systemic challenges:

i) Reluctance of farmers and advisors to take steps towards transition to AE driven by: (a) higher knowledge intensity and complexity of AE compared to more conventional farming approaches and a subsequent need for skills on the practical implementation of AE practices in specific contexts, on their benefits on the environment and on their economic performance; (b) perceived risk of lower profitability in the first years (i.e. moving from annual considerations to longer-term) due to concerns on labour-intensity, potential lower productivity, yield instability, lack of market outlets and short-term risks related to outbreaks of pests and diseases; (c) low income, high debt, limited investment capacity, volatile market conditions and overall market orientations towards standardised products that limit farmers' capacity and willingness to take risks; (d) the relationship between generational issues, education and innovation, particularly the link between age and innovation, with younger and better educated farmers being considered particularly innovative, in combination with difficulties for young people to gain access to farming (White, 2015[20]); (e) low attractiveness of farming and rural life.

ii) Lock-ins in value chains and business models that are designed for large-scale global flows: (a) the overall orientation in processing, retail and logistics towards long value chains, adapted to standard products and industrial scale, and not including externalities (e.g. energy use); (b) lack of knowledge and innovation to optimise the costs and environmental impacts of shorter value chains or value chains adapted to smaller quantities of products or designed to aggregate these smaller quantities, and weak strategies aiming to provide added value from AE products through their processing; (c) challenges in processing of products from AE production systems (such as processing of variety mixes, pulses, less standardised quality features, etc.); (d) inadequate food standards in terms of quality or appearance of the fresh products; (e) reluctance of (some) companies to invest in new/changing systems.

iii) Lock-ins restricting consumption and demand for products coming from AE: a) insufficient consumer awareness of the costs and added value of AE practices and insufficient incentives that could trigger increased demand for products produced under AE principles; b) issues around the affordability of AE products and, in some cases accessibility (absence of shops selling them/food deserts); c) challenges around dietary change to adjust the composition of diets to what can sustainably be produced through AE; d) economic system and cultural mindset oriented towards short-term and price-based competition.

iv) Potential socioeconomic and environmental trade-offs derived from the actual implementation of AE transition, and uncertain global and European economic contexts impacting on a) food price and security; b) farmers' income; c) consumers' engagement and satisfaction in terms of quantity, quality, and variety; d) employment rates and attraction of needed work-force; e) availability of funds to perform the necessary investments; f) return on investments; g) long-term stakeholder involvement and economic sustainability of actions; h) potential environmental trade-offs following non-integrated or non-properly tested or adapted practices. Regional, national and European policy contexts may also have an influence, mostly associated with non-suitable and

[20]White, B (2015) Generational dynamics in agriculture: Reflections on rural youth and farming futures. Cahiers Agricultures, Vol 24

incoherent policy frameworks or regulations and undesirable long-term legal uncertainties.

1.2 Why a partnership?

1.2.1 Directionality & complexity

Directionality: Agricultural policies of the EU, Member states (MS) and Associated Countries (AC) converge towards similar goals and objectives that call for more sustainability in agriculture, while ensuring a sufficient delivery of quality products, in particular in the food sector (but also feed, fibre, etc.), respecting the environment, contributing to combating climate change, delivering ecosystem services and providing a better life for people, including the farmers themselves. The EU and the MS/AC share the ambition of contributing actively to reaching the SDGs and agree that urgent action by all countries is needed to that end. Numerous policies identify AE as a promising approach. These common ambitions call for working together and pooling resources in a concerted effort to lift lock-ins, enable and steer the AE transition through a R&I partnership. As indicated previously, the challenges require action at different scales: European, national, regional and local. This calls for the different MS/AC and the EU to act jointly towards the same objectives, using the various policy tools at their disposal. The partnership, as a unique instrument at EU-level dealing specifically with AE, represents a powerful instrument to coordinate and support MS/AC in proposing and testing innovations, tools and policies and working together on common methodologies to steer transition and measure progress towards impact.

Complexity: A partnership is needed to focalise the efforts of the EU, the MS and AC as well as regions, farmers and citizens, in a co-creative manner, in order to address the urgent need for concrete action. Moreover, agriculture is a shared competence of EU and MS/AC. As per the delivery model of the new CAP, general rules are defined at EU level in line with EU policy objectives, while leaving Member States the possibility and the responsibility to identify in their national CAP Strategic Plans[21] their priorities, objectives and the actions needed to reach those, in agreement with the EC. As a consequence, the policy for products stemming from AE has to be decided jointly by the EU and MS. In other respects, the complexity of the challenges to address and the ambitious work to perform cannot be carried out by any MS/AC alone, nor by the EU. A critical mass is required in order to achieve an in-depth redesign of the agricultural sector and systems. Such a critical mass can only be reached by bringing together EU research funding bodies and national ministries related to the domains of agriculture and the environment, and beyond. On top of that, the targeted redesign requires a higher degree of integration in terms of bringing together all relevant actors, coordinating the activities and the policies and regulatory context. In addition, as the partnership also intends to put the EU in a leading role at international level in the domain of AE, close collaboration within the EU is required in order to address the international community with a unified voice.

As stated earlier, AE processes are complex. In order to increase understanding and uptake, it is necessary to increase the availability of long-term data that allow for an accurate analysis of the

[21] https://agriculture.ec.europa.eu/cap-my-country/cap-strategic-plans_en

evolution of ecological processes over time. Assessing AE processes therefore requires long-term approaches along with landscape scale coverage that go beyond individual farms and across national borders and need to be embedded in the knowledge and innovation system of every country. Such approaches are not possible with the usual EU or national R&I projects which have a limited duration, usually three-four years. This calls for longer-term efforts, as featured in the Horizon Europe partnership instrument. Moreover, AE processes are highly knowledge-intensive and require that farmers are equipped with the necessary skills and knowledge for the effective adoption of AE practices. In addition to this, the agricultural landscapes differ among countries and their regions, and given that one single country or region will only be able to provide partial solutions to a common challenge, ensuring an exchange of good practices and experiences across MS/AC becomes crucial. Furthermore, there is wide scope for improving knowledge of agricultural transition processes, place-based innovations and how to steer, monitor and evaluate such transition and co-creation processes. Joint learning would not only be on the "what" (production practices, which might be applied between localities e.g. encountering similar challenges) but also on the "how" to accompany the evolution of actors: the methodology aspects can and therefore must be shared across Europe (if not beyond), in order to move iteratively to optimal solutions.

1.2.2 A partnership in comparison to other instruments

Co-funding instruments (e.g. ERA-NET Cofund under Horizon 2020) have proven a limited capacity to mobilise financial resources to jointly fund research. Through this funding scheme, the EU resources had a "leverage effect" on the national resources put in common to address the agreed topics. Nevertheless, the (in particular financial) size of these instruments was restricted and became a barrier when it came to addressing challenges of a broader nature.

In the last decades, the EU and the MS/AC have co-funded and/or worked together in numerous R&I initiatives in the broad field of agriculture and the related bioeconomy. However, the landscape still remains fragmented between Joint Programming Initiatives (JPIs) in particular the JPI on Agriculture, Food Security and Climate Change (FACCE-JPI), plenty of ERA-NETs (e.g. Core Organic, SusCrop, FACCE SURPLUS, ERA-GAS, SusAn, FOSC), the European Joint Programme (EJP) on Soil, etc. In parallel, R&I was also funded directly via the work programmes under H2020 (RIAs and IAs). Excellent research was performed thanks to these instruments, nevertheless this was not sufficient to trigger a real change in paradigm, partially due to the dispersion of efforts among all initiatives and lack of a common strategy bringing together the outputs to make them available to the interested communities, and more specifically the farmers and the private sector.

Moreover, considering the specific orientation of the proposed partnership to work with Living Labs (LLs) and Research Infrastructures (RIs), an appropriately long-term instrument such as a partnership is required. Unlike other instruments (e.g. research projects with a three-year duration), the partnership will cover at least seven growing seasons, allowing for a longer time frame that is appropriate to initiate and sustain changes in the long-term.

While joint calls for transnational research projects planned under the umbrella of this partnership remain an important aspect in order to increase knowledge and develop innovation and solutions, the partnership requires a degree of cooperation and a nature of activities which go much beyond these approaches. Regular collaborative research projects can contribute to

launching facilities or setting up networks, but are not suited to sustain them in the long run nor to integrate them in bottom-up grassroots initiatives in specific territories. They are also not suited to ensuring the long-term involvement of countries in the process and the coordination of their activities, all of which are essential factors to ensure the long-term approaches that AE processes require.

Within the AE framework of the partnership, efforts will be made to transform R&I dynamics in present agricultural knowledge and innovation systems (AKIS) to become more grounded, co-created, timely and relevant to farmers and society. This will be key to provide the whole range of knowledge and practices which are necessary for a transition towards AE of a substantial part of the EU farming sector. The adoption of AE practices requires the development of an ambitious and longer-term joint action at European level involving European, national and regional funders. It will trigger a dynamic adaptation of the research agenda towards greater, more relevant and quicker impact. Impacting policies so as to provide an appropriate legal framework to the future agricultural systems is also an essential aspect. The partnership aims, in addition, to work specifically on communication and dissemination aspects that will ensure outreach to all concerned actors. Finally, monitoring the transition by assessing the performance of AE practices and of the LLs also calls for an instrument which goes much beyond former ones. The partnership instrument is suited to cover the full range of activities necessary to trigger the desired redesign of our agri-food systems.

1.2.3 A partnership combining AE, LLs and RIs

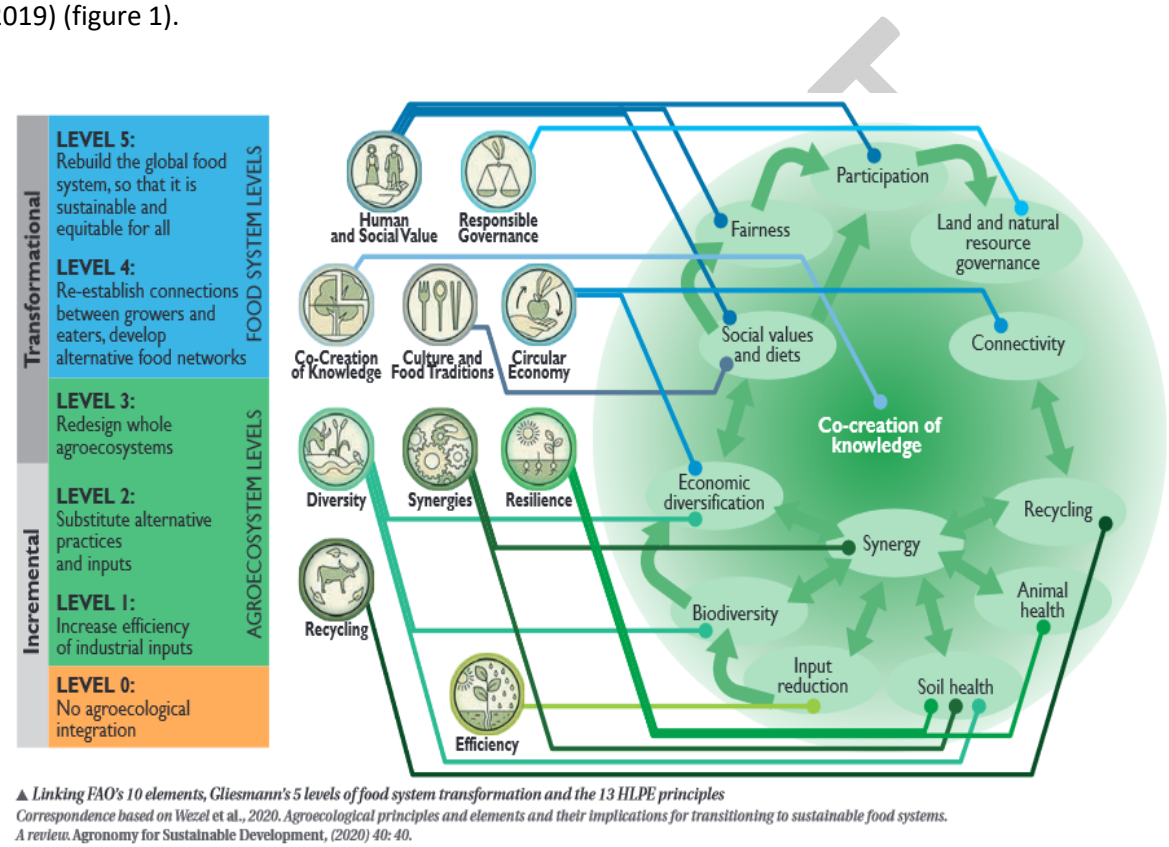
Agroecology (AE): is a dynamic and holistic approach to agriculture considered at the same time a science, a set of practices and a socio-political movement aimed at supporting the transition of agri-food systems towards more sustainable practices. It aims at connecting science, practice and society and triggering the adoption of a set of policies aimed at sustainable agricultural practices.

As an outcome of the discussions led by the SCAR Strategic Working Group on Agroecology (SCAR-AE), AE will be considered in the context of this document as "the science of ecological processes *applied to agricultural*[22] *production systems* benefiting from the interplay of science, technology and traditional or indigenous knowledge by farmers and stakeholders in value chains". AE can contribute to mitigating climate change, protecting biodiversity and ecosystems, and strengthening the sustainability and resilience of farming and land use systems. AE practices are already emerging in many European countries and are recognised in the European Green Deal[23]. AE could become a fundamental tool for the EU in its effort to respect planetary boundaries and in response to increasing consumer demand for healthy, affordable, pesticide-free and nutritious food. In its recent Communication 'Safeguarding food security and reinforcing the resilience of food systems'[24], the EC highlights innovation through agroecology as one of the tools that can mitigate pressure on input costs without hurting production capacity, leading to long-term progress in productivity. In the context of this partnership, innovation is the introduction of something new (or renewed, a novel change) which turns into an economic, social or environmental benefit for practice.

[22] Agriculture in the context of this document should be seen in the wider sense
[23] https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en
[24] https://ec.europa.eu/info/sites/default/files/food-farming-fisheries/key_policies/documents/safeguarding-food-security-reinforcing-resilience-food-systems.pdf

At the international level, the Food and Agriculture Organisation of the United Nations (FAO) also promotes the potential of AE, stating that "*agroecology is based on applying ecological concepts and principles to optimise interactions between plants, animals, humans and the environment while taking into consideration the social aspects that need to be addressed for a sustainable and fair food system*"[25]. In this context, the FAO has developed and approved ''The 10 Elements of Agroecology''[26].

In addition, a systemic approach has been synthesised and defined by the High Level Panel of Experts[27] for the World Committee on Food Security in the 13 principles of agroecology (HLPE, 2019) (figure 1).



▲ *Linking FAO's 10 elements, Gliesmann's 5 levels of food system transformation and the 13 HLPE principles*
Correspondence based on Wezel et al., *2020. Agroecological principles and elements and their implications for transitioning to sustainable food systems. A review.* Agronomy for Sustainable Development, *(2020) 40: 40.*

Figure 1: Linking FAO's 10 elements, Gliesmann's 5 levels of food system transformation and the 13 HLPE principles[28]).

More explicit than the ten elements, on which they are based, these provide indications and guidelines for concrete implementation.

[25] http://www.fao.org/agroecology/home/en/
[26] https://www.fao.org/agroecology/overview/overview10elements/en/
[27] HLPE 2019. https://www.fao.org/3/ca5602en/ca5602en.pdf
[28] https://knowledge4policy.ec.europa.eu/publication/agroecological-transformation-sustainable-food-systems_en

While the partnership will continue to strive for a common understanding of the concept of AE in Europe, in order to guide the R&I activities of this partnership , common aims for AE are set. These inter-connected aims are to be understood as the implementation of the current state of science and technology by farmers and stakeholders in value chains:

a. Reducing greenhouse gas emissions from agriculture, active removal and carbon storage, as a contribution to climate protection with the goal of climate neutrality;

b. Preserving natural resources, minimising resource losses at farm and landscape levels, reducing and phasing-out the use of pesticides and mineral fertilisers and closing nutrient cycles;

c. Improving water retention in the landscape;

d. Strengthening the resilience of agricultural systems in a changing climate;

e. Improving (agro)biodiversity at farm (including plant and animal breeds), field (including site-adapted varieties and crop rotation), and landscape levels;

f. Adapting cropping patterns and farm structures to landscape form, relief, and soil heterogeneity, within farms and also across farm boundaries at the regional level;

g. Enhancing the delivery of ecosystem services, biodiversity and beneficial biological interactions (including promoting antagonists of diseases and pests) among different components in the agroecosystem including nature conservation;

h. Promoting soil health and quality through an appropriate management of organic matter and soil microorganisms, and tillage practices;

i. Minimising food competition between humans and livestock by transforming and upgrading biomass, residues, and co-products from the food industry that are not suitable for human consumption;

j. Developing science-based livestock management strategies that reduce the current reliance on non-renewable resources and improve animal welfare;

k. Promoting sustainable land use and the interconnection of arable and livestock systems as part of a circular and sustainable bio-economy at different scales;

l. Defining and adhering to social standards and building sustainable value chains - creating and optimising further processing and marketing opportunities for products from diversified agro-ecosystems (including regional, national or global marketing);

m. Improving communication between producers and consumers on sustainable value chains, changing consumer behaviour.

It is important to note that there are approx. 14 millions farms/holdings in the EU, with high variation, not only in terms of size and pedo-climatic conditions and biogeographic regions across the EU MS and AC but also in terms of cultural backgrounds and traditions. This poses challenges in addressing the EU policy objectives and targets all over Europe in a coordinated way. Moreover, the approach and implementation of AE vary widely throughout Europe. AE is a knowledge-intensive, systemic approach that has implications for the whole span of agricultural practices, from breeds and varieties used to farming practices related to soil management and crop diversification strategies, integration in value chains, and business models that can economically and socially sustain these more locally-adapted practices and provide greater market opportunities for farmers and citizens.

Therefore, coordinated large-scale initiatives are needed to attain tangible results at the farm level and beyond, to promote the development, uptake and upscaling of these practices at the adequate landscape and regional levels, while at the same time considering the specificities of the local context. A strong coordination with other partnerships enhances concrete results

across the whole system. The rationale for this partnership is that strongly linking agriculture to ecological processes and biodiversity will render it more sustainable and resilient. To do this, a real-life approach, involving all actors, as exemplified by living labs, and/or in a science-based and open science context, as exemplified by research infrastructures, will ensure that this is not just an academic exercise. This will require overcoming the barriers cited above and specifically, for this partnership, addressing the knowledge gaps through research, the lack of long-term, coherent data sets through standardisation and long-term support for research infrastructures and the need for networking and the exchange of knowledge and good practices through a Europe-wide network of living labs and research infrastructures (see below).

Accelerating AE transition means co-developing solutions and activities using open innovation arrangements, designing policies and developing skills and competences for the transformation of the overall agroecosystem, involving all the relevant actors. Advances will also depend on the capacity to monitor the changes and impacts at the whole agroecosystem level. Two main tools appear suited to shape, share, and renew the collective efforts and investments in this area:

Living Labs (LLs): Since their appearance in 2000 as real-life testing and experimentation environments for developing information and communication technologies[29], LLs have been implemented in many economic sectors. They place the user at the centre of innovation and operate as intermediaries among citizens, research organisations, companies, local and regional authorities for joint value co-creation, rapid prototyping or validation to scale up innovation and businesses. In LLs, three categories of outcomes are co-produced: business, social and knowledge[30]. LLs are increasingly central for implementing sustainable transition, e.g., in health infrastructure, rural development, etc. ENoLL, the European Network of Living Labs[31], founded in 2006, supports the evolution and the uptake of the Living Lab paradigm worldwide and has developed a labelling process. According to ENoLL, five key elements must be present in a living lab, regardless of their application domain: 1) active user involvement, 2) real-life setting, 3) multi-stakeholder, 4) multi-method approach, 5) co-creation (i.e. iterations of design cycles with different sets of stakeholders). These key elements are reinterpreted in each socio-economic sector to fit best the aim, the context, and the diversity of participants involved in each LL. A description of the main features foreseen for LLs and RIs to make AE transition is provided in the partnership dossier (see footnote 3 in this document).

