LEGUMINOSE

the way to a green transition

Map of Establishment of Dynamic Innovation Partnership (DIP)

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1 PU = Public

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Summary

This Deliverable (D2.1) provides the first edition of the **Partnership Map** and the **guidelines for how to create and manage the Dynamic Innovation Partnerships (DIPs)** in the Leguminose project. The DIPs are designed to facilitate the implementation of the multi-actor approach, hence connect with stakeholders to design, execute, communicate and, implement research and new findings. The DIPs are focused on markets, value chains, innovation and business development. Once organised, the dynamic innovation partnerships will be used for finding the new value chain actors and explore new market opportunities for products from grain legume-cereal intercropping systems – conventional and organic. The DIPs complement the field trials and on-farm living labs of project.

A dynamic innovation partnership frames a group of stakeholders representing diverse actors in the grain legume-cereal intercropping value chain. We will organize DIPs in six partner countries. Each DIP will function as a national entity, and we will organize events to facilitate knowledge sharing and learnings across the DIPs. In principle, the DIP is a form of an innovation network, designed to foster knowledge exchange, collaboration and in the end, hopefully innovations and new business opportunities for diverse value chain actors including farmers.

Based on a survey targeted at the consortium partners we have compiled key findings about stakeholders' interests, needs, opportunities and connections with regards to adopting grain legume and cereal intercropping systems from a markets and value chain perspective. Among the most important findings from the survey are that:

- The markets and value chains for mixed crops are emerging and vaguely defined;
- Grain legume and cereal intercropping seems most adopted in the organic agri-food system compared to the conventional one;
- Most of the mixed crops are destined at feed purposes (particularly on-farm use) and applications in food is in sincerely lack of innovation;
- Consumers have generally very limited, if any, knowledge about intercropping;
- The agro-ecological benefits from grain legume and cereal intercropping are evident however, the valorisation of these benefits still appear challenging for value chain actors;
- Governments in the EU and United Kingdom are implementing schemes that promote sustainable farming systems, this could induce a wider uptake of intercropping practices and lead to a larger crop volume for the market.

The most important benefits resulting from grain legume and cereals intercropping systems relate to closing the nitrogen cycles, improved yield stability and protein content, more diversity in farming systems and, enhanced biodiversity. In addition, the use of agricultural chemicals (fertilizers and pesticides) can be reduced. Growing grain legumes and cereals together can be implemented in many ways in practice and, the crop can be used for food or feed. Intercropping systems seem to be relevant for both organic and conventional farming systems. Conventional farming systems would benefit from a reduced use of mineral N-fertilizers. Another issue is the rising prices on N-fertilizers due to the

volatility in the market for agricultural inputs and supply chain challenges. Organic farming systems would benefit from higher yields due to a more efficient use of Nitrogen and reduced prevalence of pests and pathogens stemming from crop rotations.

The advantages of intercrops in crop rotations needs to be demonstrated and communicated to farmers and other value chain actors. This challenge has been highlighted by partners from Germany, Italy and the UK. It is important to show and explain to farmers that how the grain legume and cereal intercropping system works (e.g., benefits to soil, carbon sequestration and, N-fixation), and the benefits (e.g., biology and reduced environmental impact) that follow for adopting this farming system. Especially, awareness raising activities targeted at farmers about how intercropping could improve soil health and the importance of developing more resilient farming systems is fundamental. However, no changes in farming practices will occur without proper seeds, practices and machinery for cultivating mixed crops, nor without market actors demanding these crops.

The result is the organisation of six Dynamic Innovation Partnerships. The DIPs will be continuously updated during the project and managed by a key partner in each of the partner countries. Based on the guidelines laid down in this report, some tasks in the Leguminose project will contribute to develop the DIPs further and other tasks will benefit from engaging with the DIPs.

The author acknowledges the support from the Leguminose partners for providing insights to complete this report and, for valuable comments and editing.

1. Introduction

1.1 Scoping Deliverable D2.1

Based on the text from the Grant Agreement, the D2.1 is defined as stated here:

"This Deliverable will include the Map showcasing the establishment of **Dynamic and Innovative Partnerships (DIPs)**. The primary purpose of this deliverable is to show how the Consortium will organise (create and manage) the DIPs that underpin the multi-actor approach of the project (i.e., **Guidelines**). Relevant stakeholders will be identified by using a systematic snowball sampling technique. The secondary purpose of this deliverable is to map stakeholders' needs, interests, and opportunities for each location (i.e., partner country). The result is a Dynamic Innovation Partnership Map that will be continuously updated during the project. The Map will be **used for finding new value chain actors and explore new market opportunities for intercropping products**."

The Leguminose project is designed to investigate the barriers and enablers for a wider adoption of grain legume and cereal intercropping practices in the EU, United Kingdom, Egypt and Pakistan. We therefore focus the organization of the DIPs on **conventional and organic** grain legume and cereal intercropping systems, well aware that there are many other intercropping systems for growing legumes and cereals. As **grain legume and cereal intercropping systems** we consider the planting, cultivation and harvesting of grain legumes in combination with cereals, thus at least two plant species farmed at the same time at the same field.