In the context of the G20 Meetings of Agricultural Chief Scientists[32] (MACS), the EC has actively contributed to the discussion on the potential of "agroecosystem living labs" for improving the effectiveness and adoption of more sustainable agricultural practices[33]. Agroecosystem living labs (ALL) have been defined in this context as "*transdisciplinary approaches which involve farmers, scientists and other interested partners in the co-design, monitoring and evaluation of new and existing agricultural practices and technologies on working landscapes to improve their effectiveness and early adoption".* Furthermore, McPhee and colleagues[34] have specified the unique features of ALL by analysing their commonalities and differences with other categorised

[29] Følstad, 2008. Towards a Living Lab for development of Online Community services. The Electronic Journal for Virtual Organizations and Networks (10) : 48-58.
[30] Dubé et al., 2014. Le livre Blanc des Living Labs, Umwelt Service Design, Montréal, p. 133.
[31] https://enoll.org/about-us
[32] https://www.macs-g20.org/
[33] https://www.macs-g20.org/fileadmin/macs/Annual_Meetings/2019_Japan/ALL_Executive_Report.pdf
[34] McPhee et al., 2021. Sustainability 2021, 13(4), 1718; https://doi.org/10.3390/su13041718

LLs. ALLs were found to belong to the "place-based LLs", along with urban and rural living labs. The categories developed by Steen and van Bueren[35] for urban living labs (i. aims, ii. participants, iii. activities, iv. context) were then used to identify commonalities and particularities.

Unique features of LLs for *AE transition* (hereafter Agroecology Living Labs, AELLs) can then be inferred, considering the expectations for AE transition. AELLs, like other place-based living labs, work towards improving sustainability and resilience of the agroecosystem, but the scale goes up to the landscape level. What makes AELLs unique, compared to ALLs, are: i) their even stronger local embeddedness, ii) the larger diversity of their origins, from farms to networks or communities, and iii) the higher heterogeneity and intensity of knowledge and innovations needed and produced (from practice to policies) based on the management of biodiversity and the circularity in the use of resources at different scales. Thus, they require stronger meta-governance[36] and a tight orchestration of the activities. AELLs can have different scales: they can be built at the level of the farm and its immediate surroundings (although at such scale this may be a network of farms), at the landscape or at the regional level. These characteristics make AELLs adapted to accelerate AE transition. Their potential depends on appropriate set-up and adequate implementation in the local context in which they are built, as well as their capacity to sustain themselves in the long-term.

Research infrastructures (RIs): the following definition is given by DG RTD[37] "Research Infrastructures are facilities that provide resources and services for research communities to conduct research and foster innovation. They can be used beyond research e.g. for education or public services and they may be single-sited, distributed, or virtual. They include: major scientific equipment or sets of instruments; collections, archives or scientific data; computing systems and communication networks; any other research and innovation infrastructure of a unique nature which is open to external users". RIs can be defined as facilities, in a very broad sense, that provide services for research communities, whether or not they are managed by research institutions, working in a long-term perspective. By mobilising these assets, Europe's RIs have the potential to boost the capacity to deliver scientific breakthroughs[38]. RIs, along with LLs, can support research and innovation to rapidly address the societal challenges related to farming systems faced by Europe and the world and can be key to leading and preparing the necessary economic, social and environmental transitions.

The following main criteria can characterise RIs: (a) long-term and FAIR[39]. principles, (b) size of the research community that uses facilities and services, (c) diversity of facilities, of data, of contexts that allow scientific production and (d) innovation, education, public services contribution. The long-term perspective is key in the area of work of the partnership since understanding the evolution of agro-ecosystems needs to take place over a long period of time. The partnership, with its network of LLs and RIs, will provide a unique opportunity to support and assemble harmonised data on key variables at the EU level.

[35] Steen and van Bueren, 2017. Urban Living Labs. A living lab way of working. Amsterdam Institute for Advanced Metropolitan Solutions.
[36] Metagovernance is understood as a "Governance of governance"; see Metagovernance for Sustainability, A Framework for Implementing the Sustainable Development Goals by Louis Meuleman. Routledge, London.
[37] https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/research-infrastructures_en
[38] ESFRI WHITE PAPER, 2020, https://www.esfri.eu/esfri-white-paper
[39] Guiding Principles for scientific data management: Findability, Accessibility, Interoperability, and Reuse of digital assets

RIs can be important facilities for AE transition as they are unique assets for a wide range of users for analysing the diverse dimensions and implications related to the redesign of agroecosystems and of agri-food systems, and improve scientific knowledge appropriation. They are complementary to LLs as they provide means to monitor relevant biotic and abiotic variables related to agroecological impacts, and to evaluate different scenarios of AE transition considering longer-term and larger scales (e.g. regions). They are dedicated to support research communities. In the future, they have the potential to allow scientists to observe / experiment / predict agroecosystem and agri-food redesign. All together they contribute to making a body of scientific knowledge on AE available for the transition. They can support (a) various degrees of agriculture and agri-food redesign (from incremental to strong redesign, biodiversity in agroecosystems), (b) sustainability assessment (impacts, ecosystem services, ecological, social and economic dimensions), (c) vulnerability - adaptability - resilience assessment (emergent properties of agroecosystems) and (d) dynamics of AE transition. Examples of EU level AE-relevant RIs include:

- AnaEE[40] provides understanding on the functioning of all types of agroecosystems, under all European climates, and their interactions with soils and the atmosphere, thanks to the scientific experimental approach (manipulation and modelling), by applying multiple drivers (such as drought, heat, elevated CO_2 levels, management methods) notably in the framework of current global change pressures.
- EMPHASIS[41] brings knowledge on plant phenotyping and plant-environment interactions, creating new, high yielding varieties in plant breeding adapted to climate change and new management techniques.
- eLTER[42], based on a socio-ecosystem concept, is particularly relevant at landscape scale with real life observations and modelling approaches.
- Lifewatch ERIC[43] creates virtual labs with different tools for storage, exchange, consultation, analysis and model data on agroecosystems, and analyses their evolution under different management scenarios, providing decision support systems for different management and global change scenarios.

Accordingly, a large and diverse set of RIs can contribute differently but in complementary ways to AE transition. Interdisciplinary and transdisciplinary training and innovation are increasingly prominent activities of RIs, developing various services, specific to various users. They are indispensable assets to understand socio-economic and ecological processes from an academic point of view. Recently a European call was dedicated to the development of services for AE[44].

On 01.09.2022, the Horizon Europe project “Integrated SERvices supporting a sustainable AGROecological transition (AgroServ)” was launched. The overarching mission of AgroServ is to support research and innovation by providing customised and integrated RI services in view of achieving a sustainable and resilient agriculture and supporting agroecological transitions. AgroServ, thanks to a large consortium of recognised European RIs, features a vast offer of services at all scales, from the molecule, to the organism, to the ecosystem, and to society.

[40] Analysis and Experimentation on Ecosystems: https://www.anaee.eu/
[41] European Infrastructure for Plant Phenotyping: https://emphasis.plant-phenotyping.eu/
[42] Integrated European Long-Term Ecosystem, critical zone and socio-ecological Research: https://elter-ri.eu/
[43] e-Science research facilities for scientists investigating biodiversity and ecosystem functions and services in order to support society in addressing key planetary challenges: https://www.lifewatch.eu/
[44] https://www.anaee.eu/news/horizon-europe-anaee-coordinates-proposal-infra-call-agroecological-transitions

Beside these RIs, some hybrid approaches, between research and society, useful for farmers and farmers' networks, for citizens and for research, can also be considered. Research can bring and collect knowledge in such hybrid settings. Some of them are not so far from LLs. Examples include networks of farms at regional or national level (even a few farms in a small territory), citizen science, platforms with innovation tools (e.g. serious games[45]) and co-creation platforms where innovation is more or less collectively in the making, and where scientists are involved. Even if academic contribution cannot be easily recognised in such networks because of difficulties in providing generic knowledge or sufficient data sets, they can be fully considered as open innovations for AE. Such hybrids can be mapped as RIs, sometimes included in them, if research is involved (to different extents) and knowledge produced.

LLs and RIs can be complementary in allowing ambitious experimentation between practice and science at different scales to provide science-based evidence about the effect of measures in agriculture. LLs and RIs, hand in hand, should form efficient instruments to accelerate AE transition.

The Green Deal, the Farm to Fork strategy and the Biodiversity strategy highlight AE and AELLs as a 'promising approach' and both agroecology and agroecology living labs have become a central Horizon Europe (2021-2027) concept.

The redesign of food systems is central to these strategies. Regarding primary production, increased attention to the context (spatial-bio-geographic, economic, social) specificity associated with agroecological practices is needed, which implies that standard agricultural solutions are inadequate[46]. Rather, agricultural sustainability practices depend on local physical conditions and spatially-specific management (of nutrients, water resources, etc.), as well as local socio-economic, cultural and political regulatory conditions[47]. This renders the pursuit of solutions not only relatively place-based, but also knowledge intensive. Agroecology practices and agroecology transition therefore benefit from high levels of social capital in the shape of rural institutions which address knowledge intensiveness through facilitation of knowledge sharing[48], interdisciplinarity[49] and innovation[50].

The LL approach is regarded as a methodology that can address both local knowledge needs and upscaling the place-based nature of agroecology, through a combination of local livings labs and networks of living labs.

An overview of the potential contribution of AE and the partnership to EU and international policy context is provided in the partnership dossier (see footnote 3 in this document).

[45] Djaouti, Damien; Alvarez, Julian; Jessel, Jean-Pierre; Rampnoux, Olivier (2011). "Origins of serious games". Serious Games and Edutainment Applications. Springer.
[46] Altieri, M.A., Funes-Monzote, F.R. & Petersen, P. Agroecologically efficient agricultural systems for smallholder farmers: contributions to food sovereignty. Agron. Sustain. Dev. 32, 1–13 (2012). https://doi.org/10.1007/s13593-011-0065-6
[47] Pretty, J., Benton, T.G., Bharucha, Z.P. et al. Global assessment of agricultural system redesign for sustainable intensification. Nat Sustain 1, 441–446 (2018). https://doi.org/10.1038/s41893-018-0114-0
[48] Wezel, A., Herren, B.G., Kerr, R.B. et al. Agroecological principles and elements and their implications for transitioning to sustainable food systems. A review. Agron. Sustain. Dev. 40, 40 (2020). https://doi.org/10.1007/s13593-020-00646-z
[49] McPhee, C.; Bancerz, M.; Mambrini-Doudet, M.; Chrétien, F.; Huyghe, C.; Gracia-Garza, J. The Defining Characteristics of Agroecosystem Living Labs. Sustainability 2021, 13, 1718. https://doi.org/10.3390/su13041718
[50] IFPRI 2012: Global Policy Report 2013

2 Methodology – inputs to the Strategic Research and Innovation Agenda

2.1 First inputs

In spring 2019 the Commission services were asked to put forward first proposals for candidate European partnerships to be funded under the first Strategic Plan (2021-2024) of Horizon Europe. On that occasion, DG AGRI, in collaboration with DG ENV, DG RTD, DG CLIMA and the JRC, presented a first concept[51] of this partnership that received wide initial support from the MS and AC represented in the Horizon Europe Shadow Programme Committee. DG AGRI subsequently organised a series of five webinars in May and June 2020[52] to officially kick-off the preparation process and to open the dialogue with EU MS and AC, and a wide range of stakeholders. Over 170 participants took part in these webinars.

In addition, in order to support the preparation of the candidate partnership, the EU funded two Coordination and Support Actions (CSA) in the Work Programme 2020 of Horizon 2020 "FNR-01-2020"[53]. Two CSAs were selected for funding and are currently running: Agroecology for Europe (AE4EU)[54] and The European Agroecology Living Lab and Research Infrastructure Network: Preparation phase (ALL-Ready)[55]. Both have been deeply involved in the work of SCAR-AE, in particular the preparative work for the partnership, including the present Scientific Research and Innovation Agenda (SRIA).

Following requests from several countries, a dedicated Strategic Working Group on Agroecology (SCAR-AE) was set up under SCAR in early 2021[56], with the task of preparing the partnership in close cooperation with the EC. SCAR-AE members are national representatives from 28 MS and AC (see Figure 2). Also included in the work is a large group of observers representing a broad range of stakeholders (see Annex 1).

Figure 2: Member States and Associated Country members of the SCAR-AE

[51] https://research-and-innovation.ec.europa.eu/system/files/2020-09/aellri-ec-input-partnership-discussion.pdf
[52] https://ec.europa.eu/info/research-and-innovation/research-area/agriculture-forestry-and-rural-areas/partnership-agroecology-webinars_en
[53] https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/fnr-01-2020
[54] https://cordis.europa.eu/project/id/101000478
[55] https://www.all-ready-project.eu/
[56] https://scar-europe.org/index.php/agroecology

In particular, SCAR-AE has developed the "partnership dossier" (see footnote 3 in this document) describing the framework of the future partnership. The dossier was delivered at the end of 2021, refined in early 2022 and finally published on the EC website in March 2022.

SCAR-AE was structured in 6 Task Forces (TF) focussing on the following aspects and delivering specific outputs for the preparation of the partnership's dossier:

- TF1: Common understanding of AE, AELLs and related RIs at the European level. Instead of developing a new definition of AE, common aims were agreed and a consensus was reached among MS/AC. In addition, a shared vision on LLs and RIs related to AE was developed.
- TF2: Recommendations on agroecological research needs to be addressed in the partnership. This TF made a first identification of research gaps related to the development and implementation of AE principles. It also provided a comprehensive list of more than 70 research and innovation needs addressing the bottlenecks slowing down AE transition identified by TF3 (see below).
- TF3: Recommendations on R&I instruments needed to test agroecology concepts and practices. TF3 identified the barriers and bottlenecks preventing a fast AE transition related to knowledge, methodology, production, overall-agri-food value chain, data, and policy. This TF also provided suggestions, instruments, and capacity building activities to overcome them.
- TF4: Recommendations on suitable funding schemes and regulatory drivers to promote the long-term (programmes and infrastructures) and short-term (projects) initiatives dealing with AE transition, including consideration on the type of investments required to achieve the objectives of the partnership.
- TF5: Recommendations on the potential governance of the partnership. Considering the ambitious size of the partnership, both financially and in terms of diversity, this TF discussed the possible modalities for the strong governance needed. TF5 delivered a suggested governance for the partnership, which will be considered by the future partnership consortium.
- TF6: Collaboration with relevant actors. This action was devoted to ensuring all relevant actors (national and regional; other SCAR Working Groups; international organisations and activities, and other pertinent R&I and EU actors and initiatives, including other existing and upcoming European partnerships and missions) participated in the partnership's preparation and contributed to the work of the 5 other task forces. In particular, TF6 organised the inclusion of observers into SCAR-AE (initiatives which, although they do not represent MS/AC, get the same level of information in relation to the partnership's preparation as official SCAR members; an essential aspect in the co-creation process with all relevant stakeholders). TF6 also organised 4 "project slams" with different foci, where relevant initiatives, such as ongoing Horizon 2020 projects, could present their work, outputs and outcomes to SCAR-AE, so this could feed into the work of other TFs and could contribute to the exercise of R&I gap identification and priority identification in the context of the future partnership. A list of these initiatives is provided in Annex 2.

The leaders of these Task Forces joined the "Drafting Group" together with the co-chairs of SCAR-AE, representatives from DG AGRI, from FACCE-JPI[57] and 3 CSAs [58] funded under Horizon 2020. This group was responsible for combining the outputs gathered in the different Task Forces and for delivering the partnership dossier.

During the process, involving close to 200 people, SCAR-AE has gathered inputs from a wide range of stakeholders, including national representatives, academics, researchers, EU-funded projects, ERA-NETs and Joint Programming Initiatives, farmers' organisations, European Technology Platforms and EU research infrastructures, as well as various services across the EC. The dossier was developed in accordance with a pre-determined template, considering the initial concepts developed by the Commission along with feedback received from MS and AC, including Country Contact Points (appointed by MS/AC to follow the development of the partnership). DG AGRI, in coordination with DG RTD and with other DGs in the EC, has closely guided the drafting process to facilitate alignment with the overall EU political priorities and ambitions and with the R&I priorities under Cluster 6 of Horizon Europe, as well as to ensure compliance with the criteria for partnerships under Horizon Europe.

2.2 The development of the SRIA

SCAR-AE mobilised its entire workforce since the end of 2021 in order to develop the present SRIA. At first, a SRIA Core Team and a Drafting Group were put in place for the initial development of the SRIA and outlining the SRIA's conceptual framework.

On the basis of the inputs collected in 2021, e.g. the research needs identified under TF2, first ideas of a conceptual framework and of the proposed core themes of the SRIA were outlined.

In April 2022, SCAR-AE organised a workshop to launch the broader consultation process. Besides SCAR-AE members and observers, participants included country contact points and representatives from other entities such as other SCAR working groups, Horizon 2020 projects related to AE, ERA-NETs, JPIs, research infrastructures, Living Labs and other Horizon Europe projects. Several EC DGs were also represented. Around 100 participants joined this online workshop and were consulted on R&I priorities to be addressed by the future partnership.

The outcomes of the workshop were used to adapt the SRIA's draft conceptual framework iteratively, which was then presented and discussed at the 5th SCAR-AE meeting in June 2022. This enabled the preparation of a first draft of the present document. This draft was commented by members of the SCAR-AE Drafting Group; in addition and in parallel, two external[59] internationally recognised experts in the fields of agroecology and living labs were consulted.

Feedbacks received were used to develop a "consolidated draft" that was shared with the entire SCAR-AE and with relevant services in the EC for their consideration before starting the online public consultation in July 2022. The latter ended in October 2022, and close to 120 feedbacks (see Annex 4) from a broad range of sectors were received, analysed, and incorporated.

The SRIA draft was carefully updated with the help of the inputs received and discussed again within SCAR-AE. The SRIA Core Team presented the updated version to the respondents to the

[57] https://www.faccejpi.net/en/faccejpi.htm
[58] "European Agroecology Living Lab and Research Infrastructure Network" (ALL-Ready), "Agroecology for Europe" (AE4EU) with also the contribution of "Soil Mission Support" (SMS).
[59] From countries not involved in the partnership preparation

consultation mid-November 2022, highlighting the main changes following their comments. The document was fine-tuned until the end of December 2022, including through meetings of SCAR-AE and of the SCAR Plenary, for the finalisation of the present SRIA final draft.

The development of the SRIA, like the development of the partnership's dossier, followed a co-creation approach, in which all the inputs from all relevant actors were taken into consideration. This was achieved not only by collecting inputs from actors who were already members of SCAR-AE all along the SRIA development, but also by proactively addressing a broader range of stakeholders. In this sense, SCAR-AE members and the EC presented the partnership and the SRIA in several events since 2020, which also provided opportunities to raise awareness and consult stakeholders on the R&I priorities to be addressed by the partnership. Just in the first half of 2022, the partnership and the state-of-the-art of the SRIA were presented in more than 30 EU and national level events. The spectrum of stakeholders involved this way in the co-creation process is particularly broad, ranging from students to farmers, from local to national authorities, including regions, the private sector, research projects, etc.

2.3 Plans for SRIA adoption and update

The SRIA is fully aligned with the objectives and expected pathways to the impacts of the partnership, which are stated in its intervention logic. The SRIA also provides an overview of horizontal activities (e.g. communication) and specific research activities. This foundational work will serve as an input for the definition of the partnership annual work plans and will also help to set up a monitoring framework, which uses key performance indicators (KPIs) to measure the progress towards the SRIA's objectives.

At the time of writing the current SRIA, it is expected that the partnership could start at the earliest at the end of 2023, more probably in early 2024. While submitting the partnership proposal in response to the topic included in the Horizon Europe Work Programme 2023-2024, the SRIA will be the keystone to prepare the first Annual Work Plan. Ultimately, the SRIA will be considered as final once it is adopted by a formal decision-making body (the "Governing Board") of the partnership.

The development of the SRIA is an evolving process. Therefore, an open process to assess its relevance and a plan for updating the SRIA during the partnership lifetime will be implemented in order to take into account outcomes of the partnership and related initiatives and projects but also potential new policy priorities. The update of the SRIA will follow a similar approach to the one used for the preparation of the first draft, while benefiting from the progress made within the partnership and the entities of its governance.

3 The Agroecology Partnership: Ambition and operation

3.1 Ambition and expected impacts

In order to address the challenges presented in the first chapter of this document, AE transition needs to be implemented following a systemic approach, supporting integrated action in research (fundamental to applied) and in coherent policies that promote an adequate supply of affordable healthy food, enabling responsible and healthy consumer behaviour, but also renewable raw material for non-food biomass.

The vision

This partnership relies on a common vision to ***"Team-up and unlock the transition to agroecology so that farming systems are resilient, productive and prosperous, place-sensitive, as well as climate, environment-ecosystem, biodiversity and people-friendly by 2050***". In order to achieve impact on people, policies, planet, productivity and prosperity, we need a change in paradigm in science, policy and practice to support:

i) A **thriving agricultural sector**, which is economically viable, attractive to young generations and well connected to society.

ii) New as well as improved **farming practices, products and services** that contribute to positive ecological, climate and environmental impacts of agri-food systems.

iii) The **strengthening** of social capital, values, networks, skills and awareness on AE.

iv) Evidence-based, systems-oriented **governance & policy making** with governments and institutions and thereby policies that are more open, flexible, participatory, risk sharing and therefore capable of enabling transformative changes.

The intervention logic of this partnership aims to fulfill these needs ; it has been carefully co-created within SCAR-AE with broad contributions of all relevant actors. It describes the logical steps towards a vision and identifies *in fine* the required activities. An overview of the Intervention Logic and its General and Specific objectives is provided in Figure 3:

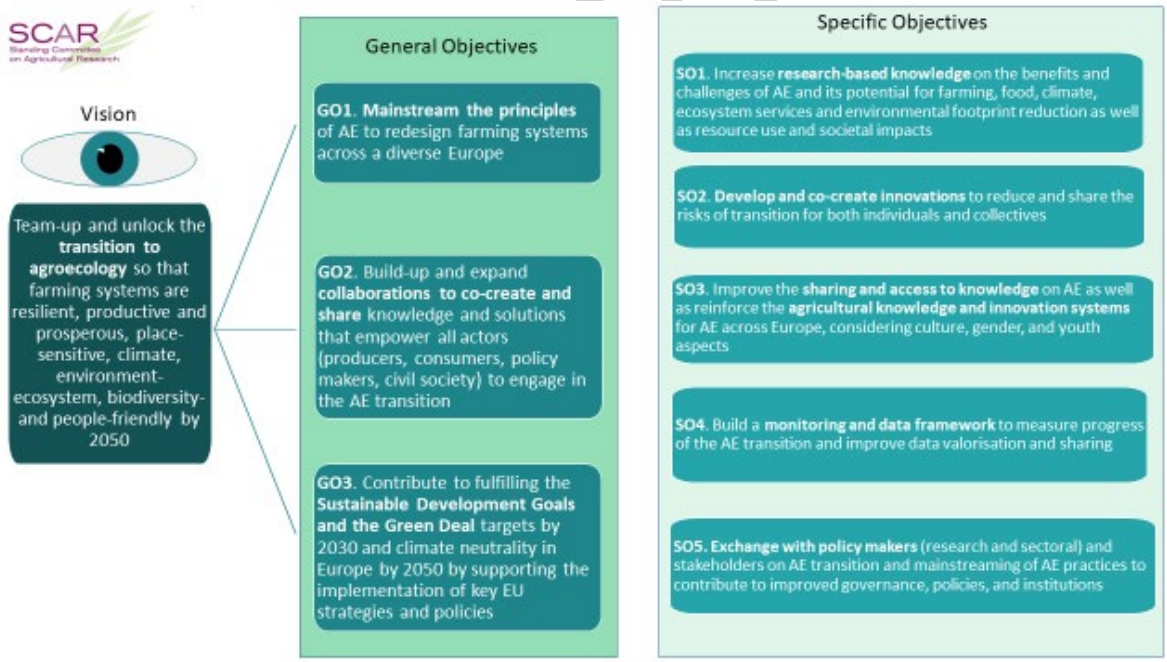


Figure 3: Intervention logic of the Agroecology Partnership

Three General Objectives (GO, long-term goals) will contribute to achieving the 2050 vision of the partnership:

- **GO1. Mainstream the principles** of AE to redesign farming systems across a diverse Europe.
- **GO2.** Build-up and expand **collaborations to co-create and share** knowledge and solutions that empower all actors (producers, consumers, policy makers, civil society) to engage in AE transition.

- **GO3.** Contribute to **fulfilling the Sustainable Development Goals and the Green Deal** targets by 2030 and climate neutrality in Europe by 2050 by supporting the implementation of key EU strategies and policies.

Specific Objectives (SO): To achieve these general objectives, this partnership will support research and related activities that contribute to achieving objectives of key strategies under the Green Deal, notably the Farm to Fork and the EU Biodiversity strategies and specific SDGs (see partnership dossier, footnote 3 of this document), enabling transformative change in the agricultural sector towards AE. The partnership will achieve this by focusing on five Specific Objectives (SO) to be delivered by the end of the partnership, 2030-2035:

- ***SO1****. Increase research-based knowledge on the benefits and challenges of AE and its potential for farming, food, climate, ecosystem services and environmental impacts reduction as well as resource use and societal impacts*; this implies research on e.g. AE benefits and trade-offs for climate change mitigation and adaptation.
- ***SO2****. Develop and co-create innovations to reduce and share the risks of transition for both individuals and collectives*. LLs, by definition, bring together actors to co-create innovation in real life conditions while reducing risks for both the individual farmer (or other actors) and the collective.
- ***SO3****. Improve the sharing and access to knowledge on AE as well as reinforce the agricultural knowledge and innovation systems for AE across Europe, considering culture, gender, and youth aspects*; this will be achieved through a network of LLs and RIs, as well as targeted communication to different actors; this also includes removing the current barriers and lock-ins that prevent the engagement of scientists, advisors and farmers in AE transition.
- ***SO4****. Build a monitoring and data framework to measure progress of AE transition and improve data valorisation and sharing*; harmonised methods and a set of common indicators will be developed to measure progress, integrating currently fragmented data repositories, including those of research infrastructures, and making them available.
- ***SO5****. Exchange with policy makers (research and sectoral) and stakeholders on AE transition and mainstreaming of AE practices to contribute to improved governance, policies, and institutions,* based on evidence and to provide supportive mechanisms; in order to achieve impact, the involvement of policy makers and stakeholders is needed and policies and governance adapted to support AE transition.

By pursuing these objectives and related activities, the partnership will leverage efforts across countries, sectors and disciplines that will allow achieving key expected impacts related to the Scientific, Societal (including environmental), and Economic and Technological domains:

A. Scientific (by 2030-2035)
Expected Impact 1: State-of-the-art science, research and innovation unlock the transition to agroecology.
Expected Impact 2: More evidence-based, open, flexible, participatory and risk sharing policies enable transformative changes in farming systems.
B. Societal including environmental (by 2040)
Expected Impact 3: Agricultural sector and rural areas are prosperous, attractive to young generations and connected to the rest of society.
Expected Impact 4: Stronger social capital, values, networks, skills and awareness of agroecology.
Expected Impact 5: Agroecological farming practices provide maximum positive contribution to biodiversity, climate and the environment, creating circular and sustainable farming systems.
C. Economic & technological (by 2040)
Expected Impact 6: Agroecology-based farming is economically viable.
Expected Impact 7: Agroecological farming systems and related value chains are resilient, productive, place-sensitive, widespread, and contribute to ensuring European food security, without compromising global food security, livelihoods and environment.
Expected Impact 8: Through Living Labs and networking of Living Labs, farmers are empowered and equipped with relevant knowledge and social, organisational and technological tools while supported by competent and independent advisory services to drive and scale up the transition towards agroecology.

3.2 Triggering transformational changes in the R&I ecosystem

The partnership will trigger transformational changes in the broader R&I ecosystem and set the direction for knowledge creation, facilitating experiments that will improve understanding and uptake of AE processes, and ultimately influencing policy making. Activities will go from fundamental research on AE through to applied research, giving rise to ready-to-use solutions for the scaling up in real-life environments and demonstration of prospective implementation strategies. Ultimately, the partnership will contribute to filling existing knowledge gaps on AE, contribute to more open innovation and user-driven research on AE, addressing the wide geographical/territorial specificities in the EU through place-based approaches with long-term perspectives, and to improving the sharing of knowledge within and across EU countries and beyond.

Delivering on the partnership's ambitions requires implementation of a portfolio of activities that correspond to the following eight **Operational Objectives (OO),** to be achieved during the partnership's lifetime:

- **OO1.** Support transnational R&I activities as defined in the SRIA on the challenges and potential of AE to address biophysical, environmental, climate, social and economic dimensions of sustainability, at farming, local environment and broader societal levels.
- **OO2.** Support research in and on living labs across Europe to support AE transition.
- **OO3.** Build and organise a European network of new and existing living labs and research infrastructures for knowledge sharing and co-creation on AE innovations at various scales.
- **OO4**. Build capacities of various actors to foster collaboration for AE transition.
- **OO5.** Improve access to and use of services provided by research infrastructures and other relevant initiatives for long-term measurement, observation and experimentation in support of AE.
- **OO6.** Set up a framework, data management, indicators, and tools to monitor AE transition, its social, economic, environmental and climate performance and impacts, for different actors, contexts and scales.
- **OO7.** Design and implement communication and dissemination activities to support AE transition through uptake by practitioners and to improve stakeholder engagement, including the wider public.
- **OO8**. Put in place mechanisms for science-policy dialogue in support of the establishment and implementation of evidence-based policies (research and sectoral) that support AE transition, including long-term funding for AE R&I.

3.3 Alignment with Horizon Europe Strategic Plan 2021-2024

The overall intervention logic of the Agroecology Partnership is fully aligned with the Horizon Europe Strategic Plan 2021-2024[60] as it will contribute to its four Key Strategic Orientations (KSOs). More precisely, it is aligned with the impact area "High quality digital services for all" of KSO A, the three impact areas of KSO B: "Sustainable food systems from farm to fork on land and sea", "Clean and healthy air, water, and soil", and "Enhance ecosystems and biodiversity on land and in waters", three impact areas of KSO C "Climate change mitigation and adaptation", "Affordable and clean energy", "Regenerative, circular and clean economy", and the impact area "Inclusive growth and new job opportunities" of KSO D.

4 Core research and innovation themes

The overall purpose of this SRIA is to identify the knowledge and the innovations that are necessary to accelerate AE transition[61] in a consistent way, encompassing local, regional, national, and European scales. It aims to promote a European large-scale endeavour for an agricultural sector that is fit to meet the targets and challenges in relation to climate change, biodiversity loss, food security[62] and sovereignty and the environment. The underlying principles guiding the transformations are those depicted in section 1.2.3 and summarised in Figure 1. The conceptual framework of the Agroecology Partnership's SRIA is provided in Figure 4.

[60] https://op.europa.eu/en/web/eu-law-and-publications/publication-detail/-/publication/3c6ffd74-8ac3-11eb-b85c-01aa75ed71a1.
[61] Agroecology transition (singular) is used in this chapter when considering global or overall European perspectives. The term "Agroecology transitions" (plural) is used instead as related to territorial/landscape transformations.
[62] 'Food security' includes addressing food loss and waste in primary production.

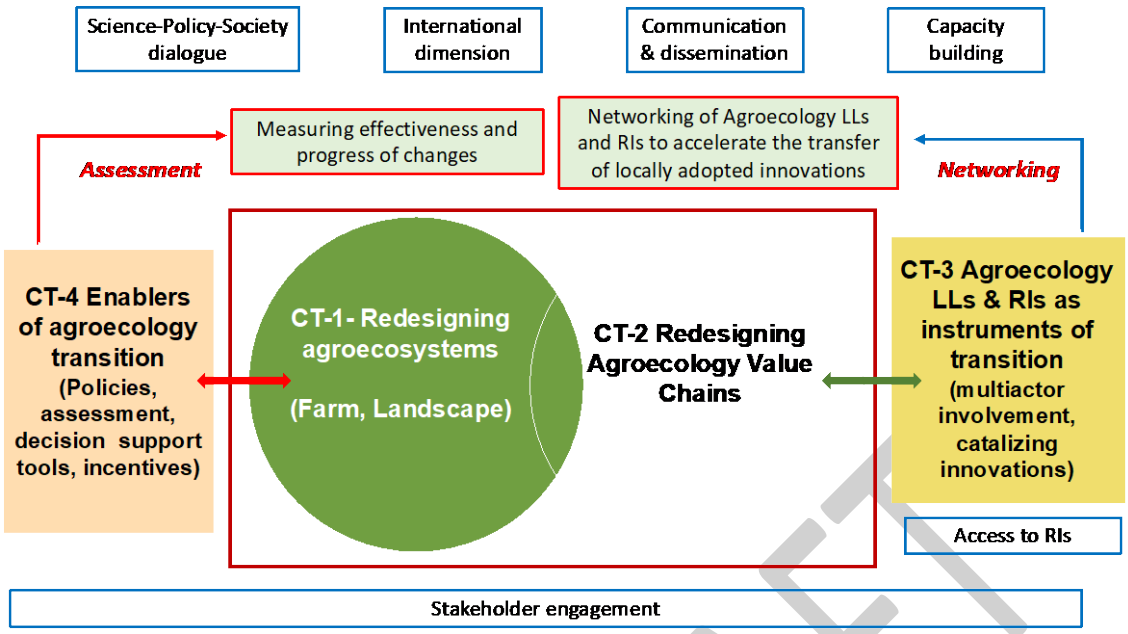


Figure 4: Conceptual framework of the partnership's SRIA showing its four core research and innovation themes (CTs) in the centre, supported by cross-cutting issues (light green boxes) and supporting activities (blue boxes)

Moving towards this scenario calls for a redesign of agroecosystems, at both farm and landscape scales, aiming to reduce the use of agrochemical inputs in agriculture, through the closure of nutrient and energy flows and to ensure their resilience to climatic and extreme meteorological events, while enhancing the provision of food, feed, fibre, biomass and ecosystem services.

The social and economic feasibility of this redesign will rely on the transformation of agri-food value chains connected to those territories committed to AE transition. The coordinated redesign of agroecosystems and agroecology value chains will involve production and upstream and downstream segments. It should be performed by considering different scenarios constructed with the participation of the different stakeholders of those European districts/territories/regions engaged in AE transition, defining a common vision of the resulting landscape after the agreed interventions, and considering the potential associated socio-economic and environmental benefits and trade-offs.

As stated before, LLs, RIs and their interlinkage are perceived in the Agroecology Partnership's context as instruments with high potential to boost AE transition by providing the adequate long-term framework, facilitating an iterative dialogue and multidisciplinary research, triggering relevant research demands, enhancing the co-design, co-development and rapid uptake of innovations.

At the same time, they are also a matter of research. For instance, there is still a need to identify the key features of LLs leading to successful and fast uptake of innovations in different contexts. Moreover, the actual benefits of both AE LLs and RIs in accelerating AE transition at a larger scale still need to be demonstrated. Similarly, methodologies for their appropriate application and the improvement of their internal operations and interlinkages need to be tested, improved, and implemented.

Speeding up AE transitions also requires an appropriate enabling environment. The assessment of transitions is also needed to identify existing barriers and unlock them with the provision of aligned policies and associated instruments and incentives. This will also allow the evaluation of the contribution of agroecology to meet European policy targets and to measure the effectiveness and progress of change at the European scale.

While actions are performed at the local and landscape scales, they need to be scaled up at the European level. Thus, research supported by a network of AE LLs and RIs is needed to ensure an appropriate exchange of knowledge and data and further valorisation of locally driven innovations. Further research will also be needed to identify the common features of successful transitions in the different pedoclimatic regions and the instruments facilitating them.

Achieving the SRIA's objectives will deliver the following expected outcomes:

1. Implementation of agroecological farming practices integrated in specific territories and landscapes and based on existing sociocultural heritage to substitute intensive practices related to conventional agriculture. A particular focus will be placed on:
    a. Management practices enhancing the optimal recycling of nutrients and organic matter and closed energy flows, along with the diversification of crop and livestock breeds, crop species and their mixtures, and agroecosystems.
    b. More rational and efficient use of water, biomass and nutrients in agroecosystems.
    c. Management of pests, diseases and invasive species through integrated crop protection leading to a reduction in the use of chemical pesticides of at least 50% by 2030 and the discontinued use of the ones with the highest negative impacts on biodiversity and ecosystems.
    d. Improved supply of ecosystem services supporting enhanced crop yield, soil health, water quality, biodiversity of agroecosystems and landscapes, enhanced pollination, livestock welfare and human health and wellbeing, resilience to climate emergency impacts, and climate change adaptation and mitigation, including long-term carbon storage and reduction of the greenhouse gas emissions.
2. Provision of decision-making and risk assessment tools related to the application of AE principles at different geographical scales and tailored to specific stakeholders. These tools will consider the multidimensional domains (social, economic, governance and environmental aspects) related to AE transition.
3. Reduction of technological and socio-economic risks associated to AE transition by the participative construction of adequate business models and the collaborative design and implementation of actions related to all phases of agroecology value chains. Key social aspects such as farmer generation renewal, access to land, gender and inclusiveness issues will be specially considered in this regard.
4. Accelerate the up-scaling and valorisation of AE practices and innovations by benefiting from European network(s) of LLs and RIs, which enhance the spread of successful co-created models and methods, and facilitate capacity building and knowledge and data sharing.

5. Provide evidence-based recommendations for policy makers based on the assessment of the benefits and trade-offs of AE innovations under different scenarios and scales, and the enhancement of inclusive, transparent and empowering decision-making processes.

The following sections provide a contextualised insight into the four core themes and identify the research needs associated with them.

4.1 Core Theme 1: Redesigning agroecosystems

Support transnational R&I activities as defined in the SRIA on the challenges and potential of AE to address biophysical, environmental, climate, social and economic dimensions of sustainability, at farming, local environment and broader societal levels (OO1).

Agroecology transition must ensure food security and farm economic viability confronting conditions related to the reduction of fossil-fuel based agricultural and energy inputs, general reduced availability of water resources and water shortage in semi-arid areas, higher temperatures, and increased likelihood of extreme climatic events. The enhancement of agroecosystem resilience, the closing of nutrient and energy flows, the improved efficiency of input and resource use, and the enhancement of above- and below ground agrobiodiversity, will be highly demanded under these circumstances. An increase of ecosystem services associated with the sustainable management of agroecosystems will be also highly valued. A more balanced share of the land area dedicated to the production of food, feed, and non-food agricultural products is also expected along with the integration and confrontation of agricultural land use with other human activities likewise requiring significant amounts of land within a given territory.

This context demands the identification and implementation of suitable farming practices adapted to local conditions and appropriate landscape planning. This calls for a participative design of agroecology farming systems integrating agronomic, socio-cultural, and ecological aspects which include the contribution of AE to the protection and restoration of nature, notably to achieve ecological corridors, which in turn may have substantial positive effects on agrobiodiversity. It also requires the ex-ante co-definition and evaluation of different scenarios envisioning and planning the landscape and the agroecosystems resulting from agroecology transitions, and the assessment of the benefits and trade-offs associated with them, including the ecosystem services related to agricultural practices. Redesigning agroecosystems will require the assessment and use of digital tools for AE transition. The research needs associated with those requirements are presented below. Although they are presented in different subsections, they should not be considered as isolated items. In fact, their impact would benefit from addressing them in combination to enhance synergetic effects and avoid potential trade-offs.

4.1.1 Supporting the change of practice to achieve resilient and sustainable ecosystems

Today, there is an increasing demand for reducing the use of external inputs in agriculture, combined with a more rational use of resources while maintaining or increasing the supply of agroecosystem services and ensuring food security. This partnership will support this objective by triggering and supporting AE transition that promotes changes in practices at both farm and landscape levels, and from farm to fork. Local and traditional agricultural knowledge from farmers and other relevant actors needs to be recognised, evaluated, integrated and adapted

to present-day knowledge and technology, to integrate it in the innovations associated with transitions. The involvement of farmers and other stakeholders is the cornerstone for the fulfilment of the transitions. Therefore, gaining knowledge about their perceptions and willingness to participate, by involving them in the design of solutions, is needed to define the right incentives (see 4.3.4). Also, the influence of gender perspectives, generation renewal and migratory effects on transition needs to be analysed.

In many parts of Europe, organic farmers are pioneers in developing and adopting agroecological practices. Recognising the transformational potential of organic farming, the EC has set in the Farm to Fork strategy the target of achieving 25% organic farmland by 2030. However, in 2020, only 9,1% of the total EU agricultural land was under organic production[1]. This partnership will help to accomplish this objective and will be a win-win both for agroecology and for organic farming. The partnership will build on the achievements of organic farming to drive the AE transition. At the same time, research in agroecology under this partnership will also benefit the organic farming sector and help tackle its challenges. This partnership will integrate R&I activities benefitting the organic farming sector and is committed to support organic farming R&I as an important driver of agroecology.

4.1.1.1 Genetics and breeding for AE

Genetic resources are the basis of diversity, adaptability and resilience in agricultural systems. There is a need to identify, assess and enhance the use of genetic resources adapted to local conditions and enhance agrobiodiversity in farming systems. The potential of participatory breeding will be explored in view of developing plant varieties and breeds that meet the needs of agroecological farming. (e.g., demand lower consumption of inputs, such as nutrients and water), are adapted to more variable climatic and management conditions and can better cope with biotic and abiotic stresses, while maintaining and even improving current yield levels. The use of the locally adapted genetic material should also be based on the assessment of its characteristics, e.g., in terms of nutritional quality and suitability for mixed cropping, resource efficiency, resilience towards biotic and abiotic stresses, and contribution to crop, animal and soil health. The use of landraces and traditional breeds will be of particular interest in this regard, along with a more effective use of ex-situ genetic resources. The further development of phenotyping and genotyping tools, as well as increased knowledge on the molecular basis of (complex) traits and combination of traits will benefit all types of breeding activities in view of delivering a wider range of plants and animals that are adapted to agroecological farming methods. In this context, the environmental, health, social and economic implications (e.g. regarding intellectual property rights and the structure of the seed sector) of the use of novel breeding techniques for AE transition should be assessed.