1.2 About the report

In this report we use the term **grain legume** for leguminous plants that are cultivated for their seeds which are used for feed and food purposes. Grain legumes include peas, beans, chickpeas, lupines, lentils, peanuts and soyabean.

This deliverable connects with Task 2.1 "Organise Innovation Partnerships at field experiment locations" and **constitutes the foundation for motivating a wider adoption of grain legume and cereal intercropping systems in Leguminose partner countries and beyond.**

Furthermore, by developing and updating the Partnership Map, the DIPs contribute to achieving the Milestone 5 (Stakeholder framework and database) connected with Task 2.2.

The report is elaborated with an **explorative approach** and builds primarily on a survey targeted at Leguminose partners and secondly, on diverse references to scientific and grey literature. As many of the partners have been involved in previous projects about legumes, intercropping, biodiversity, agronomy, organic farming, plant-based food or similar topics, the consortium already holds much knowledge about grain legume and cereal intercropping from diverse perspectives. In addition, the partners also have their own contacts and networks to stakeholders of relevance to the Leguminose project. The DIPs are intended to serve as innovation networks targeted at value chains, markets and business innovation. To capture partners' insights about challenges and opportunities stemming from intercropping and with an impact on markets and value chains, IFAU decided to carry out a survey targeted at the partners.

The e-mail survey featured six open-ended questions as presented in Appendix 1, and was sent to partners in February 2023. All partners responded to the survey. This provided IFAU with information about national priorities and opportunities, and key issues that need to be addressed in the project. Based on these results, IFAU has elaborated a preliminary map of stakeholders and their needs, interests and opportunities of relevance for a wider adoption of grain legume and cereal intercropping practices. The results of the survey are compiled in the report's section 3 and the Partnership Map. A more detailed mapping is planned in T2.2 and is beyond this report. The survey also provided information about EU and national projects focusing on the intercropping (Appendix 2).

1.3 What is a Dynamic Innovation Partnership

The Dynamic Innovation Partnerships play a central role for implementing the multi-actor approach of the project in combination with the on-farm living labs and, the field experiments. The **DIPs create a forum** where exchange of knowledge, practices and experiences can take place. The DIPs are **created to focus on overcoming challenges and exploiting opportunities for intercropping by emphasizing the issues related to markets, value chains and, business development** by means of exchanging knowledge, practice and experience. The ambition is that the DIPs will underpin innovation and stimulate new thinking and new relationships.

The added value of the DIPs lies in the structured national and cross-border knowledge exchange, the diversity of stakeholders who are selected through purposeful recruitment (explained in section 2.1) and, the untapped potential for innovation. In addition, the DIP is a strong basis for communication, dissemination and training activities.

It is therefore in the interest of each partner country to organize a Dynamic Innovation Partnership that best meets the local conditions, needs and opportunities. As national partners are foreseen to have the best contacts to key actors in that specific country, the **DIPs are considered an opportunity for national partners to create a forum to engage with front-runners and other important actors that can play a role for motivating changes in a business-oriented context.** This will further underpin the motivation to adopt grain legume and cereal intercropping practices by farmers.

In the **Grant Agreement there are many activities planned in various WPs that require involvement of various stakeholders**, such as data gathering, workshops, demonstrations and many other. This is further detailed in section 2.2. Therefore, the implementation of the **DIPs is intended NOT to pose extra costs or re-direct resources** from what has already been agreed with partners in the Leguminose Consortium.

1.4 Framing Dynamic Innovation Partnerships

A Dynamic Innovation Partnership functions like a forum for knowledge exchange and relationship building with the **purpose of pursuing innovation and business development**. This points to the theories of innovation networks; see for example Cohen and Levinthal (1989) and Fombrun (1982). An innovation network is characterised by its organisation; the relational ties between the members, and the network governance (Dhanaraj and Parke, 2006). In essence, **an innovation network is** organised with a focal organisation who coordinates the network; a group of members tied together by informal

ties; a shared goal of members and the network organization; a purpose of stimulating knowledge exchange and relationship building, all with the aim of pursuing innovation. To quote Hargadon and Sutton (1997):

"Ideas from one group might solve the problems of another, but only if connections between existing solutions and problems can be made across the boundaries between them. When such connections are made, existing ideas often appear new and creative as they change form, combining with other ideas to meet the needs of new users. These new combinations are objectively new concepts or objects because they are built from existing but previously unconnected ideas".

In innovation networks (as in our DIPs), given the uncertainty of the innovation process, a crucial element of network management is to identify those actions that will create value for the network and its members, as well as find ways to extract value (Dhanaraj and Parkhe, 2006). The latter connects with the business development aspect, so the DIPs must find ways to frame "business development" – particularly when businesses are investing time and resources in innovation networks. Here, we need to consider that, innovation networks are not static structures rather, they should be regarded as dynamic organizations that adapt as they develop. For example, members who joined when the network was started are not necessarily members through the lifetime of the network. Therefore, the innovation network must foresee entries and exists of members. This process may certainly contribute to create the dynamics needed for an innovation network to develop and remain relevant to its members and the overall purpose of the network.