4.1.1.2 Managing pests and diseases through innovative agronomic practices

- Identify and adapt agronomic practices based on AE principles reducing pressures from pests to an acceptable level by developing and strengthening integrated pest management approaches based on AE principles, benefiting from the use of functional biodiversity to reduce/remove the need to use external inputs.

- Identify the development and risks from potential new prevalent pests and pathogens under AE practices.

4.1.1.3 Reducing fossil fuel inputs

- Strengthen interdisciplinary and multidisciplinary research and develop technological innovations based on AE principles to reduce the use of inputs, increase their suitability and efficiency, and provide new alternatives. This involves increasing on-farm biodiversity (i.e., soil microbiome, N-fixing biota, and improved management of manure and crop residues). It also includes innovations to perform on-farm removal of manure and slurry-related hazards to soil health (e.g., antibiotics and copper).
- Identify and adapt agricultural management ensuring diversification of species, farming systems, practices and land uses (e.g., mixed systems, agroforestry systems, rotations, intercropping, cover crops and strip crops, introduction of leguminous species, recovery of permanent crops, animal husbandry, fuel and industrial crops, biogas production), while analysing their benefits and trade-offs.
- Assess the role of digital tools to improve input use efficiency in agroecological farming.
- Analyse the balance between AE uptake and the production of bio-based goods aiming to replace fossil-based ones, and ensure the latter adopt AE principles.
- Develop innovative ways of producing on-farm renewable and alternative energy sources of agricultural traction, groundwater lifting and product storage.

4.1.1.4 Provision of ecosystem services

- Analyse the role of agroecological farming in increasing resilience to climate change, increasing soil organic matter and water retention and storage, sequestering carbon and enhancing long-term carbon storage, reducing GHG and air pollutant emissions and nutrient leaching, reducing pesticide use, increasing quality of surface- and groundwaters, and preventing land erosion, among other ecosystem services.
- Explore synergies between AE and natural ecosystems for the provision of ecosystem services at landscape level.
- Search for ways to support diversified production systems to increase resilience, including the assessment of the role of digital technologies to achieve this.

4.1.1.5 Restoration of biodiversity and nature

AE's contribution will be key to protect and restore nature and in some situations it will be implemented for this objective. R&I in this field should:

- Explore and monitor the contribution of AE to promote and restore the health of agroecosystems, such as farmland birds and insects, particularly pollinators.
- Research on enhanced crop production resulting from better pollination as a consequence of pollinator-friendly farming methods.
- Explore how AE can support the EU Biodiversity Strategy 2030[63] objective of restoring at least 10% of agricultural area under high-diversity landscape features. These include, inter alia, buffer strips, rotational or non-rotational fallow land, hedges, non-productive trees, terrace walls, and ponds.

[63] https://environment.ec.europa.eu/strategy/biodiversity-strategy-2030_en#:~:text=The%20EU's%20biodiversity%20strategy%20for,contains%20specific%20actions%20and%20commitments

- Analyse mutual benefits between thriving biodiversity and AE, notably productivity gains coming from the reduction of inputs and increased soil fertility.

4.1.2 Landscape agroecology and territorial planning

Agroecology transitions go beyond the farm level as their impacts can only be verified at a larger geographical scale. In fact, they usually depend on the commitment of citizens and stakeholders living in a specific territory. Therefore, territorial planning and landscape agroecology are relevant dimensions to boost transitions. Research in this field should:

- Explore options, including social valuation methods, for participative landscape planning that speed up AE transitions and maximise the provision of ecosystem services, while considering the social dimension. This may include the upscaling of best organic farming practices and the contribution to ecological corridors for nature protection and restoration.
- Investigate governance, methodologies and tools to ensure coherence and compatibility of planned actions at the landscape level (e.g., urbanisation models, goods transport models, rural-urban connectivity, protection of soils with a high agricultural value, consonance of renewable energy models and food production, hydrological planning with establishment of priorities of uses among the economic sectors, and within the agricultural sectors considering the most sustainable ones).
- Provide insights on the minimum size and dimension of ecosystem and agroecosystem types and of ecological infrastructures required to provide specific ecosystem services.
- Find the best specifications of geo-spatial information systems coupled with process-based models to facilitate integrated landscape planning.
- Explore ways (including Big Data approaches) for integrating information from existing statistical surveys and data sources.
- Find new ways of functional integration of different waste streams (e.g. waste water, livestock manure, urban and industrial organic waste …) to ensure the closure of nutrient and energy flows within specific biogeographical areas.
- Explore the benefits and trade-offs derived from interacting landscape mosaics (including diversified agroecosystems, managed and natural ecosystems) and the implementation of land use practices enhancing the efficient use of by-products, land, and other resources.

4.1.3 Decision support tools for farmers

Farmers and advisors committed to AE transitions should rely on adequate decision support systems and digital services. These should be adapted to their needs and help them in making evidence-based decisions of management choices considering the demand for products coming from agroecology and local needs, land structure, agroclimatic conditions, and the farming practices to be implemented in each territory.

Similar tools suited for conventional practices are already available, but they need to be adapted to AE schemes and needs, while relying on a reasonable number and easy-to measure set of variables. Research must be performed to define them, validate the tools across a wide range of conditions and identify ways to increase their use, considering factors such as user performance expectancy, relevance, accuracy, ease of use, trust, and cost, among others.

4.1.4 Analysing social aspects related to agroecology transition

The research foreseen will aim to:

- Identify farmers' motivations and obstacles for engaging in agroecology transition, such as uncertainty about farm sustainability/profitability, including yield instability, lack of connection to the value chain, access to land and to finance.
- Understand the factors that make agroecological farming attractive for (young) farmers.
- Analyse the impact of generation renewal, migration, and gender and inclusion dimensions on AE transition, and reciprocally, the effect of AE on these aspects.
- Understand the socio-economic and cultural barriers and potential levers to facilitate the engagement of the different stakeholders in AE transition and uptake of its innovations.
- Analyse how the common goods become common aims aligned with the One Health approach[64], bringing together the stakeholders to co-create knowledge and innovation such as multifunctional landscapes, value and health implications of food, reduced use of pesticides, and soil quality, water quality and quantity, healthy and biodiverse ecosystems, and job creation and quality.
- Identify the diversity of contexts influencing societal engagement in AE transitions (cultural influence, starting point of the transitions, number and type of stakeholders involved...).

4.2 Core Theme 2: Redesigning agroecology value chains

Support transnational research and innovation activities as defined in the SRIA on the challenges and potential of AE to address biophysical, environmental, climate, social and economic dimensions of sustainability, at farming, local environment and broader societal levels (OO1).

Agroecology transition cannot be performed solely by redesigning agroecosystems since their social and economic sustainability relies very much on the entire value chain. Hence, transition calls for the adaptation of territorial/landscape value chains to the transformation of agroecosystems through better understanding of farmer, market and consumer linkages with respect to agroecological products. This connotes improved comprehension of systemic AE transition that couples agricultural practices and value chain perspectives through the involvement of stakeholders, the provision of technological innovations and the construction of appropriate business models. The experience gathered by the organic farming sector in promoting alternative food networks and new business opportunities could be useful in this regard. Cooperation with the Sustainable Food System Partnership is envisaged: socioeconomic and environmental impacts of AE value chains must be considered when analysing and designing European food systems to ensure that current and foreseen trends of overall systemic transformations are taken into account in the construction of scenarios to design AE transition and predict or assess its impact.

Specific research needs associated with the redesign of agroecology value chains are presented in the following subsections.

[64] https://www.who.int/news-room/questions-and-answers/item/one-health

4.2.1 Coupling agricultural practices and value chain perspectives

- Analyse and improve the quality of AE products (e.g. nutritional and organoleptic features) to increase consumers' acceptance.
- Find ways to cope with the quality requirements of the different stakeholders related to each node of AE value chains (i.e., storage, preservation, packaging, processing). This involves both the adaptation of farming practices to address those needs and the provision of technological innovations to deal with the heterogeneity of agroecology products and co-products.

4.2.2 Traceability of products

Explore ways to ensure the trust of consumers and other stakeholders by using technologies that enable tracking AE products and co-products across the value chain or labelling methodologies ensuring the application of AE principles for their generation.

4.2.3 Developing and evaluating adapted business models

Agroecology transition has implications on the relations among the stakeholders of the agri-food chain which call for the development of new business models that can ensure the economic feasibility of AE approaches for all actors, especially farmers, and considering externalities at different scales, including global. To this end, new business models should reflect a fair calculation of the costs of nutrients, carbon, and energy expenditure of AE production and the ecosystem services it brings to society. External costs, and the impact of the global economy on food prices and social systems, should also be considered. In addition, business models should integrate the value of services across the agri-food value chain, and potential environmental, social and economic benefits and trade-offs (including food safety and yield instability).

More specifically, the research needs that the partnership will address are:

- Explore mechanisms aiming to define legitimated food prices sufficient to remunerate the farmers and integrate negative externalities while being affordable for consumers.
- Provide instruments for predicting and analysing socio-economic and environmental consequences of the policies and decisions taken by consumers, industries related to the overall value chain, and farmers on agrifood system dynamics as contextualised at the landscape level. Identification of farmers' needs to adopt AE practices and prediction and analysis of impacts on their income and wellbeing must be a central part of this analysis.
- Consider macro- and meso-economic factors potentially affecting AE transitions and build scenarios for the development of appropriate business models and marketing strategies related to both upstream and downstream commercial activities.
- Contribute to defining appropriate tools for performing cost-benefit analyses of proposed agroecological practices enabling their comparison with conventional practices, considering also the provision of ecosystem services and impact on human health and wellbeing. In this regard, impact evaluation of AE transitions on the agricultural input sectors and embedding agricultural inputs into the re-designed agroecological value chains must be considered.
- Contribute to the creation of new circular, sustainable and resilient business models associated with shorter and fairer value chains connected to territories and overall structures and expertise available at local level. These business models should consider farm

size, seasonality, and diversity of food products. The relationships with long value chains, considering regional, national, European but also global context and trade, should be taken into account. The coexistence with other value chains should be also considered. Moreover, business models should be iteratively adapted along the stages of AE transition.

- Propose adapted and alternative logistics and infrastructures and assess their feasibility by analysing the economic impact of AE on the value chain.
- Consider opportunities for new businesses related to the development of new or adaptation of existing machinery aiming to reduce labour-intensive activities.
- Find ways to enhance synergies of AE-based value chains with other value chains co-existing in the same territory (i.e., tourism, education, sports, etc.).
- Help understand the impacts of major crises (e.g. climate change; COVID; war in Ukraine and associated price and markets shifts) on the deployment of AE transition.
- Help understand the role of large-scale investors in food production as drivers of "change" (e.g. ultra-processed food, alternative proteins proposed as solutions)

4.3 Core Theme 3: Agroecology Living labs and Research Infrastructures as instruments enhancing multi-actor involvement for AE transition and the acceleration of creation and adoption of innovations

Support research in and on living labs across Europe to support AE transition (OO2).
Improve access to and use of services provided by research infrastructures and other relevant initiatives for long-term measurement, observation and experimentation in support of AE (OO5)

Agroecology Living Labs (AELLs) and Research Infrastructures (RIs) and their interlinkage have a high potential to accelerate the creation and adoption of the innovations that will be needed to address AE transition. However, their effective use in this context requires further research on the criteria the AELLs and RIs should meet for this purpose and the methodologies, tools, governance, and organisational aspects supporting their operation. Also, a set of indicators needs to be defined both to assess the impact of AELLs and RIs on transition, and their individual performance. Finally, the possibilities and the drivers promoting the participation of the different stakeholders in these instruments need to be identified to subsequently propose sound incentives to enhance their cooperation.

4.3.1 Involvement of agroecology living labs and research infrastructures in accelerating agroecology transition

Identifying the specific features that make AELLs a suitable instrument to trigger AE transition in different contexts and how they are modulated by local conditions is a prerequisite for their wide adoption. Specific methodologies, tools, and governance mechanisms also need to be developed or improved to increase their performance. Similarly, methodologies need to be developed to benefit from the services provided by RIs in the multidisciplinary or transdisciplinary AE context and their linkage with AELLs. The specific role of RIs in the provision of a wide range of services, data and capacities to redesign agroecosystems, and their complementarity to AELLs need to be understood for AE transition. In fact, RIs provide innovative resources and services enabling interdisciplinary research for AE on a long-term basis, contributing to deeper understanding of agroecosystem functioning. Moreover, they can contribute to the EU-required green and digital transitions by providing harmonised

mechanisms for sharing data, practices, tools, and methodologies to quantify agroecological practices' ecological and socio-economic impacts at different scales. The above-mentioned services must be complemented by outreach and training activities aiming to facilitate the best use of them by the whole community of stakeholders. The associated specific research needs are:

- Create and adapt organisational models, as well as methodologies and tools ensuring multi-stakeholder trust and involvement, up to the consumer, leading to the co-design, co-creation and co-development of innovations and their rapid uptake.
- Identify appropriate governance principles ensuring a fair ownership of knowledge, data and innovations and risk sharing.
- Design methodologies to set co-created strategies and prioritise activities for coherent planning of AELLs.
- Share, communicate and validate criteria for AELLs. Find methods to increase the potential of RIs and their linkage with LLs in the acceleration of AE.
- Explore methods to gain benefits from RI-related multidisciplinary environments.
- Investigate the features of RIs that will provide capacities to redesign agroecosystems along with AELLs and outline their functions.
- Develop capacities of RIs to test assumptions and provide experimental platforms for AELLs in view of supporting innovations or inferring the impact of AELLs at a larger scale.
- Design and assemble models supporting the provision of multidimensional scenarios related to AE transition facilitating the structuring of science-policy interactions and supporting knowledge-based decisions. Cooperation with the Food System Partnership is envisaged regarding the construction of those scenarios.
- Formulate methodologies to facilitate data compilation and harmonisation from AELLs and RIs.

4.3.2 Assessing the impact of Agroecology Living Labs and Research Infrastructures

The suitability of AELLs and RIs to accelerate AE transitions must be ascertained through an appropriate assessment of their impact by users and different stakeholders, including policy makers. Research needs in this regard are related to the definition of adequate indicators and monitoring schemes considering the multidimensional domains (economic, social, environmental and institutional), the specific advances towards AE transition, and the level of maturity of AELLs and RIs. Specific research needs are presented below:

- Identify a minimum list of reliable and 'easy to measure' indicators to assess the enhancement and implementation of socio-technical innovations from AELLs and RIs.
- Construct platforms and appropriate instruments to assess the impacts of innovations proposed by AELLs considering the spatial variations in the transition phases, the maturity of the AELLs, the time needed to verify their impact in different domains, and the time span under evaluation.
- Build up instruments to evaluate the multidimensional influence of AELLs and RIs in AE transition concerning economic, environmental, social and institutional impacts.

4.3.3 Assessing the individual performance of Agroecology Living Labs and Research Infrastructures

Similarly, the stakeholders participating in AELLs and RIs need indicators and monitoring frameworks to assess their own performance and to improve their internal operations. Specific indicators must be defined for evaluating the degree of involvement of a wide range of stakeholders, and for examining quantitatively and qualitatively the performance of the LLs with respect to the objectives and expectations of the stakeholders involved. A participatory approach led by stakeholders is primordial in this research line.

4.3.4 Finding incentives to engage in agroecology transition

Research should focus on:

- Drivers and expectations related to the involvement of stakeholders considering cultural, social, behavioural and economic variations across European territories.
- Identification of the incentives (financial and beyond) needed to maintain and support co-creation activities in LLs.

4.4 Core Theme 4: Enablers of agroecology transition

Appropriate conditions must be in place to accelerate AE transition, such as coherence across sectoral policies and instruments, decision support tools for policy- and decision makers, and incentives to engage stakeholders in long-term initiatives. To this end, for upscaling, best practices from the organic sector could serve as a model.

Concrete R&I actions are needed, related to the development and assessment of conceptual frameworks, methodologies, and tools. The specific research needs are described below.

4.4.1 Enhancing coherence between agricultural, environmental, and other sectoral policies

Increasing coherence between relevant sectoral policies related to AE transition relies, among others, on the following factors:

- The participation of a wide range of actors involved in different sectors;
- The definition of comprehensive scenarios to assess the synergies and trade-offs of the simultaneous application of relevant policies and instruments affecting the transition at different geographical scales;
- The analysis of the impacts related to the amended or new schemes that may be proposed during the development of the partnership.

Moreover, in-depth analysis of the impact of policy instruments on AE transition is also needed. The CAP and Green Deal Strategy, including the EU Biodiversity Strategy and the Farm to Fork Strategy, are specially relevant in this regard. The impact of EU environmental legislation, such as the Habitats and Birds Directive, the Water Framework Directive, EU Soil policy[65] and the Future Nature Restoration Law, needs to be taken into account.

[65] https://ec.europa.eu/environment/soil/soil_policy_en.htm#:~:text=The%20new%20EU%20soil%20strategy,with%20concrete%20actions%20by%202030%20.

Currently, the institutional settings and the specific tools needed to meet such requirements are insufficient or unavailable. The following R&I actions will aim at addressing this gap.

4.4.1.1 Institutional settings and multi-actor involvement

- Identify the factors that can limit or hamper the coherence between sectoral policies impacting AE transition; propose and evaluate means to align the aim, goals, targets and some practical aspects of the implementation of the policies.
- Explore new institutional designs that facilitate multi-actor involvement in AE transition across a wide range of sectoral governance, research, and policy domains.
- Explore new governance approaches for food system transformation through AE, including research on science-policy-society interfaces and how they can be redesigned to ensure equitable outcomes.
- Develop tools and models to understand farmers' motivations for supporting or rejecting policies underpinning AE practices.

4.4.1.2 Overarching evaluation of policies and instruments

- Provide knowledge on the role and impact of policy contexts, regulations, and instruments at different geographical scales (local to international) in promoting AE transition: eco-schemes, public payment for agroecosystem services – including carbon farming, taxation instruments, transaction costs on the labour market, public procurement, adapted credits, land-banks, new labelling, applications of the polluter-pays principle.
- Undertake ex-post analysis of new or amended schemes proposed during the development of the partnership to provide more robust assessments of their performance.

4.4.1.3 Common Agricultural Policy-related research needs

- Define how much AE implementation is needed across the different geographical scales to meet the objectives of the Green Deal and of the CAP.
- Analyse the impacts of the combination of various CAP interventions and make evidence-based recommendations for their eventual incentivation through appropriate policies and instruments.
- Evaluate the implications of CAP national strategic plans and impact of CAP interventions on AE transition.

4.4.2 Developing decision-support tools for risk assessment, policy making and landscape planning

Evidence-based decision making will rely on the construction of scenarios and appropriate tools that allow selecting the most beneficial choices for the development of AE transition in a given landscape thus contributing to design its pathways.

Stakeholders involved in AE transition will need to choose between several options regarding e.g., the adoption and spread of innovations and the implementation of specific practices while planning appropriate landscape transformations or analysing different policy instruments. This requires the construction of scenarios considering the available geospatial information, the

multidimensional aspects of the transition and the identification of the risks, synergies and drawbacks related to the implementation of specific alternatives.

The construction of those scenarios will rely on the building, adaptation and combination of validated models that will be able to assess the sustainability (economic, environmental, and social) of impacts of different choices and serve as demonstrators for policy makers and other stakeholders.

These models should be suited for different purposes at the landscape level such as the provision of sufficient food/feed/energy or the identification of economic, social, and environmental changes related to the redesign of farming systems and associated trade flows.

Modelling may also play a relevant role in defining ways of engaging farmers in the transition, helping them to foresee the appearance, balance sheet and multidimensional features and associated impacts of their farms related to the different transformational options.

4.4.3 Identification of incentives

Research needs include the identification and testing of appropriate incentives (i.e., technical support, technology transfer, fiscal and regulatory measures, and cross-compliance incentives) supporting long-term coherent initiatives. Since farmers are the cornerstone of AE transition, specific incentives (e.g. through the CAP) should support them to ensure a fair income. These incentives may be devoted to mitigating the financial risks of those farmers initiating the transition, and consider payments related to the provision of ecosystem services, among others. As mentioned in the section “Research and knowledge needed to redesign agroecosystems” these incentives must be based on the previous identification of potential social barriers and drivers of AE transition, considering cultural, social, and economic variations across European territories.

4.5 Cross-cutting issues to scale-up transitions at the European level

As the core themes of the SRIA primarily focus on research needs related to the farm and landscape levels, cross-cutting issues arise aiming to provide a European perspective by capitalising on the local experiences and outcomes.

Two main items are identified in this regard: 1) the networking of AELLs and RIs to accelerate the transfer of locally adopted AE innovations and 2) measuring the effectiveness and progress of changes at the European level.

4.5.1 Networking of AELLs and RIs to accelerate the transfer of locally adopted agroecology innovations

Build and organise a European network of new and existing LLs and RIs for knowledge sharing and co-creation on AE innovations at various scales (OO3)

In order to improve the sharing and access to knowledge on AE, as well as reinforce the agricultural knowledge and innovation systems for AE across Europe (SO3), the partnership will build a network of LLs and RIs. Although AE requires locally adapted solutions and therefore AELLs need to be place-based, the sharing of knowledge across LLs can allow a faster up- and out-scaling of AE to promote its transition across Europe, translating it into usable services for

advisors and supporting change of practices for farmers. Networking of AELLs and RIs at the European scale is needed in order to capitalise on the data and the explicit and tacit knowledge and innovations created by these instruments at the local level. This will help ensure the up-scaling of AE practices, the spread of their innovation models and an increased valorisation of innovations when considering a broader scale. The network could serve also as an instrument to propose recommendations for institutional redesign and provide an evidence base for European policies.

To this end, the following research needs have been identified:

- Validate the criteria defined in past and ongoing projects, notably the CSAs ALL-Ready and AE4EU, to organise and put in place a European network of AELLs and RIs, with wide coverage of local conditions and diversity of territories.
- Develop methodologies to enhance the uptake of AE innovations and their integration in value chains at larger geographical scales.
- Explore approaches to spread successful innovation models, methods, and tools for the co-creation of innovations.
- Explore procedures to facilitate knowledge and data sharing, and capacity building and training within the network.
- Develop and test governance and financial models ensuring the sustainability of the network.

Other sets of activities not related to research but aiming to reinforce this network will include:

- Continue to identify existing LLs and RIs relevant for the network, present benefits in joining and structure the network (e.g. terms of reference).
- Promote the creation of new LLs across Europe, e.g. organising an EU-wide call(s) for new LLs with national/regional funding.
- Animating the network of LLs and RIs (including all actors, e.g. farmers, advisors, researchers, policy makers) to set the stage for a European-wide community contributing to AE transition. This includes organising their participation in the governance of the partnership.
- Establishing a programme, creating and using tools for the identification and sharing of best practices, cross-fertilisation and fostering knowledge exchange among LLs at various levels, by organising and carrying out demonstration activities, cross visits, pilot tandem projects for mutual learning (e.g. for new LLs), exchanges, setting up of working groups on both thematic and horizontal issues, and establishing online platforms and networks both for scientists and practitioners.
- Ensuring cooperation, synergies and knowledge sharing with other initiatives and LL networks at international and European level (including AC, and MS ultraperipheral regions), also involving the network of living labs and lighthouses set up under the Horizon Europe mission 'A soil deal for Europe'[66].

[66] https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe/soil-health-and-food_en#:~:text=The%20main%20goal%20of%20the%20Mission%20%27A%20Soil,habitats%20for%20biodiversity%20while%20contributing%20to%20climate%20resilience.

- Identifying and sharing best practice indicators (e.g. practical cases) to assess the performance of LLs in regards to the enhancement of socio-technical innovation and adoption of AE schemes, in synergy with monitoring activities (see 4.3.3. and 4.5.2).
- Design communication tools targeted to different actors aiming to help remove the current barriers and lock-ins that prevent the engagement of scientists, advisors and farmers in AE transition.

4.5.2 Measuring effectiveness and progress of changes at the European level

Set up a framework, data management, indicators, and tools to monitor AE transition, its impacts and social, economic, environmental and climate performance, for a variety of actors, contexts and scales (OO6)

Among the barriers to AE transition is the lack of evidence of its benefits, both at spatial and temporal scales, due to insufficient and scattered data and knowledge on agroecosystems, AE farming practices and the benefits and costs of AE transition measures, including: (a) insufficient knowledge on ecological processes and dynamics at the appropriate spatial level to address the relevant biophysical and socio-economic challenges; (b) lack of experimental and long-term data series on agro-ecosystems' functioning; (c) lack of a holistic view on how an ecosystem service and AE perspective can be tailored to monitor and assess the AE transition, including (for different scales of application) a data review and a framework for analysis; (d) lack of robust data on the context-specific positive effects of combinations of AE practices.

The impact of the partnership's research activities should be measured regarding their effectiveness in promoting relevant changes at the European, national and regional scales, including improving capacities of farmers and other actors to implement AE practices, and their contribution to relevant EU policy targets. This calls for the definition of a European monitoring and evaluation framework. In this context, the definition of what is considered a successful transition is also required.

The monitoring and evaluation framework should be designed and implemented in a participative way following multi-stakeholder and multidisciplinary approaches. Validated, accurate and user-friendly tools should be constructed and/or adapted. They must be based on a reasonable set of low-cost and easy to measure indicators related to the economic, social, and environmental dimensions of transition at the European level. These tools should integrate assessments, data, and experiences. In this sense, the activities will support and gain benefit from the transformation of the Farm Accounting Data Network (FADN) to a Farm Sustainability Data Network (FSDN)[67] to enable sound evaluation of AE transition. The partnership's monitoring and evaluation framework should also cover aspects of biodiversity and nature protection. An analysis of European-scale models that have created scenarios for AE transitions will be performed. All evaluation tools adopted or constructed under the framework of the partnership will be assessed for their accounting for the full set of societal goals. Evaluations will be designed so they foster learning processes and activate 'second level learning', that is learning that leads to generalisation and validation of local results and that critically addresses the assumptions on which first level learning is based. Particular attention should be paid to the

[67] https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12951-Conversion-to-a-Farm-Sustainability-Data-Network-FSDN-_en

timeframe for the assessments, considering the time needed to achieve significant progress in AE transition.

Moreover, the heterogeneous contexts and diversity of local conditions, and the diversity of services that the innovations should bring (e.g., ecosystem services, technological improvements, and socio-economic advances) prevent the development and roll out of standard solutions. This leads to the design of new knowledge management systems, allowing for both down- and upscaling of information and solutions, new tools to capture and aggregate place-specific data, and ways to address the trade-offs between specificity of place-based knowledge and innovation and generality for knowledge exchange at EU level. Therefore, the partnership's monitoring and data framework will aim at measuring progress of AE transition and improve data valorisation and sharing. Harmonised methods and a set of common indicators will be developed to measure progress, integrating currently fragmented data repositories, including those of research infrastructures, and make them available.

Virtual Research Environments on AE are specially suited to exchange data, information and knowledge between LLs and RIs to contribute to AE transition. Data can be both quantitative and qualitative, condensed and descriptive. As usual, the type of data needed depends on the specific purpose. A substantial part of descriptive data is to be expected because of the holistic and complex nature of AE.

Activities will be deployed at various levels and include:

- Developing a data management plan, fostering open access, and designing methods for harmonised long-term collection of environmental and socio-economic data.
- Establishing, in a participatory approach, indicators to monitor and evaluate transition/transformation towards AE at the European level, also considering monitoring processes and approaches implemented by other partnerships and missions.
- Developing methods and indicators with relevant actors ("co-creation") to monitor the AE performance (e.g. economic, environmental, social, governance) of LLs and also at various scales, contexts and pedo-climatic conditions, including by making use of RI capacities and digital technologies.
- Monitoring and assessing the results of the research projects funded under the umbrella of the partnership.

5 Supporting activities - Facilitating environment

The transition towards AE concerns the whole society, including all actors of the agri-food chain from primary production, represented by farmers, advisors, processors and retailers, to other levels in the food system, represented by consumers, policy makers and citizens in general. This means that all have a responsibility in changing agricultural production systems and addressing the consequences of such changes. Making this transition possible will require new knowledge developed through research and actual practices from farmers and a wide range of stakeholders, as described above, but also a set of supporting activities to inform, consult, advise and involve different stakeholders, including policy makers, to create capacity, raise awareness, exchange knowledge and finally to manage data and knowledge.

5.1 Stakeholder engagement

Through its design, as explained above, this partnership is particularly geared to involve stakeholders in defining knowledge needs, to carry out the required research and to ensure that suitable and new knowledge is produced and taken up by the relevant stakeholders. For this to happen, it must be demand-driven. Indeed, the LL approach chosen for this partnership aims to involve all relevant actors in an iterative co-creation process, in real life settings, and putting the end user (i.e.., the farmer) at the centre to ensure impact on the ground (see above). Research to be achieved within the partnership will be defined according to the needs as defined by the actors in the LLs during the co-creation process. Understanding the expectations and wishes of different broad groups of stakeholders, especially consumers, will be important for the AE transition to succeed. Indeed, a broad range of stakeholders are considered:

- Farmers and the wider farming / rural community would be at the centre of the partnership. Involving farmers and their representatives is required.
- Among them, AE farmers and AE farmers' associations represent a group of key interest, whose involvement will be an essential asset, in order to, on the one hand, build on their knowledge and, on the other hand, to support their efforts towards even more sustainability.
- Members of the Agricultural Knowledge and Innovation System (AKIS) at national and regional levels (including advisors, relevant research stations and experimental farms).
- Other food chain stakeholders: industry / SMEs (input providers / machinery / precision application systems / plant breeding, etc.), citizens, processors, wholesaler/ retailer etc. eventually foresters (for agroforestry-related activities).
- Local or regional public authorities (territorial planning, landscape management, regional innovation management), social farming.
- Financial sector (private and charitable), e.g. banks, assurance providers, private investors.
- App/software developers/ ICT experts.
- Civil society, citizen and consumer organisations / NGOs (including e.g. land owners).

Different levels of stakeholder engagement activities and exchanges can be foreseen to understand their expectations concerning the economic, social and environmental impacts of AE. This can be done through information sessions and other communication channels. Depending on their involvement, this should go from surveys to more active involvement in e.g. focus groups. Dedicated workshops are also a means of facilitating face–to-face interaction among stakeholders.

As part of the governance structure proposed for this partnership, two advisory boards will provide input, in particular regarding the research needs. A Science and Stakeholder Advisory Board (SSAB) is foreseen, comprised of high-level scientists in the remit of the partnership, and non-academic stakeholders. The role of the SSAB will be to provide advice and suggestions on the strategy and main activities of the partnership; to be consulted on the main documents produced by the partnership; to review the outputs and impacts of the partnership, and suggest possibilities for improvement. The SSAB will also contribute to the dissemination of information related to the partnership towards relevant scientific bodies and stakeholders.

A second board, the "Enlarged Stakeholder Board (ESB)" is foreseen to be organised into 4-6 thematic colleges, representing the broad stakeholder types from farm to fork. An open call for interest will be published, and all relevant organisations will be allowed to apply. The ESB should include one college for Living Labs; one for Research Infrastructures and one for other major initiatives (e.g., JPIs, other partnerships). The role of the ESB will be to inform the stakeholders about the main activities and outputs of the partnership. The members can contribute to the identification and co-building of research needs to be addressed by the partnership. Members of this board will also bring their own field of expertise to contribute to bridging the gaps between research and innovation, and to improve science-based knowledge transfer, including the adoption of new IPR pathways and exploring the suitability of the existing ones. The ESB will provide advice and suggestions on the strategy and main activities of the partnership.

Through the LL approach and the regular contact with stakeholders through the boards or more open consultations, the relevance to societal demands of the work carried out under the partnership will be ensured.

Funders

The adoption of AE practices requires the involvement of European, national and regional funders. In the context of this partnership, research funders are particularly relevant stakeholders. They are expected to be the decision-making members of the partnership. Involvement of both national and regional (research) funding bodies throughout the research programming cycle will be essential for the success of the partnership. In fact, achieving the partnership's objectives requires the implementation of more flexible and longer-term projects or initiatives that better take into account societal needs, the time frame needed to develop and to measure the effect of AE practices, and the embeddedness in the local or regional contexts. This may require a re-thinking of research funding modalities in Europe that promotes a dynamic adaptation of the research agenda towards greater and quicker impact.

Activities will include:

- Improving and establishing linkages with policy and decision makers, through the organisation of dialogue, training and awareness raising activities, on the need of integrating and improving coherence among policies to facilitate the development of AE.
- Developing communication products (e.g. policy briefs) that present evidence-based recommendations for impact on national priority setting and uptake in policy-making processes.
- Strengthening the coordination among the European research funders supporting AE and organic research.
- Organising targeted events that promote the design and use of policy incentives to foster AE transition.
- Conducting awareness-raising actions (e.g. workshops for funding bodies and policy makers) on how AELLs and RIs contribute to knowledge and innovation generation and on the importance of long-term funding for transformative processes towards more sustainable farming systems.
- Promoting the integration of existing frameworks and developing new ones to promote long-term investment in R&I infrastructures that support AE transition.

- Coordinating dialogues and liaising with other initiatives, in particular Horizon Europe partnerships and missions, to promote coherent EU and national policy-making and long-term funding for transition research.

Supporting activities are illustrated by various Operational Objectives defined in the partnership's proposal, as described in the following sub-chapters.

5.2 Capacity building

Building capacities of various actors to foster AE transition (OO4)

The partnership will aim at building capacities of farmers and other actors (researchers, advisors, consumers, etc.) to foster AE transition as one of its key activities.

The need for further strengthening capacities in a number of disciplines (e.g. agronomy and animal husbandry, farming systems) is recognised, as is the fact that European farmers and growers are getting older. This poses a severe sustainability challenge to the European agricultural sector. To tackle this challenge, a new generation of researchers and trained farmers, growers and advisors is needed. Although this goes beyond the scope of the partnership *per se*, it is a key consideration for the success of AE transition in Europe.

Amplifying AE in Europe via a network of open innovation arrangements, composed of LLs and RIs, is a challenge with multiple facets, both for the complexity entailed in bringing all the key stakeholders in the process, as well as for the multiple challenges to be considered, already depicted in previous sections. This highlights the need to support the various stakeholders (e.g., researchers, farmers, policy makers, intermediaries, etc.) to develop the competencies needed to make the transition possible.

Moreover, many stakeholders are involved in AE transition as well as in co-creation of AE innovation. It is therefore necessary to identify the concrete needs for capacity building of key stakeholder groups and the level at which competencies need to be developed. The ALL-Ready project has developed a first iteration of a framework of competencies for AE transition, for conducting R&I in agroecology, and for running a network of LL and RI on agroecology. This has been validated within a pilot network of LLs and RIs and will be updated and enriched within the ALL-Ready project. This framework can serve as a basis for the capacity building programme of the partnership.

Activities include:

- Continue the design of guidelines on key competencies and the formulation of didactical concepts to build up innovation capacity to support AE transition, based on the needs/patterns of knowledge of all actors at various levels (e.g., via literature reviews, workshops with senior trainers and facilitators active in this field).
- Developing training programmes, training material and tools to enhance the networking, AELLs skills and methodological competencies of various actors and to support peer-to-peer learning between the different stakeholders of LLs and RIs. Specifically the following types of activities are foreseen:
    - Organising advisory and training activities relevant for AE transition, including transition management, and provision of appropriate skills for farmers to run sustainable and profitable businesses.

    - Organising a summer school programme on AE practices and transition management in farmers' schools (apprenticeship), universities, vocational training.
    - Designing and providing transnational 'train-the-trainers' courses including for the facilitators of the living labs.
- Developing (cross-national) green entrepreneurship/"agroeco-preneurship" programmes, promoting incubation and mentorship of agri-business startups on AE and training on AE economics and finances.
- Promoting AE curricula, career systems and impact-oriented research and developing guidelines and tools for decision makers (in synergy with 5.5) and managing authorities to create a supportive environment for AE capacity building.
- Supporting training on data management and open data policies.

5.3 Access to Research Infrastructures

Improve access to and use of services provided by RIs and other relevant initiatives for long-term measurement, observation and experimentation in support of AE (OO5)

As explained in section 1.2.3, RIs are considered a fundamental instruments for accelerating AE transition. Therefore, the partnership must promote the access to their services by considering specific activities, including:

- Creating and updating a catalogue/guide for researchers and other stakeholders of RIs and their services relevant to AE.
- Collaborating with AE (e-)infrastructure entities to provide inputs (data, data management, long-term field experiments and research programmes) for the partnership activities.
- Fostering networking and dialogue between RIs to optimise their contribution to the partnership's activities.
- Facilitating access for individual researchers, LLs and other organisations to RI services that support AE transition, e.g. by brokerage events presenting services offered by RIs and conditions of access or specific calls.
- Exploring long-term sustainability governance and funding models of RIs.

5.4 Communication and dissemination

Design and implement communication and dissemination activities to support AE transition through increased uptake by practitioners and to improve stakeholder engagement, including the wider public (OO7).

Although consumers are increasingly interested in questions related to the environmental impacts of food production and there is increasing awareness about e.g. organic agriculture, agroecology is much less well known or understood by the wider public. For AE transition to succeed, there must be willingness throughout society to embrace the changes it requires – from the farmer, the processing/transformation/transport/logistics actors and retailers and finally through to consumers. This partnership will therefore design and implement communication and dissemination activities, targeted to different actors, to support AE transition to increase uptake by practitioners but also to improve stakeholder engagement,

including the wider public. Also, targeted communication efforts are needed to ensure a strong engagement of stakeholders in the co-construction of knowledge, innovation and solutions throughout the partnership time frame, enhancing their uptake. This is specially the case for farmers in the broadest sense, who are in the centre of AELLs and other open innovation arrangements, the agri-food industry and supply chains (livestock, crop and food value chains).

Further interaction with additional stakeholders will be carried out through consultations or through targeted workshops, as appropriate. Activities will include developing a communication and dissemination plan for targeted audiences, such as but not limited to:

- Developing specific and tailor-made support instruments and events to raise awareness of various stakeholders, including farmers, about the benefits and challenges of AE and its potential for improving farming systems, food security, the environment, climate, biodiversity and society resilience.
- Supporting targeted regional and supra-regional communication and participation platforms to facilitate the dissemination of information and to foster dialogue among actors, including the general public, on the benefits and challenges of AE.
- Establishing a website and other digital supports for the partnership and developing information and communication material to disseminate results from the partnership's R&I activities and to illustrate how the partnership is contributing to achieving the targets of the Green Deal and its strategies, as well as other EU policies, including the CAP.

The partnership will make use of relevant existing and future research programmes and initiatives (i.e., at EU, national but also global levels), but it also intends to have an influence on them. Therefore, the interaction with stakeholders upstream of the development of programmes through the advisory boards and the above communication activities, will ensure that partnership's activities and expected impacts are defined in convergence/synergy/complementarity with other key stakeholders' strategies and needs.

It is particularly important that the partnership's activities and outputs are announced widely, regularly, and in a timely manner to the research community, also with a view to encouraging their participation in the partnership's activities. At the same time, the partnership will require feedback from the research community on the partnership's activities and outputs. This two-way communication can be achieved by means of e.g., international conferences or seminars, a dedicated web site and newsletter, and through social media. The proposed advisory boards to be established as part of the partnership's governance structure will also have a key role in the communication and interactions with the research community and, when appropriate, in seeking their input. The European Commission can also play an important role in this regard, through its direct contact with the research projects it funds.

5.5 Science-policy dialogue

Put in place mechanisms for science-policy dialogue in support of the establishment and implementation of evidence-based policies (research and sectoral) endorsing AE transition, including long-term funding for AE R&I (OO8)

It is critical that policy be evidence-based. The partnership will therefore engage in exchanging with policy makers, as well as other stakeholders on AE transition and mainstreaming of AE

practices to contribute to improved governance, policies, and institutions, based on evidence, to provide recommendations for supportive mechanisms, and to promote the formulation of policies and governance adapted to support AE transition.

The issues of sustainable agriculture and productive farming systems require a European-wide long-term interdisciplinary research base. The Green Deal and SDG agendas, as well as the response to crises in the sector, will require the development of dynamic national and European policies. The development of such policies must be based on scientific evidence of the effect of measures on the three dimensions of sustainability – social, economic and environmental. This research will derive recommendations to national and European policy makers on current and emerging issues.