For the network members, the outcome of collaboration and knowledge sharing is of high importance for their continued interest in the innovation network (or DIP). This implies, that the central organization coordinating the network must have knowledge about what "value" means for the members of the network. For example, "value" could be considered: in monetary terms (e.g., increased sales or new business partnerships); in connection with learning (e.g., members gain knowledge and experience of a certain issue); or in non-monetary terms such as stronger personal relationships, mutual trust or otherwise. It is therefore important that the central organization identifies and understands how to assess "value" embodied in knowledge, experience and relations and, subsequent is capable of arranging its transfer to other points in the network (Dhanaraj and Parkhe, 2006).

So, the Dynamic Innovation Partnership should be considered as a form of innovation network that is anchored at a focal organisation with members sharing a common goal that will be achieved by pursuing innovation through sharing knowledge, exploring opportunities and, collaborating. Transferring the concept of innovation networks to a Leguminose-context, the DIP could be explained in these words:

The Dynamic Innovation Partnership in the Leguminose project is a partnership anchored at a university with stakeholders sharing a common goal of achieving a wider adoption of grain legume and cereal intercropping practices. This will be achieved by pursuing innovation in markets, value chains and business models through sharing knowledge, exploring opportunities and, collaborating.

The Dynamic Innovation Partnerships complement the 190 on-farm living labs that are planned for the same six countries plus Germany, Pakistan, and Egypt (in each country – 20 on farm labs). The **on-farm living labs** are centred round farmers who will incorporate grain legume and cereal intercropping practices into their current farming practices – conventional and organic farms. Through the on-farm

living labs, farmers will connect with suppliers and customers, thus important value chain actors. It is anticipated that the on-farm living labs will **focus on agronomy, farm technology, post-harvest crop handling**, and knowledge exchange and education.

In contrast to the on-farm living labs, the **DIPs are foreseen to involve a broader group of key stakeholders** that are important for building new value chains, business ideas, and market innovation, thus **emphasizing business development and value chain coherence in organic and conventional agro-food systems**. The stakeholders foreseen to be invited to the dynamic innovation partnership includes processors of mixed crops for food and feed purposes, providers of machinery and technologies for post-harvest and processing of mixed crops, traders, end-users, associations, and institutions. The DIPs span across the value chain from production of input (e.g., seed breeders) to end-users (e.g., consumers and catering companies), and connects with education, institutions, associations and other public and private organisations. The recruitment of stakeholders to DIPs will reflect the national conditions with regards to crops, products, technologies and, key needs and opportunities of value chain stakeholders.

2. Creating the DIPs

2.1 Getting started

2.1.1. How many DIPs and where to find stakeholders

In the Leguminose project, we will have field trials in Denmark, United Kingdom, Poland, Czech Republic, Italy and Spain, Figure 1. **We will create a DIP in these six countries**.

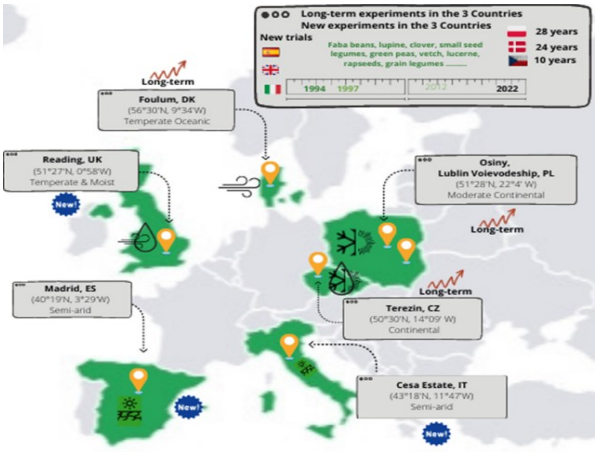

Figure 1: The six countries with field trials and Dynamic Innovation Partnerships

(Graphic by Dr. Shamina Imran Pathan, 2023)

The aim is to **organise a DIP of ca. 10 participants in each of the six countries**. The very first step is to consider what stakeholder could be relevant for the project, and especially for underpinning project

work related to markets, value chains, business development and innovation. Therefore, it is the objective for each of the DIPs is to include at least the following categories of stakeholders:

- Farmers' associations;
- Farm networks;
- Providers of technology for farming and post-harvest handling;
- Providers of seeds;
- Agricultural extension services;
- Companies that clean, separate and/or trade crops;
- Companies in the value chain that use mixed crops (e.g., producers of food and feed).

In addition, the DIP could include farmers, stakeholders from education, catering services, funding agencies, government agencies, consumer organisations, and other bodies. Figure 2 provides **inspiration for the constitution of a Dynamic Innovation Partnership**.

Figure 2: Inspiration for the constitution of a DIP.

It is up to the manager of the national DIP to identify and involve those stakeholders, that are perceived to be the most relevant ones for the project and particularly for reflecting the local (national) context, challenges and opportunities. In chapter 3 more details are provided about national priorities for whom to invite to join the DIPs.

2.1.2 Contacting stakeholders

Stakeholders will be identified through partners' own networks, from literature, newsletters, reports, and from events. Searching for stakeholders from various resources will undoubtedly lead to a long list

of potential candidates. We will apply the systematic snowball sampling technique (Figure 3) to refine the search for stakeholders to be invited for the DIPs.

First, the national organiser of a DIP (man in blue, Figure 3) identifies a few stakeholders that are knowledgeable about the grain legume and cereal intercropping systems – from research, practice, industry or otherwise. Then, we contact the first stakeholders (two persons in orange) asking who else would be important to contact – keeping the goal of the DIP in mind. This identifies additional relevant stakeholders (in green). By repeating this approach, we can establish highly relevant DIPs in each of the six countries with important stakeholders.

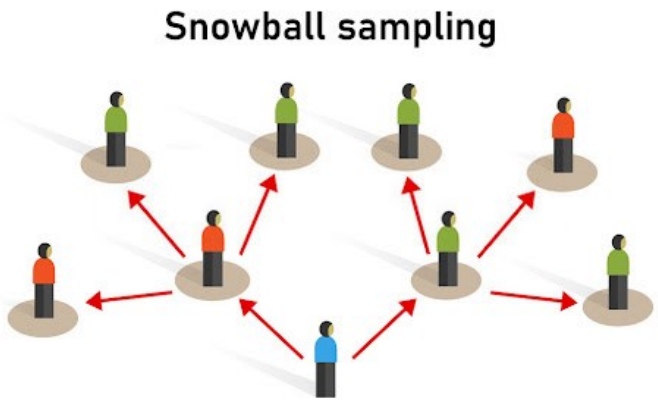

Figure 3: Illustrating the systematic snowball sampling technique

It is important to keep in mind the **goal of the DIP**: contribute to the implementation of the multi-actor approach and underpin a wider adoption of intercropping practices with special attention to the markets, value chains and business opportunities. Therefore, it is a priority for each DIP to purposefully select those stakeholders who would be considered as most knowledgeable, with most practical experience, with a strong network to relevant actors, or holding a position that could enhance a change of practices, for example in education, an association or a public entity.

It is up to the leader of the national DIP to decide on how to approach stakeholders. It could be by email, face-to-face meeting, or otherwise. The core issue is to inform the potential candidate about the requirements, expectations and benefits that may follow from accepting to join a Dynamic Innovation Partnership. It is underlined, that all DIPs will fully respect confidentiality and IPR issues arising with stakeholder engagement in project activities.

Requirements: active, but voluntary, participation in activities proposed for stakeholders, for example to join workshops, contribute to validation and testing of results, give opinions on findings, provide ideas for events, and further in this line.

Expectations: willingness to share knowledge and experience, a background enabling a strong contribution to the DIP, openminded approach to new findings and practices, and to engage actively.

Benefits: a national forum dedicated to making a change towards a more resilient and sustainable food system, enlargement of personal network, opportunities for building new partnerships, first-hand insights into new research, new ideas and new practices, and access to an international network of businesses, farmers, researchers and other stakeholders working for a wider adoption of grain legume and cereal intercropping practices. The latter refers particularly to the project's network of DIPs and the international collaboration. As a principle, stakeholders will not be paid for participating in the DIPs.

2.2 Involving the DIPs in project work

2.2.1 Topics to address in DIPs

There is already much knowledge and practical experiences available about grain legume and cereal intercropping from e.g., completed EU funded projects, national projects, private enterprise, and other sources. Appendix 2 provides an overview of EU projects about legumes, intercropping, value chains, biodiversity, and examples of national projects covering similar topics. Both conventional and organic farming systems and adjacent value chains appear in the mentioned projects. Information and contacts from the mentioned projects will be used for developing and benefitting from the DIPs in the Leguminose project. In addition to projects, industry and many organisations have published reports and studies that call for sustainable food systems, plant-based diets, biodiversity and modern farming techniques (References). This means that we have access to a huge, rich and complex dataset for developing the DIPs however, this huge dataset tends to overweight agronomic benefits over market development.

To meet the requirements of the DIPs in the Leguminose project, we have carried out a preliminary mapping of our stakeholders' interests, needs and opportunities in a markets and value chain perspective to obtain a first understanding of the impact on a wider adaption of intercropping practices. The result of the preliminary mapping is presented in section 3. Here, you find a short-list of **topics targeted at market development and value chain coherence, thus topics for the DIPs to address:**

- Insufficient volumes of crops from intercropping systems to motivate value chains and markets to emerge;
- Mixed crops are mainly used for feed; food applications are rare;
- Challenges for value chain actors to identify the market
- Appropriate to technology and solutions for processing of mixed crops
- Value chain actors exist but are not connected around mixed crops
- Market understanding of agronomic benefits stemming from intercropping practices is very limited

2.2.2 Involving the DIPs in project activities

There are many opportunities for involving stakeholders (**activating the DIPs**) in project activities. Due to their focus on markets, value chains, innovation and business development, it is important to identify appropriate activities for the DIP participants to engage in. Keep in mind that the participants in the DIPs are purposefully selected for their knowledge, experience and contacts and therefore, the

participants will expect to benefit from collaborating with the Leguminose project. The benefits for the DIP participants could be such as new business opportunities, knowledge about market opportunities, learning from other sectors or countries and, more.

In Table 1, you find a preliminary list of tasks and activities that could be relevant for a market and value chain oriented Dynamic Innovation Partnership to engage in. **Please note that tasks and activities in Table 1 are not directly linked and, are only listed here as examples.** It is the decision of each DIP manager to plan how to involve the DIP in project activities. The activities proposed in Table 1 are already specified in the Leguminose project. Therefore, the **DIPs will not impose extra work or deviation of resources for partners**.