To achieve the European Green Deal objectives, a focus on the effective implementation of actions and policies is needed. Impacting policies so as to provide an appropriate legal framework to future agricultural systems is also an essential aspect. The partnership's outputs can contribute to the necessary Science-Policy dialogue leading to the formulation, implementation, monitoring and evaluation of EU and national policies concerning AE transition. Organising such a dialogue will be necessary to have an impact on addressing the identified challenges of the transition. The question of how the research produced under this partnership will be taken up by policy makers, researchers, land managers and others is crucial. Greater emphasis should be given to research focusing on supporting the development of the best policy mechanisms to achieve the objectives set out in the partnership. Different steps in policy development could benefit from research: better formulation of objectives, impact assessments, identification of potential policy options, and comparison of the performance of these options on different sets of criteria, analysis of the conditions of implementation and deployment of these solutions, and evaluation of past policies to adjust to new measures. More importantly, society as a whole must be engaged in this process in order to participate in the decision process, and raise awareness of the social, economic, and environmental consequences of the AE transition pathways. In this way, it should actively participate in the design and implementation of the actions related to the transition and the policies and regulations enabling them.

Thus, the partnership will promote science-policy dialogue by engaging a wide range of stakeholders through appropriate instruments based on principles of transparency, legitimacy, rigour and equity. Scientific evidence and other relevant knowledge will be prepared accordingly, considering multiple scales and perspectives across the agri-food value chain. This is particularly relevant when selecting a given path for AE transition. Access to data generated in the partnership will be guaranteed so they can be revisited when assessing potential decisions.

Indeed, in a complex policy context, it will be necessary to look at the effects and consequences of different agreements, policies and laws on agricultural production and land use. It will therefore be particularly important that research developed in the framework of this partnership does not focus only on sectoral policies for agroecological production, but takes a holistic approach and hence considers the other drivers of change in food and agriculture systems in order to strive toward policy coherence. The relevance of the partnership's research for these other areas of policies (e.g. trade, development, environment, climate, competition) will need to be assessed during the dialogue with policy and decision makers. For this purpose,

the partnership will rely on modelling activities considering different scenarios and pathways. Training and dissemination events will be carried out to explain the obtained results and implications, their associated limitations and uncertainties, and the contexts influencing them. Finally, results will be interpreted to provide articulated recommendations so informed decisions, target setting and monitoring of progress can be performed. Narratives and success stories illustrating the impact of the partnership activities will be particularly addressed to policy makers, showing the positive impacts of AE and associated practices used in this partnership.

5.6 International dimension

Due to the global dimension of agroecology, the partnership will promote international collaboration supporting the alignment of agendas and to the extent possible, alignment of activities to create synergies with relevant international organisations, such as FAO and UNEP or the Consortium of International Agricultural Research Centers (CGIAR), and initiatives such as the Agroecology Coalition[68] or the Transformative Partnership Platform on Agroecology[69]. It will also foster the collaboration with non-European partners, including research and academic organisations such as the Latin-American Scientific society on Agroecology (SOCLA) but also grass-root organisations in other regions of the world, where experience could benefit European partners, especially on co-creation processes.

International cooperation would allow for the exchange of experiences and achievements related to AE transition, along with a common assessment of the global implications of national, regional and EU policies enhancing AE practices. This will serve on the one hand, to drive Europe to a leading position in the wide domain of AE. On the other hand, Europe can also learn from the experiences stemming from other continents.

Special attention will be placed on exchanging experiences on the role of LLs and their interactions with RIs in accelerating AE transition. Some countries already have valuable experience with AE and LLs. The EU has already engaged with relevant partners in the context of the Meetings of Agricultural Chief Scientists of G20 States (MACS-G20), with whom useful experiences could be exchanged in the context of this partnership.

It is expected that one of the first activities of the future partnership will be to map the potential international partners that would bring an added value to the partnership both by providing a global view and knowledge on AE and also by scaling up the agroecology activities and solutions developed in the EU at the international level. Additionally, synergies will be explored with the Partnership on Food and Nutrition Security and Sustainable Agriculture (FNSSA) as part of the African Union-EU High Level Policy Dialogue on Science Technology and Innovation.

6 Steps towards annual work plans (AWP)

Following EC rules, the partnership will establish Annual Work Plans (AWP), specifying the activities to be carried out during the year, based on the SRIA. In order to establish priority actions for the AWP, a series of annual workshops is planned with funders, stakeholders and especially AELLs and experts, in order to prioritise research call topics and other activities and

[68] https://agroecology-coalition.org
[69] https://www.fao.org/agroecology/database/detail/en/c/1376154/

to identify “low hanging fruit”. This refers to actions that are more readily accessible and which could be launched rapidly. It is also necessary to consider what type of research is a prerequisite for other activities, for example the building of scenarios may be required to examine possible research outcomes and therefore set priorities. Careful attention will be paid to the research landscape in order to identify synergies and possible collaborations with other partnerships and initiatives. These workshops will also be important opportunities to identify new EU policy priorities to be addressed in the work programmes.

6.1 Process for establishing AWPs

The preparation of each AWP will be started much in advance (at least 6 months) of their planned adoption, while taking into account that a work plan should consider the most recent outputs and outcomes of the partnership activities under the previous AWP. Since work plans must be agreed with the EC, regular consultation of EC services will be ensured. The EC will be a co-creation partner of the various work programmes, and hence be a regular participant in e.g. the workshops and activities to be organised for the purpose of updating the various work programmes.

Work plans should be based on the SRIA and the inputs from the partnership’s members and advisory boards. The Governing Board (GB) should decide on potential further inputs. The list of submitted topics for e.g. calls and other activities, will be processed by the Operational Team (in order e.g. to identify possible overlaps and suggest merges) and sent to the GB for their prioritisation. When relevant, e.g. for a call, only the organisations providing funding will be involved in this decision-making process.

6.2 Content of AWPs

Each AWP will define a balanced set of activities that will contribute to achieving the General, Specific and Operational objectives of the partnership.

AWPs will set out the research priorities, derived from the SRIA, to be initiated during the year, including competitive transnational calls for projects as decided by the GB and corresponding to (an) agreed prioritie(s) as per the Core Themes. Calls may also be targeted specifically to facilitate the setting up and/or to support the functioning and connection to the wider network of LLs.

Further activities include working in co-creation with multiple actors in LLs and RIs to (re-)define research priorities in response to needs for knowledge and AE solutions across Europe’s biogeographical regions (thus providing input to calls); commissioning (foresight or synthesis) studies on specific questions of relevance for AE transition to be defined in the SRIA; coordinated actions with other relevant initiatives, in particular other Horizon Europe partnerships and missions, to ensure and maximise synergies on R&I activities and topics, and the creation of transnational links and synergies between this partnership and other instruments supporting the multi-actor approach, such as Operational Groups under the European Innovation Partnership for Agricultural Productivity and Sustainability (EIP-AGRI).

Additionally, each AWP will set out the core activities for the year corresponding to the supporting activities described in section 5 (capacity building, communication and dissemination, policy dialogue, networking…).

7 Complementarity between the partnership and other programmes and initiatives

7.1 Complementarity with the Green Deal, Horizon Europe calls

The SRIA builds in particular on the results of state-of-the-art R&I as achieved under Horizon 2020 as well as emerging R&I under Horizon Europe.

The EU has supported collaborative working environments, including some rural LLs for over fifteen years, notably under FP 6[70], with a limited uptake in the farming and rural community so far. The creation of the "European Innovation Partnerships" (EIP)[71] under the Innovation Union flagship initiative[72], and the consequent introduction of the multi-actor approach (MAA) under Horizon 2020, triggered increased interest in open innovation methods and in the creation of LL-like approaches as part of several research projects[73]. These research projects remain, however, time-bound (often 3 years) and theme-specific, and are therefore not suited to sustain activities in the long-run, nor are they integrated in grassroots initiatives in specific territories since they normally lack focus on specific national and regional place-based contexts, which are central to AE approaches.

The EU has also supported a stream of projects on integrated ecological approaches, including organic farming and agroforestry, under Horizon 2020's Societal Challenge 2[74]. These projects address aspects relevant to AE such as integrated weed management, crop diversification strategies or soil management practices that enhance soil biodiversity, mixed farming and agroforestry, breeding for diversified farming systems, legume crops for food and feed or socio-economic aspects of AE. The portfolio[75] also includes research projects, thematic networks and one ERA-NET (CORE Organic) that address specific needs of the organic sector. These projects provide a very important contribution to building the scientific knowledge base needed for the implementation of the activities under this partnership. While much more knowledge, and thus research, is still needed to unlock the transition in the wide diversity of socio-economic, ecological and geographical contexts that can be found across the EU, past and ongoing EU-funded projects already provide a sound foundation to identify some of the needs to be tackled by research and to tailor solutions on the ground through hands-on co-creation and experimentation in LLs.

As mentioned above, the CAP also supports innovation in the agricultural sector, in particular through the European Innovation Partnership for Agricultural Productivity and Sustainability (EIP AGRI), and notably through Operational Groups (OGs). OGs are collaborative innovation projects that bring together farmers and researchers to find solutions to a specific problem in a specific context, with farmers and on-farm testing at the heart of this collaboration. OGs are

[70] See collaboration@rural (https://cordis.europa.eu/project/id/034921) funded under the call IST-2005-2.5.9 - Collaborative Working Environments together with other projects
[71] https://ec.europa.eu/info/research-and-innovation/strategy/past-research-and-innovation-policy-goals/open-innovation-resources/european-innovation-partnerships-eips_en
[72] https://ec.europa.eu/info/research-and-innovation/strategy/past-research-and-innovation-policy-goals/innovation-union_en
[73] ROBUST, COASTAL, LIVERUR, LIAISON, AGRILINK etc…
[74] https://cordis.europa.eu/article/id/442635-agroecology-research-for-resilient-sustainable-climate-ecosystem-and-social-friendly-farming
[75] https://cordis.europa.eu/article/id/430692-agroecology-transitioning-toward-sustainable-climate-and-ecosystem-friendly-farming-and-food

therefore an important tool for boosting innovation, and bring research results closer to farm practices, including in the field of AE[76]. However, OGs are also time-bound, subject to funding under the Rural Development Programmes, and hence not suited to deliver transition efforts and data management over a long period of time. The EIP-AGRI also supports knowledge exchange and pooling of resources on agricultural innovation in general and the organisation of events at EU, national and –in some countries- regional levels; however, it does not have enough resources to sustain the intense interactions that are needed among all relevant stakeholders at different levels to support the large-scale uptake of AE practices by farmers. In this regard, the Agroecology Partnership will ensure its alignment with SCAR AKIS[77] activities from the AE perspective, in particular those related to the implementation of the multi-actor approach, bioeconomy and capacity building items, role of e-infrastructures, and social innovation and inclusiveness components.

A non-exhaustive list of Horizon Europe topics that have contributed to the state of the art can be found in the partnership dossier. These topics and projects were taken into account while developing the present SRIA.

A preliminary analysis seeking potential synergies between the Agroecology Partnership and other activities framed under the HE Working Programme 2023-2024 follows. A more thorough exercise will follow when defining the first AWP of the partnership. Upcoming relevant Work Programmes shall be attentively screened while preparing the partnership's AWP and implementing them.

The Agroecology Partnership is fully aligned with the objectives of the Horizon Europe Work Programme 2023-2024 and its expected impacts and outcomes. As such, it will contribute and benefit from the actions of the six destinations defined under HE Cluster 6 – "Food, Bioeconomy, Natural Resources, Agriculture and Environment" Work Programme 2023-2024:

- "Land, oceans and water for climate action", by contributing to practices capable of reducing GHG emissions, maintaining natural carbon sinks, and enhancing the sequestration and storage of carbon in ecosystems and production systems, including by unfolding the potential of nature-based solutions, and fostering adaptations to climate change in rural areas for enhancing resilience.
- "Biodiversity and ecosystem services", by providing new knowledge and innovation for the recovery of biodiversity in agroecosystems and surrounding landscapes, and the preservation and sustainable restoration of ecosystems services.
- "Circular economy and bioeconomy sectors" and "Clean environment and zero pollution", by bringing and integrating innovation for sustainable and circular management and use of natural resources in primary production and bio-based systems, while preventing and removing pollution and unlocking the potential of the bioeconomy, ensuring competitiveness and guaranteeing healthy ecosystems.
- "Fair, healthy and environmentally friendly food systems from primary production to consumption", by supplying knowledge and integrating innovation contributing to sustainable, resilient, inclusive, safe and healthy farming systems connected with resilient value chains.

[76] See Agri-Innovation Summit in Lisieux (France, 2019): https://ec.europa.eu/eip/agriculture/sites/agri-eip/files/2019_pei_carnet_projets_ais_web.pdf
[77] https://scar-europe.org/index.php/akis

- "Resilient, inclusive, healthy and green rural, coastal and urban communities", through a better understanding of the environmental, socio-economic, behavioural and demographic drivers of change as well as deployment of digital, social and community-led innovation.
- "Innovative governance, environmental observations and digital solutions in support of the Green Deal", by enhancing and sharing use of new knowledge, tools, foresight, and environmental observations as well as digital, modelling and forecasting capabilities.

Potential cooperations and synergies are envisaged with the following destinations of other Horizon Europe Clusters, according to their Work Programmes 2023-2024:

- Cluster 1 "Health"

  The Agroecology Partnership will be interested in activities related to a) healthier diets, b) increasing the understanding of environmental, occupational, social and economic determinants of health, and c) ability and preparedness to manage epidemic outbreaks.

- Cluster 2 "Culture, creativity, and inclusive society"

  The Agroecology Partnership will have an interest in the developments of this cluster in relation to a) expanding political participation, social dialogue, civic engagement, gender equality and inclusiveness, and accountability and legitimacy of public policymaking, b) adapting for the consequences of climate change, and inclusive, socially and culturally sustainable climate transition, c) support the cultural and creative industries to turn the challenges of climate transition into opportunities, d) help design, implement and monitor a socially just and inclusive green and digital transition, e) fair and well-functioning labour markets and social protection systems, f) indicators of social progress: economic, social, cultural well-being and sustainability, and g) skills development

- Cluster 4 "Digital, Industry and Space".

  Connections of the Agroecology Partnership with Cluster 4 will be related to: a) supply of raw materials in value chains, b) advanced (nano and bio-based) materials for sustainable agriculture, c) data sharing, emerging IoT platforms, decentralised intelligence, d) advanced imaging and sensing technologies, e) Earth Observation, f) systemic approaches for accelerating uptake of innovation, and g) next generation internet

- Cluster 5 "Climate, Energy and Mobility"

  Cooperation of the Agroecology Partnership with Cluster 5 activities will be related to: a) climate knowledge through Earth Observation and Earth system model data; b) high-integrity voluntary climate initiatives and policy options; c) modelling and developments in support of local adaptation assessments and plans, d) behavioural change and governance for systemic transformations towards climate resilience; e) enhanced quantification and understanding of natural and anthropogenic methane emissions and sinks, f) role of key terrestrial ecosystems in the carbon cycle and related climate effects, g) sustainable, secure and inclusive energy supply and use.

No preliminary identification of potential cooperation of the Agroecology Partnership with activities of Cluster 3 "Civil security for society" Work Programme 2023-2024 was made as the latter was not available at the stage of final editing of the Agroecology Partnership's SRIA.

7.2 Research collaboration with other European partnerships and missions

Even considering solely the Cluster 6 (Food, Bioeconomy, Natural Resources, Agriculture and Environment) of Pillar II (Global Challenges and European Industrial Competitiveness) of Horizon Europe, there are presently 8 partnerships running or planned for the period 2021-2024. It is essential for each partnership to consider at all times this "partnership landscape" (and even taking into account partnerships in other parts of Horizon Europe) in order to avoid overlaps, create synergies and optimise the use of resources to aim at wider impact together. Identifying key cooperation topics among partnerships and efficient ways of working together, while taking into account the features of the partnership instruments and making use of the possible cooperation mechanisms accordingly, will be essential to reach the objectives of the Agroecology Partnership.

The partnership will particularly seek to collaborate with the following Horizon Europe partnerships. It is worth noting that similar to this partnership, a number of these initiatives will use LLs as instruments. While at the point of writing the present SRIA, considering the different levels of maturity of the partnerships and their SRIAs, a precise description of potential common activities is not possible, first options are presented hereunder:

- The Partnership "Safe and Sustainable Food Systems"[78] has the objective to collectively develop and implement an EU-wide committed R&I partnership to accelerate the transition towards healthy and safe diets that are sustainably produced and consumed in resilient EU and global food systems. While the Agroecology Partnership has its focus on primary production and on agroecology as the approach in focus, it is evident from the conceptual framework of figure 1, that agroecology and food system transitioning are strongly connected, and depend on the co-creation of knowledge. To ensure a systemic and integrated approach from production to diet, coordination of activities will take place, not least at the level of the interface between the agroecosystem and food system levels. This also entails collaboration on LLs, which will feature as mechanisms in both partnerships. As indicated earlier in the present SRIA, AE being a holistic approach, the Agroecology Partnership will consider the entire value chain, while ensuring there is no duplication e.g. with funding resources. It is important to mention that products originating from AE might be food and non-food (e.g. feed, fibre…). In addition, the downstream sector for food products coming from AE will probably require specific attention, which will be considered, probably as a strong cooperation item between the partnerships. Another important item which emerged from discussion with stakeholders is the impact of AE on current value chains, such as the trade-offs associated with the introduction of products from AE for such value chains; the latter could be the subject of an early activity entailing mapping value chains and performing a scenario analysis.
- The Partnership "Biodiversa+"[79] is committed to the Global 2050 Vision of 'Living in harmony with nature' adopted under the Convention on Biological Diversity, and the corresponding EU vision that, by 2050, biodiversity and its benefits to people will be protected, valued and restored (EU Biodiversity Strategy 2030, as part of the European Green Deal). Collaborative research will focus on enhancing biodiversity in agroecosystems through AE practices,

[78] https://research-and-innovation.ec.europa.eu/document/download/a35be177-7024-4849-843f-c8bfa7892712_en?filename=ec_rtd_he-partnership-sustainable-food-systems-april_2022.pdf
[79] https://www.biodiversa.eu/

measuring biodiversity in agroecosystems, monitoring of pollinators and so on. Possible synergies might emerge e.g. from aspects such as the contribution of AE to nature protection and biodiversity restoration, including biodiversity in the monitoring framework as an indicator of AE performance, functional biodiversity in support of e.g. zero pesticide use. Several instruments of collaboration could be considered, such as coordinated calls, cooperation on data and monitoring framework (e.g. bringing data sets from both partnerships together), capacity building and training activities with the idea of building a knowledge hub. It should be noted in particular that Biodiversa+ will have a possible flagship programme on "Biodiversity for supporting sustainable agriculture and forestry (including spatial planning, agro-ecology)"; close cooperation is essential while doing so.

- The Partnership "Agriculture of Data"[80] will support sustainable agriculture in the EU as well as policy monitoring and implementation by using digital and data technologies in environmental observation. Research collaboration will focus on the barriers and opportunities of ICT as an enabler of AE practices. This includes assessment of the role of digital technologies in AE transition, particularly as regards supporting diversified cropping systems, providing environmental data, emissions reduction potential, economic feasibility and access to technologies, employment and data governance issues. Potential topics of cooperation encompass e.g. the harmonisation of data, the long-term monitoring of climate change, decision-support tools based on data, sensors and satellite observation to monitor AE performance, data exchange for assessing AE impact on social, economic and environmental dimensions, capacity building for farmers to use these tools. Common workshops, alignment of calls for research projects and bilateral sharing of data generated in research projects are first ideas for collaboration.
- The Partnership "Animal Health and Welfare"[81] aims to deliver key knowledge, services and products to significantly improve the control of animal infectious diseases and animal welfare in a coordinated way which will sustain animal production and protect public health. Research collaboration will focus on integrated crop – livestock systems, as well as on AE as a tool for reduced use of antimicrobials, as a way to enhance the health and welfare of livestock, and on the safety of animal effluents used as fertilisers. The following ideas emerged in particular from initial discussions: Animal welfare might be used as an indicator of AE performance; the importance of quality of grasslands for animal welfare and the contribution of AE to contribute to maintaining/improving this quality; the way that agricultural practices in the AE frame have an impact on animal welfare (e.g. stress level); reaction of AE systems to pandemics. Beyond coordinating calls, networking capacity building, training activities might be appropriate instruments of collaboration.
- The Partnership "Water4All"[82] aims to enable water security in the long term through different types of activities, ranging from the funding of R&I projects to the strategic alignment of participating members, the support to science-policy interface, demonstration and testing of innovative solutions, networking, capacity building and international cooperation. Areas of collaboration could address the circularity and management of water in AE farming systems (i.e. use and re-use of agricultural water and use of waste water in

[80] https://research-and-innovation.ec.europa.eu/document/download/a1fccc86-af53-43d4-94d2-79c54a353d0e_en?filename=ec_rtd_he-partnership-agriculture-data.pdf
[81] https://research-and-innovation.ec.europa.eu/system/files/2022-04/ec_rtd_he-partnership-pahw.pdf
[82] https://water4all-partnership.eu/

agriculture), on the impact of AE, e.g. via the reduction of pesticide use, on water quality or on conservative water management in agriculture (such as precision farming). Research collaboration will focus on 'water-wise' agriculture such as AE cultivation and intensification methods based on integrated management of nutrient and water supply, improved understanding of the effects of agricultural water abstraction and management and emissions (nutrients, pesticides, pathogens and other organic pollutants) on agroecosystems and landscapes. It should be noted that the instrument of "Water-oriented living labs" will play a role in Water4All and this should be noted by the Agroecology Partnership when these LLs are working on agriculture.