Table 1: Examples of tasks and activities that could be relevant for a market and value chain focused DIP to engage in

Examples of tasks that could be relevant for DIPs to engage in	Examples of activities that could be organised to involve the DIPs
T2.3: Co-creation workshops targeted at designing plant combinations including **end-users;** T3.2: On-farm living labs for regional lighthouses, socio-economic studies and **innovation partnerships;** T7.2: Connecting intercropping with consumer demand through research and workshops with **value chain actors** and consumer focus groups; T8.2 and T8.3: Partners' **dissemination and communication actions;** T8.4: **Training** of stakeholders; T8.5: Clustering with **related external initiatives** (projects, networks, clusters, platforms etc.)	Planning of (socio-economic) research; Data gathering procedures; Actions to promote market development and shaping of new value chains Actions to understand end-users' needs Co-creation sessions, focus groups Relation-building activities Policy discussions to promote market and value chain development Testing and validation of results Exploitation and uptake of results Capacity building Demonstrations of e.g., technologies and products Communication and dissemination activities

2.3 Managing Dynamic Innovation Partnerships

2.3.1 Managing a DIP in one of the six countries

Each DIP will be managed by a partner in one of the six countries, where field experiments take place. Table 2 shows a suggestion for national DIP management. The final decision on national contact point will be agreed with the partners during the start-up meeting in April 2023.

Table 2: Suggested national DIP management

Country	Proposed leadership the DIP
Poland	IAPAS
Denmark	AU
United Kingdom	UNIREAD
Italy	UNIFI
Spain	CSIC
Czech Republic	AGRITEC
Coordinating the six DIPs	IFAU

The requirements for the management of a national DIP are:

Keeping the DIP continuously updated, so the number of **participants remains at ca. 10 persons.** Stakeholders may opt to leave the DIP, and other stakeholders may join. It is important that the constitution of the DIP reflects the needs of the project at all times and especially the national context. Therefore, the national manager would have insights to those issues that are of particular relevance in the country with regards to the development of markets, value chains and innovations that could stimulate a wider adoption of grain legume and cereal intercropping systems. Furthermore, the DIP manager must ensure to include stakeholders so **both organic and conventional agri-food systems** are covered.

Each DIP manager will make a **list of stakeholders** and, this list will **support the achievement of MS2** (Stakeholder framework identified, lead by partner AU).

Keeping an **overview of project tasks and activities where stakeholder involvement is required** or competences by the DIP could be beneficial for the outcome of the work. This could be tasks focused on data gathering, validation and testing of findings or solutions, or capacity building. As examples of activities that are relevant for the DIP could be mentioned workshops, field demonstrations, focus groups, and a broad range of communication and dissemination activities.

The DIP manager, or somebody helping the manager, will act as **facilitator to encourage relationship building, knowledge exchange and, promote good practices for collaboration and open dialogue among the participants in the DIP**. It is the vision that an open and constructive dialogue among DIP participants, and across DIPs, is crucial for stimulating market development and new value chains to shape. Furthermore, an open dialogue building on trust, mutual recognition and shared goals is the strongest point of departure for discussions about collaboration that could lead to innovation and new business opportunities.

It is a key requirement for the national managements to organise **two annual events** to involve the DIP participants in project activities **(refer to description of T2.1)**. It is up to the national management

to plan and decide on the topic and type of activity, e.g., webinar, demonstration, dissemination activity, testing of prototype or many other activities.

It is expected that leaders of the national DIPs will **collaborate to create an international forum** for knowledge sharing and promotion of grain legume and cereal intercropping practices and adjacent value chains. This also implies to reach out to Leguminose partners in countries with no research field experiments planned: **Germany, Pakistan, and Egypt**. In a wider view, the six DIPs could gain much insights about markets and value chains by reaching out to other clusters and networks involved in sustainable farming systems, plant-based foods or similar topics. Potential connection points could be identified from DIP managers' own network or from EU and national projects (Appendix 2).

National managers will report annually on the constitution of the DIP (name and affiliation of the stakeholders) and the activities and events with DIP involvement. IFAU will provide a template for reporting purposes and compile the results across the six DIPs. The compiled results are targeted at the Implementation and Impact sections in the project's periodic reporting, hence for updating the **Partnership Map.**

2.3.2 The requirements for coordinating the six DIPs

IFAU is responsible for coordinating the six DIPs. This implies to support partners in the development of national DIPs, motivate involvement of stakeholders in project activities and tasks, and provide ideas and contacts to keeping the DIPs updated and relevant. For example, **IFAU could provide input for consumer-oriented sessions, market briefs, contacts, set-ups for innovation workshops, or be available as sparring partner to discuss and develop ideas.**

IFAU will propose ideas for how to implement cross-border collaboration between the six DIPs and partners in Germany, Pakistan, and Egypt to motivate the implementation of the multi-actor approach and stakeholder engagement. As examples of **cross-border activities** could be mentioned:

- Field demonstrations (in connection with General Assemblies);
- Webinars;
- Attending events;
- Training activities;
- Validation and testing of project results;
- Joint communication and dissemination activities;

IFAU will organise a start-up meeting to appoint the managers of the national DIPs and, to ensure that all managers are comfortable with the plans and procedures for working with dynamic innovation partnerships. Additional meetings with national DIP managers are organised according to the needs of the project. The proposed timeline for managing and involving DIPs in the project is shown in Table 3.

Table 3: Proposed timeline for DIPs during the Leguminose project

Time	Activities	Who
March 2023	Procedures for organising and involving DIPs are defined (D2.1)	IFAU
April 2023	Start-up meeting	IFAU and potential national DIP leaders
May 2023	First overview of the constitution of the six DIPs and plans for involvement in the project	DIP managers
November 2023	First reporting of constitution, activities and tasks with involvement of the DIPs	DIP managers and IFAU
May 2024	Update on the constitution of the six DIPs and plans for involvement in project activities	DIP managers
May 2024	Update on plans for international collaboration	IFAU
November 2024	Second reporting of activities and tasks with involvement of the DIPs	DIP managers and IFAU
May 2025	Update on the constitution of the six DIPs and plans for involvement in project activities	DIP managers
May 2025	Update on plans for international collaboration	IFAU
November 2025	Third reporting of activities and tasks with involvement of the DIPs	DIP managers and IFAU
May 2026	Update on the constitution of the six DIPs and plans for involvement in project activities	DIP managers
May 2026	Update on plans for international collaboration	IFAU
October 2026	Final reporting of activities and tasks with involvement of the DIPs	DIP managers and IFAU

3. Mapping stakeholders' interests, needs and opportunities

This section compiles the findings from the preliminary mapping of stakeholders' interests, needs and opportunities. The mapping builds on a survey (Appendix 1) and in this section, the most important findings with regards to markets, value chains, business development and innovation are presented.

3.1 Potential value chains and markets for mixed crops

Growing grain legumes and cereals together can be implemented in many ways in practice and, the crop can be used for food or feed, as it came clear from the survey. In the Czech Republic grain legumes could be planted together with e.g., winter wheat, winter rape, spring barley or in combination with silage maize. In Spain, planting vetches together with oats is a mixed crop for feed purpose. Another example from the Czech Republic is that intercropping of barley and peas can form a significant part of a feed base for dairy cows (high quality roughage with high energy and protein content). Furthermore, it was revealed in the survey that, it would be considered more likely that British organic farms with livestock would be more inclined to adapt grain legume and cereal intercropping than farms without livestock. The option to use the mixed crop as feed on the farm is the main issue here.

Grain legumes for human consumption in Spain (chickpeas, lentils, peas, dry broad beans) have experienced a decrease in cultivated area. Its production in Spain is scarce and depends a lot on imports from countries like France, Lithuania, Romania and even Canada. Grain legumes cultivation account just for 16% of the total arable land in Italy, yet the production is far below the market demand. By adopting grain legume and cereal intercropping systems, the European production of especially dry beans, chickpeas and lentils is anticipated to increase. This would lead to a reduced import dependency for pulses for human consumption. Grain legumes are considered as a valuable source of proteins for human consumption. Intercropping could represent a sustainable way to increase Italian legume grain production as well as provide a solution for the loss of organic matter that is undergoing in all regions of the country.

Grain legume and cereal intercropping is recognized as a means to increase the protein content of the cereal component leading to an improved crop quality without the use of synthetic fertilizers. Cereals with a higher protein content are in demand for food, particularly wheat for bread. Grain legume and cereal intercropping systems could be a way to increase local production of feed protein, reduce pests and reduce the climate impact from farming (e.g., increased carbon sequestration in the soil and reduced use of fertilizers). In Germany, ca. 50% of all cereals are produced for feed and grain legumes (mostly soybeans) are added to increase the protein content of the feed. By using a locally produced mixed crop, it is possible to keep the protein value chain within the country and to make use of the grain legume and cereal crop without a separation procedure.

When it comes to using the mixed crop for food, the market opportunities become more challenging to identify. This is mainly due to the fact that it is not clear what to use the mixed crop for, hence pointing to a significant need for innovation in processing and marketing. One suggestion is to demand a price premium from buyers for the mixed crop but, that would require to find a niche market that appreciates the added value of an intercropped product. The food market challenges have been highlighted in the survey by partners from Denmark, Germany, Austria, United Kingdom and Spain.

3.2 Intercropping and agro-ecological benefits

From policies in the EU e.g., Green Deal and the Organic Action Plan there is a push to find solutions to reduce the use of agricultural inputs, especially synthetic fertilizers (Nitrogen). The push is strengthened by the price increase on synthetic fertilizers and situation of shortages occurring as a consequence of the war in Ukraine. The UK is phasing out EU subsidies that were provided under the Common Agricultural Policy (CAP) and introducing Environmental Land Management schemes (ELMS). The principle behind this is payment for environmental goods and services. Part of ELMS is the

Sustainable Farming Incentive (SFI) and this includes payments to farmers to undertake activities which include intercropping. These trends are underpinned by statements from Leguminose partners in Austria and Italy explaining that there is an urgent need to close the Nitrogen cycle. This means to reduce the application of synthetic nitrogen and make better use of N in the soil to prevent N-leaching.