- The Partnership "Circular Bio-based Europe"[83] funds projects advancing competitive circular bio-based industries in Europe. Research collaboration will focus on AE as a system that ensures circularity, resource efficiency and recycling in agriculture. In particular, collaboration may seek to improve understanding of the carbon footprint and nutrient loss reduction potential of circular biomass chains, in particular through novel local biomass production systems coupled with biomass refining and waste management systems. Cooperation with this partnership might be key when considering the non-food use of biomass originating from AE farming systems.

Another new instrument introduced in Horizon Europe, EU Missions are a coordinated effort by the Commission to pool the necessary resources in terms of funding programmes, policies and regulations, as well as other activities. Each Mission will operate as a portfolio of actions to achieve a measurable goal that could not be achieved through individual actions. In particular, calls in a separate part of the Work Programme in Horizon Europe are dedicated to the implementation of the Missions. The Agroecology Partnership will avoid any overlap by paying particular attention to the Missions' Work Programmes. Recently, a toolbox of possible mechanisms for cooperation between partnerships and missions was presented by the EC, including: joint calls/topics, cross referencing, integration-alignment-coordination of governance structures, cross-initiative assemblies, cluster of projects (foster interaction, exchange of data and deliverables, involvement in respective activities), exchange of results/methodologies/experiences, formal commitment (MoU), partnership additional activities, contact point structure (implementation and clarification, strategic input exchange), visibility/promotion, joint events. The following Missions shall be particularly relevant for the Agroecology Partnership:

- The Mission ''A Soil Deal for Europe"[84] aims in particular to establish 100 living labs and lighthouses to lead the transition towards healthy soils by 2030. Living labs are in this case an interesting enabler for synergies with the Agroecology Partnership, since they will represent the common ground allowing the development, testing and uptake of solutions benefiting soil health and following AE practices. Research collaboration will focus on AE as a tool to improve soil health and increase carbon sequestration in soils. As the scope of the soil living labs established under this mission is likely to overlap with those of the Agroecology Partnership when it comes to soil management practices, both are likely to

[83] https://www.cbe.europa.eu/
[84] https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe/soil-health-and-food_en

benefit from research activities on and in living labs. Multiple synergies could be foreseen, in terms of:

(i) Mechanisms, as some LLs could be common to both initiatives;

(ii) Thematic areas, as AE practices are typically meant to be beneficial to soil health and several common research themes could be relevant (such as recovery of soils, reduction of inputs, combatting desertification, prevention of erosion, soil biodiversity and microbiome, carbon farming);

(iii) Monitoring activities, considering soil health as an important indicator of AE performance;

(iv) Target groups, as several mobilised stakeholders to be involved in LL are likely to be common for both instruments;

(v) Knowledge exchange and literacy, through common capacity building or engagement sessions at national or regional levels.

(vi) Linkage with the EIP AGRI OG and EIP network, to promote and up-scale solutions tested under common LL.

(vii) Impact on policy; increased through common policy briefs.

- The Mission ''Adaptation to Climate Change''[85] has the objective to accompany at least 150 European regions and communities towards climate resilience by 2030. Research collaboration should focus on AE as an approach to support adaptation to climate change in specific geo-climatic regions.
- The Mission ''Climate-Neutral and Smart Cities''[86] aims to deliver 100 climate-neutral and smart cities by 2030 and ensure that these cities act as experimentation and innovation hubs to enable all European cities to follow suit by 2050. Research collaboration could focus on achieving climate-neutrality of food supply to cities, including urban agriculture.
- The Mission "Restore our Ocean and Waters by 2030" will help achieve the marine and freshwater targets of the European Green Deal, such as protecting 30% of the EU's sea area and restoring marine ecosystems and 25000 km of free-flowing rivers. As one of its objectives, the Mission will prevent and eliminate pollution by, for example, reducing the use of chemical pesticides in the sea by 50%.

Activities to ensure research collaboration and synergies could include the coordination of programming (e.g. coordinated transnational calls), joint learning on transition processes and methodologies to steer such transitions, regular exchange of results/knowledge, common dissemination events, joint workshops with stakeholders, capacity building activities, monitoring and evaluation activities, etc. Dialogue with these initiatives has already started with a view to further concretising these synergies and will be deepened in preparation of the partnership as well as throughout its entire duration.

Finally, while the Agroecology Partnership is committed to working with other partnerships and missions, a mechanism might be needed to ensure a coherent landscape. This coherence cannot

[85] https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe/adaptation-climate-change_en
[86] https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe/climate-neutral-and-smart-cities_en

be ensured if each single partnership is looking for bilateral, potentially multilateral collaborations with the others. An overarching structure / mechanism would be needed that is able to ensure a more "horizontal" overview and ensure links and synergies in the broader landscape.

8 Evaluation and monitoring of the impact of the partnership

In order to assess the performance of the partnership in achieving its objectives, the following Key Performance Indicators (KPIs) are proposed in line with the partnership's Specific and Operational Objectives. It should be noted that these KPIs are quantitative, while it might be necessary to also include qualitative indicators at a later stage.

The entire framework for reporting and monitoring will be revised and fine-tuned during the first year of operation of the partnership, taking into account the recommendations of the Expert Group[87], before being adopted by the GB.

Besides this assessment of the performance of the partnership *per se*, two other monitoring activities are planned under the umbrella of the partnership. Both will also provide important input for the monitoring of the impact of the partnership:

- The research projects funded in the frame of joint calls for transnational research projects will be monitored, probably in a similar way as in past ERA-NETs. The partnership might in particular benefit from the long-term expertise collected in FACCE-JPI on this aspect[88].
- Significant resources shall be dedicated to work on the Operational Objective 6 (Set up a framework, data management, indicators, and tools to monitor AE transition, its social, economic, environmental and climate performance and impacts, for different actors, contexts and scales). Aspects such as the performance of AE, its uptake and upscaling, the performance of AELLs will be measured, which do not only rely on the partnership performance *per se*.

[87] A robust and harmonised framework for reporting and monitoring European Partnerships in Horizon Europe: https://op.europa.eu/en/publication-detail/-/publication/6b63295f-d305-11eb-ac72-01aa75ed71a1/language-en/format-PDF/source-215872593?fbclid=IwAR19i1AHDuiNVJgfRrPuZ8DmIGFa9S5AWcEOxNnARUg3znCuw9y-oQM_zGM
[88] https://www.faccejpi.net/en/faccejpi/strategy/monitoring-and-evaluation.htm

Proposed KPIs in relation to the partnerships' objectives:

Specific Objective	**Operational Objective**	**Expected outcome**	**Proposed Indicators**
1. Increase research-based knowledge on the benefits and challenges of AE and its potential for farming, food, climate, ecosystem services and environmental impacts reduction as well as resource use and societal impacts	1. Support transnational R&I activities on the challenges and potential of AE in addressing biophysical, environmental, climate, social and economic dimensions of sustainability, at farming, local environment and broader societal levels	Calls for transnational research projects are launched each year, with a significant number of funding organisations involved, a broad geographical coverage and a substantial budget. EU and national/regional agroecological R&I agendas are complementary, leading to the co-creation and implementation of a long-term pan-European strategic research and innovation agenda.	1) Number of joint calls, 2) Number of projects, 3) Volume of funding spent in projects, 4) Number of researchers and research organisations involved, 5) Number of regions/countries involved in the projects
	2. Support research in and on LLs across Europe to support AE transition	A large number of LLs is involved in the research projects in the frame of joint calls. Calls are scoped with substantial input from LLs. Knowledge on LL as instruments to foster the AE transition is increased across Europe and is used as a basis for designing specific programmes	1) Number of research projects involving LLs, 2) Number of LLs involved
2. Develop and co-create innovations to reduce and share the risks of transition for both individuals and collectives	2. Support research in and on LLs across Europe to support AE transition	A large number of LLs is involved in the research projects in the frame of joint calls. Calls are scoped with substantial input from LLs. Knowledge on LLs as instruments to foster	1) Number of calls for research involving LLs, 2) Number of LLs involved

		the AE transition is increased across Europe and is used as a basis for designing specific programmes	
	3. Build and organise a European network of new and existing LLs and RIs for knowledge sharing and co-creation on AE innovations at various scales	The network includes a significant number of participants covering a broad and diverse geographical area. The network is an important tool for knowledge sharing and co-creation.	1) Number of initiatives recruited to the network, 2) Number of activities organised within the network, 3) Number of events aiming at demonstration and networking; 4) Number of regions covered by the network.
3. Improve the sharing and access to knowledge on AE as well as reinforce the agricultural knowledge and innovation systems for AE across Europe, considering culture, gender, and youth aspects	3. Build and organise a European network of new and existing LLs and RIs for knowledge sharing and co-creation on AE innovations at various scales	The network includes a significant number of participants covering a broad and diverse geographical area. The network is an important tool for knowledge sharing and co-creation.	1) Number of initiatives recruited to the network, 2) Number of activities organised within the network, 3) Number of events aiming at demonstration and networking
	4. Build capacities of various actors to foster AE transition	Multiple groups of stakeholders, especially farmers, are equipped with appropriate knowledge on AE	1) Number of different target groups trained (e.g. farmers, students, entrepreneurs, policy makers, etc.), 2) Number of people trained
	5. Improve access to and use of services provided by RIs and other relevant initiatives for long-term measurement, observation and experimentation in support of AE	RIs are more easily accessible, more often used and integrated into the partnership's activities	1) Number of national and European RIs and their services included in the catalogue, 2) Number of RIs contributing (e.g. data) to partnership activities, 3) Number of individual researchers using services of RIs
	7. Design and implement communication and dissemination activities to support AE transition through increased uptake by practitioners and to	Practitioners and stakeholders are informed in an appropriate and accessible way on AE and associated practices.	1) Number of tools for awareness raising produced, 2) Number of translations to national languages of partnership documents, 3) Number of articles on website,

	improve stakeholder engagement, including the wider public	A robust European R&I system for AE integrating science and practice is put in place.	of newsletters per year, of awareness raising events
4. Build a monitoring and data framework to measure progress of AE transition and improve data valorisation and sharing	5. Improve access to and use of services provided by RIs and other relevant initiatives for long-term measurement, observation and experimentation in support of AE	RIs are more easily accessible, more often used and integrated into the partnership's activities	1) Number of national and European RIs included in the catalogue and number of services provided, 2) Number of RIs contributing (e.g. data) to partnership activities, 3) Number of individual researchers using services of RIs
	6. Set up a framework, data management, indicators, and tools to monitor AE transition, its impacts and social, economic, environmental and climate performance, for a variety of actors, contexts and scales	The partnership is equipped with a strong monitoring framework and makes use of it to follow the AE transition	1) Number of indicators co-created with relevant actors to assess AE performance, 2) Harmonisation of long-term data collection and compilation, 3) Narratives/success stories from the partnership
5. Exchange with policy makers (research and sectoral) and stakeholders on AE transition and mainstreaming of AE practices to contribute to improved governance, policies, and institutions	4. Build capacities of various actors to foster AE transition	Multiple groups of stakeholders are equipped with appropriate knowledge on AE	1) Number of different target groups trained (e.g. farmers, students, entrepreneur, policy makers, etc.), 2) Number of people trained
	6. Set up a framework, data management, indicators, and tools to monitor AE transition, its impacts and social, economic, environmental and climate performance, for a variety of actors, contexts and scales	The partnership is equipped with a strong monitoring framework and makes use of it to follow the AE transition	1) Number of indicators co-created with relevant actors to assess AE performance, 2) Harmonisation of long-term data collection and compilation, 3) Narratives/success stories from the partnership
	8. Put in place mechanisms for science-policy dialogue in support of the establishment and implementation of	A strong science-policy dialogue provides policy makers with the tools and scientific evidence to develop appropriate policies in	1) Number of communication products (e.g. policy briefs) targeted at policy makers, 2) Number of events

	evidence-based policies (research and sectoral), that support AE transition, including long-term funding for AE R&I	support of the AE transition. Evidence-based, systems-oriented and transformative governance and policy-making are supported	promoting AE to policy makers, 3) Number of training events aimed at science-policy dialogue

9 Annexes

Annex 1: Membership of the SCAR-AE

Strategic Working Group on Agroecology (SCAR-AE)

Countries member of SCAR-AE (28 countries):
SCAR-AE is composed of representatives of EU Member States and Horizon Europe Associated Countries, nominated by the SCAR representative of the country. The current membership of SCAR-AE is as follows: Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Georgia, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Moldova, The Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Spain, Sweden and Turkey.

Key Advisors (involved in the core work of SCAR-AE):
Key Advisors are involved intensively in the work of SCAR-AE. In this regard they contribute to all meetings of the "Coordination Group" (together with the co-chairs of SCAR-AE and DG AGRI of the EC) and report regularly on the performed work and main outcomes of their projects. They are also involved in the work performed in the different "Task Forces" under SCAR-AE (see 2.1). The 4 Key Advisors of SCAR-AE are: the Joint Programming Initiative on Agriculture, Food Security and Climate Change (FACCE-JPI), the CSA "The European Agroecology Living Lab and Research Infrastructure Network: Preparation phase" (ALL-Ready), the CSA "Agroecology for Europe" (AE4EU) and the CSA "Soil Mission Support" (SMS).

Observers (involved in process at plenary level, further observers join on regular basis):
Observers are organisations/initiatives active in themes that are of direct relevance to SCAR-AE and the partnership. They were proactively addressed by SCAR-AE and/or requested such status which was then considered on an ad-hoc basis by SCAR-AE. SCAR-AE paid attention to a have a proper balance of interests represented amongst the authorised observers. Observers are invited to participate in the meetings of SCAR-AE and its Task Forces when relevant, receive the information that is needed to participate in the meetings and have the opportunity to comment on the documents prepared by SCAR-AE.
Currently, observers in SCAR-AE are (this list is regularly updated/broadened): SCAR SG Task Force, SCAR SWG AKIS, SCAR SWG Food Systems, SCAR SWG Fish, SCAR SWG Bioeconomy, SCAR SWG ARCH, SCAR SWG Forest, SCAR CWG AHW, SCAR CWG SAP, Horizon Europe partnership Biodiversa+, Agroecology Europe, TP Organics, ERA-NET Core Organic, ERA-NET SusAn, ERA-NET FACCE SURPLUS, ERA-NET ICT-AGRI-FOOD, COPA-COGECA, La Via Campesina, ERIAFF, ERRIN, EnoLL, ETP Plants for the Future, EEB (European Environmental Bureau), EuroCoop (European association of consumer cooperatives), IBMA (International Biocontrol Manufacturers Association), IFOAM - Organics International, BIOEAST Initiative, Animal Task Force, Birdlife, LifeWatch ERIC and AnaEE.

Annex 2: List of initiatives presented in SCAR-AE project slams meetings

The following initiatives were presented in 2021 in the frame of the SCAR-AE "project slams":

ALL-Ready	Coordination and Support action	IWMPRAISE	Research and Innovation Action
AE4EU	Coordination and Support action	JPI HDHL	Joint Programming Initiative
AnaEE	Research Infrastructure	LEAP-AGRI	ERA-NET
BRESOV	Research and Innovation Action	LEGVALUE	Research and Innovation Action
Climate-KIC	Knowledge and Innovation Community	LifeWatch	Research Infrastructure
COPA-COGECA	Representation of farmers	LIFT	Research and Innovation Action
CORE-Organic	ERA-NET	LIVESEED	Research and Innovation Action
DIVERFARMING	Research and Innovation Action	METROFOOD	Research Infrastructure
DiverIMPACTS	Research and Innovation Action	OK-Net Arable	Research and Innovation Action
DIVERSify	Research and Innovation Action	OK-Net EcoFeed	Research and Innovation Action
EIP-AGRI	European Innovation Partnership	Biodiversa+	Horizon Europe Partnership
EJP OneHealth	European Joint Programme	ReMIX	Research and Innovation Action
eLTER	Research Infrastructure	SCAR AKIS	SCAR Strategic Working Group
EMPHASIS	Research Infrastructure	SCAR Food Systems	SCAR Strategic Working Group
EnoLL	European Network of Living Labs	SMS	Coordination and Support action
ERA-GAS	ERA-NET	STARGATE	Research and Innovation Action
ERIAFF	Network of European Regions	SusAn	ERA-NET
EURAGRI	Not-for-profit Organisation	SusCrop	ERA-NET
FACCE SURPLUS	ERA-NET	SUSFOOD2	ERA-NET
FACCE-ERA-NET+	ERA-NET	TP Organics	European Technology Platform
FACCE-JPI	Joint Programming Initiative	TRUE	Research and Innovation Action
FAO TAPE	Agency of the United Nations	UNISECO	Research and Innovation Action
FOSC	ERA-NET	Water JPI	Joint Programming Initiative
ICT-AGRI-FOOD	ERA-NET		

Annex 3: Overview of events in 2022 where the SCAR AE Core Group has presented the partnership

Date	Place/Virtual	Event	Topic of presentation	Participants/Addressee
20.01.2022	Virtual	SCAR-AE Meeting	Presentation of the partnership proposal	SCAR-AE members & observers
26.01.2022	Virtual	AE4EU Annual Meeting	Presentation of the partnership objectives, timelines, organization, state of play	
11.02.2022	Virtual	Joint meeting ETPs	Partnership objectives	ETPs
19.02.2022	Dubai	EU Green Deal and Farm to Fork Strategy Conference	Presentation of the partnership proposal	High-level
01.03.2022	Virtual meeting	FACCE-JPI Governing Board Meeting	Scientific scope of the European partnership 'Accelerating farming systems transition: Agroecology living labs and research infrastructures'	Researchers and public officers
11.03.2022	Maó (Menorca Island, Spain)	Menorca island's transition to become a sustainable agrifood territory	European Research and Innovation Programmes and Initiatives supporting agroecological transition	Researchers, general public, local authorities
14.03.2022	Virtual	TP Organics Webinar Agroecology Partnership	Presentation of the partnership proposal, Introduction to the Agroecology Partnership's SRIA preparation	TP Organics, Researchers and public officers
17.03.2022	Virtual	FACCE-JPI GB meeting	SRIA preparation	FACCE-JPI
01.04.2022	Virtual	EPSO Board meeting	Partnership intervention logic and instruments	EPSO
05.04.2022	Virtual	Cluster 6 Programme Committee	Partnership resources and governance	
06.04.2022	Valencia (Spain)	11th conference on EU R&I Framework Programme in Spain	Needs for a successful participation of Spanish Living Labs in the Agroecology Partnership and the Mission "A soil deal for Europe"	Researchers, public officers
12.04.2022	Virtual	Working Party R&I of COPA-COGEGA	Presentation of the partnership objectives, timelines, organization.	Broad range of stakeholders

29.04.2022	Virtual	Workshop to launch the process to develop the Strategic Research and Innovation Agenda (SRIA)	Presentation of the partnership proposal	Broad range of stakeholders
05.05.2022	Lugo (Spain)	AE4EU meeting	Presentation of the Agroecology Partnership and its SRIA preliminary research needs	Researchers, practitioners, regional and local public officers
10.05.2022	Aarhus (DK)	SusCrop consortium meeting	Presentation of the partnership proposal	SusCrop members
13.05.2022	Virtual	Meeting of BIOEAST thematic groups	Status of the partnership preparations	BIOEAST thematic groups
18.05.2022	Brussels (BE)	CORE Organic Cofund Final Research Seminar	Presentation of the partnership proposal	CORE-Organic members
20.05.2022	Virtual	MSc course on Agroecology of WUR (NL)	Presentation of SCAR, the partnership…	Students
10.06.2022	Virtual	SCAR-AE Plenary meeting	Update on dossier, presentation of SRIA table of content, conceptual framework, core themes…	SCAR-AE members & observers
14.06.2022	Brussels	Meeting with the regional representation in Brussels of the 'Pays de la Loire'	Presentation of the partnership objectives, timelines, actors (role or regions) and synergy with other initiatives as Soil Mission	Representatives of the region's commissions of agro-food industry, fisheries, forest, water, environment, bioeconomy.
15.06.2022	Paris (FR)	SCAR Plenary	Presentation of the partnership	SCAR members
15.06.2022	Thessaloniki (Greece)	ERIAFF ANNUAL CONFERENCE	Candidate Partnership under Horizon Europe ”Accelerating farming systems transition: agroecology living labs and research infrastructures”	Regional Ministries and public officers / Researchers / Politicians
23.06.2022	Virtual	Missions & Partnerships - Directional matchmaking events (Natural environment)	Synergies among Soil Mission and other initiatives, mainly the Agroecology Partnership	European Commission DGs representing the five HE Missions and representatives from different partnerships
13.07.2022	Virtual	Defining Lifewatch ERIC Roadmap	Presentation of the Agroecology Partnership’s objectives, SRIA core themes and expected timeline for its implementation	Representatives of all centres and national nodes of LifeWatch ERIC