Intercropping systems is practice that can mitigate soil erosion and reduction in soil fertility. For example, in some regions in Spain and Italy, soils have very low organic matter contents. Data for Italy show that, cultivated plains generally have excessively low organic matter contents of less than 2% and, in the South and on the largest islands, even less than 1%. This increases the risk of erosion, and it makes soil covers with biomass very important as a means to prevent erosion and provide biomass for soil quality improvement.

Intercropping cereals with grain legumes leads to lower variability of agricultural costs. This is because the intercropping system calls for a reduced use of agricultural chemicals and fertilizers, and the improved yield stability derived from the synergies between the legumes and cereals. Furthermore, by having two crops in the same field there is the opportunity to harvest at least one crop should the other one fail. It should also be mentioned that intercropping systems can lead to improved plant health through reduced pressure from pests (mentioned for Italy and UK) and reduced use of agro-chemicals such as pesticides (mentioned by e.g., Denmark, Czech Rep., Italy, Germany and UK).

Biodiversity is high on the agenda in many countries. In Tuscany, for example, grain legume and cereal intercropping could be practiced in connection with bee keeping. This example illustrates how important it is to understand the inter-dependence of species to promote biodiversity, productivity and sustainability. Once mastering the intercropping techniques, farmers are in a position to better manage multi-functional farms by working with biodiversity, ecosystem services, production of food and feed, while protecting and maintaining natural resources. Grain legume and cereal intercropping systems can introduce more diversity in crop rotations and bring more biodiversity into the landscape which would benefit pollinators as recommended by Leguminose partners in the UK and Italy. Additionally, other varieties of cereals and grain legumes could be cultivated, for example heritage varieties that may cater to premium but niche segments in the food market.

3.3 Relevance for conventional and organic agri-food systems

The interest in the organic farming system is increasing across Europe, well supported by the EU Commission's Action Plan on Organic Farming and the Green Deal, and an increasing awareness in society of the need for a more sustainable and resilient agri-food system. Grain legume and cereals intercropping systems are relevant for both conventional agricultural practices and organic farming practices but, not in the same way. In short, conventional farming systems would benefit from a reduced use of mineral N-fertilizers. This is because the N-leaching has a negative impact on the environment and, by using legumes as source of Nitrogen dependency on synthetic fertilizers can be reduced. Another issue is the rising prices on N-fertilizers due to the volatility in the market for agricultural inputs and supply chain challenges. Organic farming systems from would benefit from higher yields due to a more efficient use of Nitrogen and, the reduced prevalence of pests and pathogens stemming from crop rotations.

In Austria and Italy, grain legume and cereal intercropping systems are considered as most relevant for organic farming systems due to the reduction of the N-deficit in cereal-based crop rotations. Another

reason for emphasizing the relevance of organic farming for intercropping is that organic products are more expensive than conventional products, in Tuscany up to 30% more expensive. By targeting a high-price market (i.e., organic products), farmers may be in a better position to compensate for lower crop yields compared to conventional farming methods. Data from Italy show that by 2020, more than 50% of the grain legumes are farmed in organic farming systems (47,000 ha). In the UK, it is perceived that grain legume and cereal intercropping systems would be most relevant for the organic farming system, particularly for organic farming systems with livestock. This is because the mixed crop can be used directly on the farms as feed for livestock. Intercropping systems are relevant for both organic and conventional farming systems, it is mentioned by Leguminose partners in Germany, Denmark, Spain and the UK. The arid climate in Spain points to conventional farming systems as most relevant for adopting grain legume and cereal intercropping in the Iberian Peninsula, particularly for crops destined for feed use.

3.4 Achieving larger volumes of mixed crops from intercropping

Based on experiences of several Leguminose partners, it is clear that there is a need to better communicate to stakeholders (especially farmers) what is “grain legume and cereal intercropping”. Especially, awareness raising activities targeted at farmers about how intercropping could improve the soil health and the importance of developing more resilient farming systems is fundamental. But, no changes in farming practices will occur without proper seeds, practices and machinery so, farmers must be involved in discussions about appropriate technologies and practices hence, take active part in developing new value chains.

Here, it is important to distinguish between farming systems with plant production and farming systems that include livestock production. The latter may have a higher willingness to adopt grain legume and cereal intercropping practices as the crop can be used for feed. Farms without livestock will need a market for the mixed crop, and this market is only vaguely defined. Pioneer farmers, agricultural extension services and, researchers play a central role for raising awareness by farmers and value chain actors. This emphasizes the need to properly educate agricultural advisors in the science and practices of grain legume and cereal intercropping in conventional and organic farming systems.

From the Leguminose partner survey it is revealed that, partners in Germany, UK, Spain, and Denmark identify access to proper farm machinery (equipment for the sowing and harvesting of the mixed crop) is a key requirement for a wider adoption of grain legume and cereal intercropping practices. From a practical perspective, the challenges of growing mixed crops can materialise as different seed sizes, different sowing depths, different sowing dates, different harvest dates. Having the right combination of seeds has been identified as a challenge by several of the project’s partners. The right combination of grain legumes and cereals must be a priority, and varieties need to be selected so that they complement each other and do not smother each other. Several partners in the project have pointed to the need to put more efforts into breeding seed varieties targeted at intercropping practices and end-user applications.