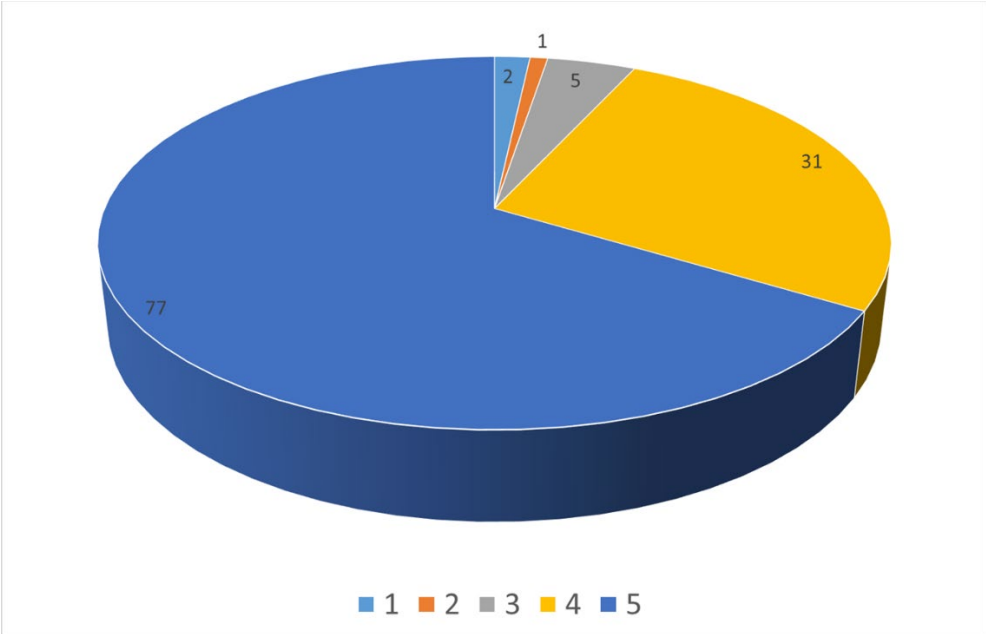
21.07.2022	Virtual meeting	RecAP project	Interview and debate on P relevance for the Agroecology Partnership	Researchers
27.07.2022	Nürnberg (DE)	FiBL session at BIOFACH	Presentation of the partnership	Organic farming
01.09.2022	Virtual	Kick-off meeting of Horizon Europe project 'D4AgEcol'	Presentation of EU-funded research in agroecology, including the agroecology partnership (process, objectives, SRIA preparation)	Members of the consortium of D4AgEcol
28.09.2022	Virtual	Kick-off meeting of Horizon Europe project 'Agroecology-TRANSECT'	Presentation of EU-funded research in agroecology, including the agroecology partnership (process, objectives, SRIA preparation)	Members of the consortium of Agroecology-TRANSECT
29.09.2022	Bari (IT)	Mediterranean Diet Conference	Presentation of the partnership	Diverse
29.09.2022	Virtual	EU R&I days	Synergies with Mission Soil	Diverse
29.09.2022	Virtual	Policy dialogue EU-Colombia, Ecuador, Peru	Presentation of EU-funded research in agroecology, including the agroecology partnership (process, objectives, SRIA, international dimension)	European Commission and representatives from Colombia, Ecuador and Peru
05.10.2022	Virtual	Kick-off meeting of Horizon Europe project 'OrganicTargets4EU'	Presentation of EU-funded research in organics and agroecology, including the agroecology partnership (process, objectives, SRIA preparation)	Members of the consortium of OrganicTargets4EU
12.10.2022	Brussels (BE)	Organic Innovation Days	Presentation of the partnership, Organics in the agroecology partnership and the soil mission	TP Organics members, wide audience
13.10.2022	Brussels (BE)	Water4All Kick-off	Presentation of the partnership	Water4All partnership
17.10.2022	Prague (CZ)	AgroEcoServ Kick-off	Presentation of the partnership	AgroEcoServ consortium
20.10.2022	Virtual	SCAR Steering Group meeting	Status of partnership preparation	SCAR SG members
25.10.2022	Budapest (HU)	SCAR AKIS	Progress of SCAR-AE incl. of the partnership	SCAR AKIS members
25.10.2022	Madrid (Spain)	XXI International N Workshop	Exploring the potential of the Horizon Europe candidate partnership on Agroecology Living Labs and Research Infrastructures to reduce farming reactive nitrogen losses	Researchers, practitioners, public officers

15.11.2022	Brussels (BE)	European Partnerships Stakeholder Forum	Virtual poster on the Agroecology Partnership, Explore opportunities for collaboration between Soil Mission and Partnerships (e.g. related to funding, geographical overlap, common stakeholders, etc)	Whole community of co-funded, co-programmed and institutionalised partnerships, EC DGs representatives, MS/AC representatives
22.11.2022	Virtual	Workshop: Presenting the current version of the Agroecology Partnership's Strategic Research and Innovation Agenda	Presentation of consultation outcomes and on updates to the SRIA	SCAR-AE members & observers
28.11.2022	Brussels (BE)	Meeting between the 'New Agriculture New Generation' Greek Organization and the EU Soil Mission	Exchange on the Soil Mission activities and more specifically the living labs and the related activities carried out by the organization at local level in Greece, with views on potential engagement with the Mission or the living labs in general. The link with the Agroecology Partnership was made to relate to one of their areas of work which is Regenerative Agriculture.	New Agriculture New Generation members and, through them, all the stakeholders they represent.
30.11.2022	Brussels	Training for National Contact Points	Partnership's objectives, with focus on the topic text	National Contact Points
06.12.2022	Virtual	SCAR-AE Plenary meeting	Update on partnership, on consultation outcomes, presentation of SRIA final draft	SCAR-AE members & observers, respondents to the open consultation
13.12.2022	Virtual	Info days	Partnership topic	General public
15.12.2022	Virtual	SCAR Plenary	Presentation of potential synergies with other partnerships and missions	SCAR members

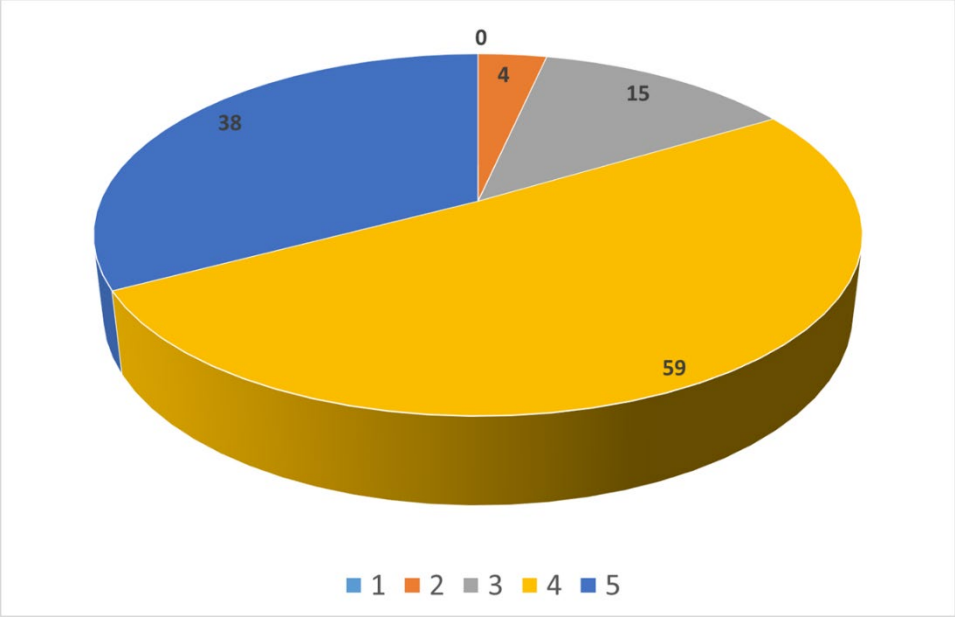
Annex 4: Outcomes of the public online consultation to the SRIA first consolidated draft:

116 responses were collected during the public online consultation between July 2022 and October 2022.

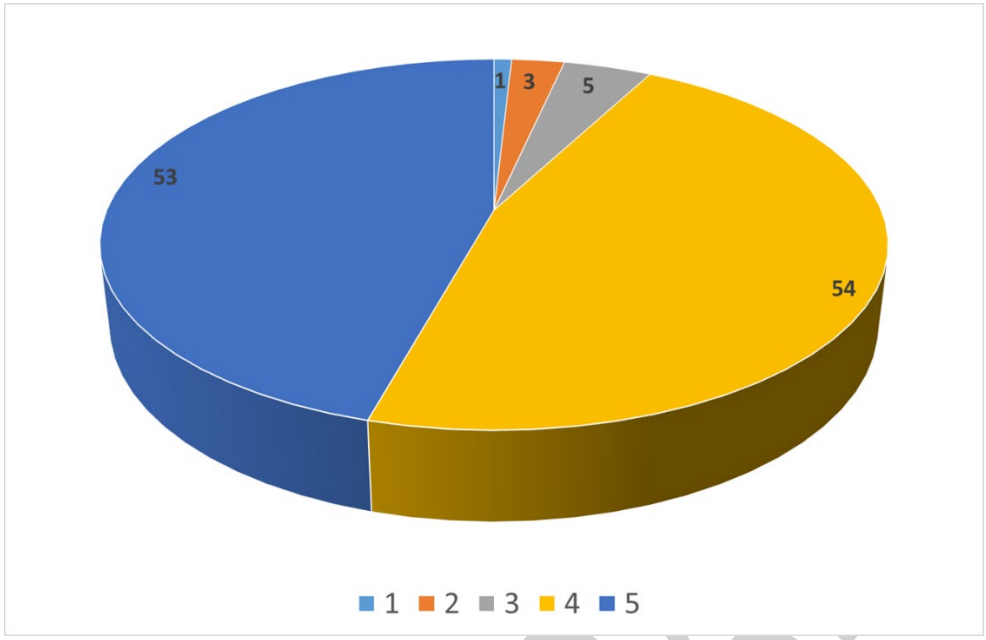
To the question "Do you agree that agroecology has the potential to contribute to tackling challenges faced by the agricultural sector?", the respondents answered as follow (1 meaning fully disagree and 5 fully agree):



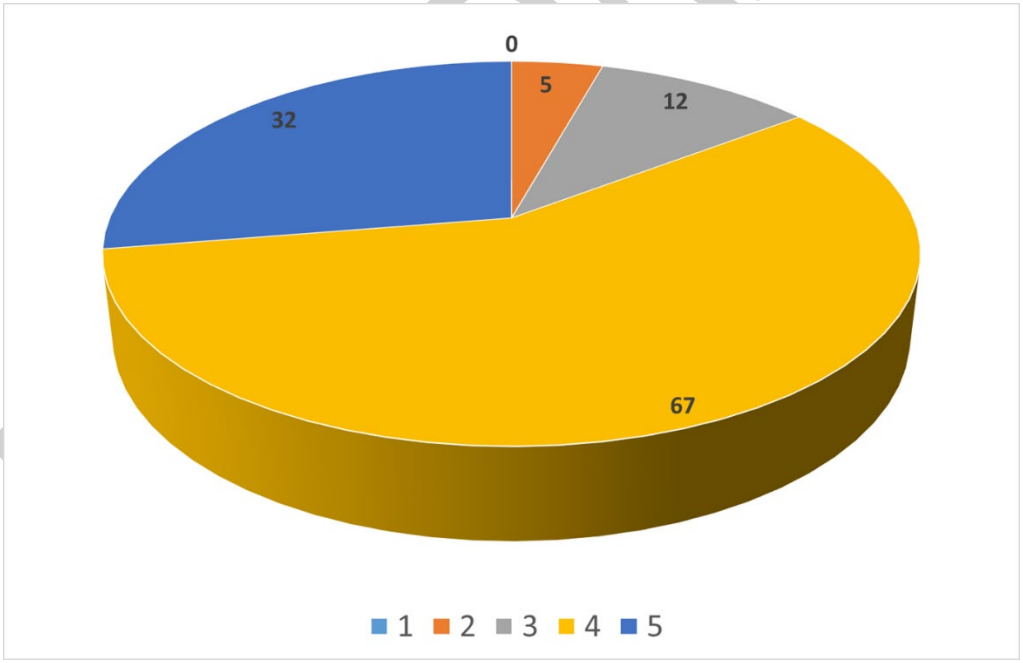
To the question "Do you consider the general scope of the SRIA to be appropriate to accelerate the agroecology transition?", the respondents answered as follow (1 meaning not appropriate and 5 very appropriate):



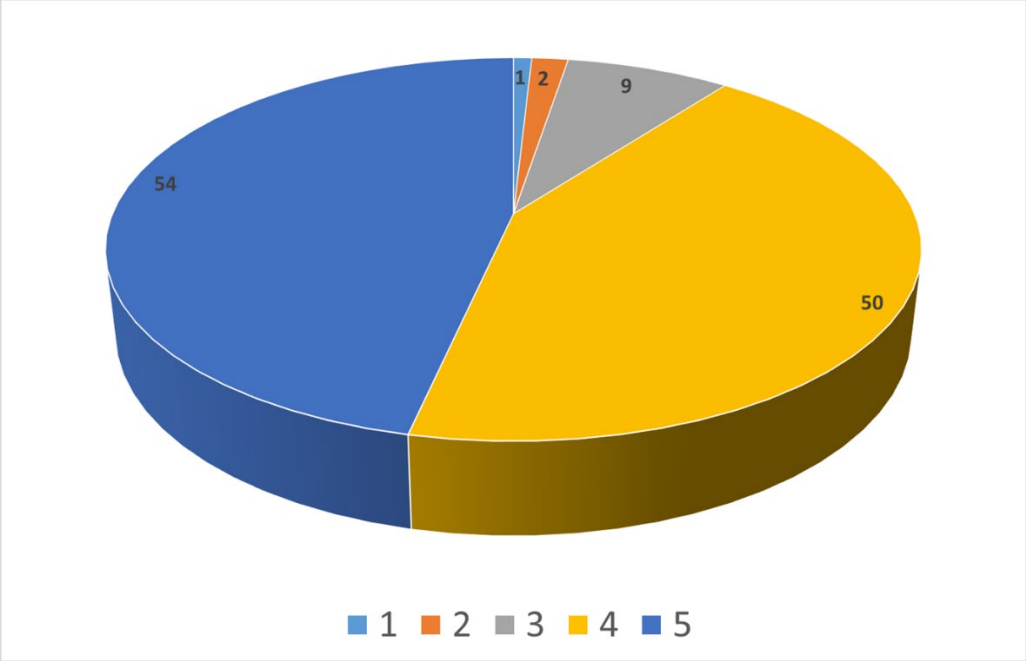
To the question “To what extent do you agree with the vision (see chapter 3.1)?”, the respondents answered as follow (1 meaning fully disagree and 5 fully agree):



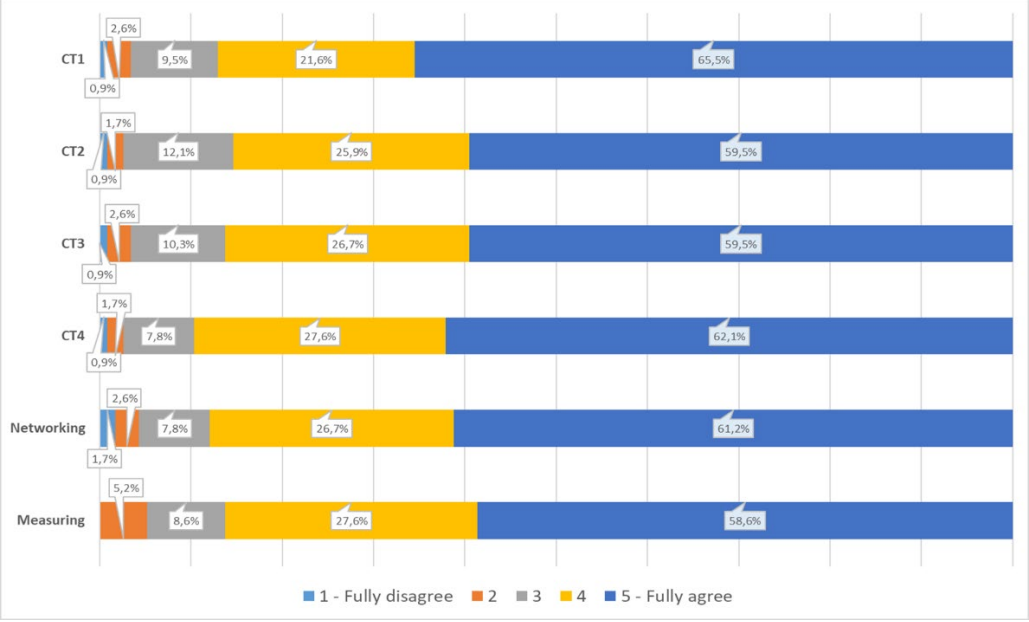
To the question “To what extent does the intervention logic support the vision (see chapter 3.1)?”, the respondents answered as follow (1 meaning fully disagree and 5 fully agree):



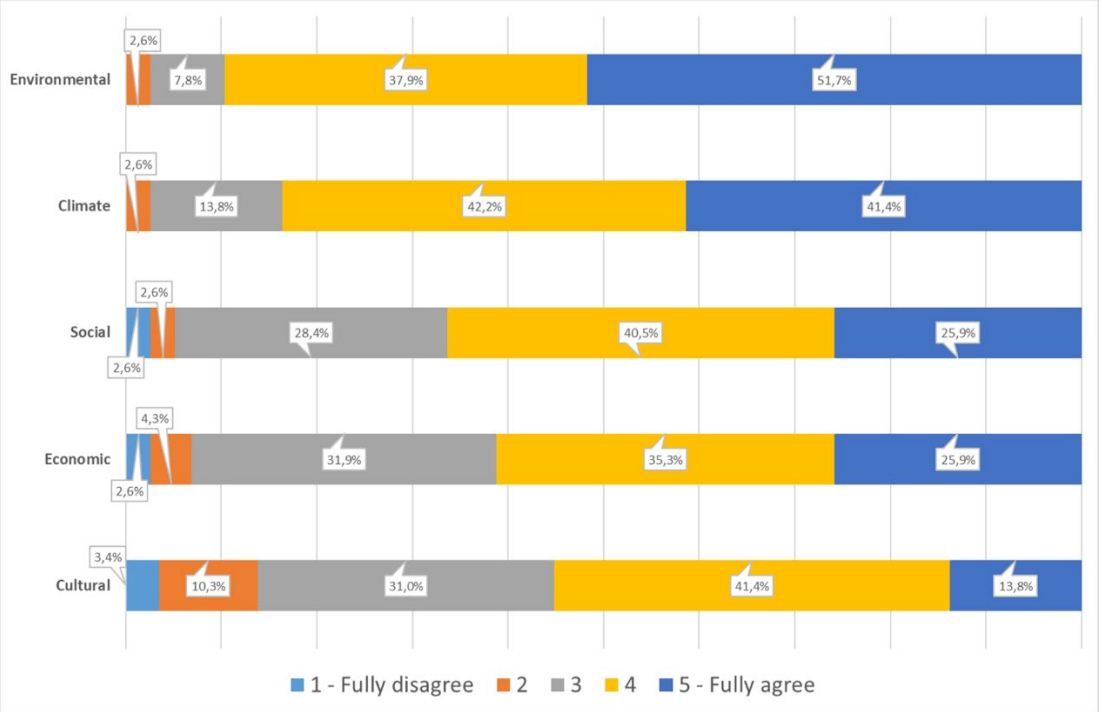
To the question “Do you agree that the Core Themes and cross-cutting issues are relevant and will contribute to meeting the challenges?”, the respondents answered as follow (1 meaning fully disagree and 5 fully agree):



To the question “Do you agree that the following Core Themes/cross-cutting issues are necessary to reach the objectives of the partnership?”, the respondents answered as follow (1 meaning fully disagree and 5 fully agree):



To the question “Do you consider that the following perspectives are well taken into account?”, the respondents answered as follow (1 meaning fully disagree and 5 fully agree):



To the question “Do you agree that the supporting activities are necessary?”, the respondents answered as follow (1 meaning fully disagree and 5 fully agree):