Also, post-harvest technologies need to be adapted to the handling of a mixed crop and in many places, adequate technologies for separating the mixed crop are simply not available. Identified challenges that need to be solved are for example: the problem of separating the mixed crop after harvest; to prevent debris from legumes in the cereal part as this can spoil a cereal crop, and to prevent cereals in

the bean crop since the beans can then not be guaranteed to be gluten free. So, there are many challenges to overcome before a mixed crop is ready for either on-farm use or for the market.

Farmers depend on a proper income from the crop and, uncertainties (or lack of information) about how intercropping practices impact on farm income may prevent many farmers from exploring intercropping. For example, Czech farmers with experience in intercropping of legumes and cereals claim that there is a need for effective plant protection measures to prevent fungal and root diseases. Therefore, it has to be demonstrated that the adoption of grain legume and cereal intercropping practices could be a way to maintain income and crop yield stability while reducing costs for agricultural chemicals. This emphasizes the need to demonstrate the **economic benefit at farm level** that may follow from adopting grain legume and cereal intercropping practices.

Government support schemes targeted at the agricultural sector are important to promote the adoption of intercropping practices. Leguminose partners have identified these examples:

- Germany: to make good farming practices an element in a support scheme for promoting intercropping;
- Czech Republic: direct financial support for farmers practicing legume-cereal intercropping;
- United Kingdom: government has announced that policy will support the development of intercropping through financial payment (Environmental Land Management Schemes).

3.5 Building the Partnership Map

Farmers, seed providers and machinery providers are very important to connect with in order to increase the adoption of intercropping practices. This is because one of the main barriers for intercropping is technical in its nature: the type of sowing, the sowing machines, as well as the harvest (seed size, different doses, different sowing depth, different sowing dates, harvest date, separation). Knowledge providers such as researchers and agricultural extension services are also very important for providing information and experience about overcoming agronomic barriers (nutrient management, pest control, diseases, weeds), finding opportunities for marketable crop combinations, and for promoting applications of mixed crops for on-farm use or in value chains.

No changes to current practices or existing value chains will take place without the involvement of various businesses. Therefore processors of food and feed and, companies that produce diverse typologies of machines and equipment but be considered as important stakeholders for the Dynamic Innovation Partnerships in the project. The survey's findings about important stakeholders are compiled into a **Partnership Map**, Table 4. It provides an overview by partner country of those stakeholders that are considered as important to include in the national DIP in order to promote market development, new value chains and a wider adoption of grain legume and cereal intercropping systems – conventional and organic. The Partnership Map will be continuously updated and expanded during the project.

Table 4: First edition of Partnership Map - key stakeholders to connect with in the DIPs, by Leguminose partner countries, March 2023

Stakeholders	Austria	Germany	Denmark	Italy	Spain	UK	Czech R.
Policy maker, regional and national	X			X			
Government agencies		X	X				
Interest groups, NGOs	X	X					
Farmers' associations	X	X		X	X		
Farmers and farm networks	X	X	X	X	X	X	X
Seed providers		X		X	X	X	X
Farm machinery providers		X	X	X	X		X
Separation technology		X				X	X
Agricultural extension services		X	X			X	X
Traders		X				X	
Researchers		X		X	X		
Laboratories				X			
Schools and education				X			
Banks		X					
Market actors Food		X			X	X	
Market actors Feed		X	X		X	X	X
Consumers		X		X			

Intercropping of grain legumes and cereals seem to hold untapped business opportunities for several groups of stakeholders. For farmers, a key issue is the routes for valorising of the mixed crop: On-farm use or market. For providers of seeds, farm machinery and post-harvest technologies, there is a market demand for solutions that facilitate farmers' adoption of intercropping practices. These solutions target genetic improvements, seed combinations, adapting farm machinery to cultivating mixed crops, and especially, solutions for separating and cleaning the mixed crop. For businesses in the feed industry, mixed crops are already part of formulations for compound feed, or the mixed crop is used

on-farm for feeding livestock. The business opportunities for mixed crops targeted at the food industry is emerging and, currently mainly targeted at niche markets, specialty products or applications by smaller producers. The large-scale food industry demand is yet to be developed. But, if the mixed crop is separated and cleaned, the two fractions (grain legumes and cereals) have well-developed markets and applications for food purposes.

Interest groups and associations have been identified as important to connect with to promote the adoption of grain legume and cereal intercropping systems. For example, the Austrian associations: Boden ist Leben (https://www.bodenistleben.at/) and Humusbewegung (https://humusbewegung.at/) advocate sustainable farming systems. The organization Food for Life promotes change towards sustainable food systems in Scotland (https://www.foodforlife.org.uk/). Other associations such as Chamber of Agriculture (Austria) and the Agriculture and Food Council (Denmark) are connected to industry and policy makers. As an example of a farmers' association could be mentioned ASAJA in Spain (https://www.asaja.com/). For the United Kingdom, organizations such as Agricology (www.agricology.co.uk) and Pulse Growers Organisation (www.pgro.org) are important stakeholders. Interest groups and associations play an important role for stimulating new partnerships, innovation and business development for diverse actors in the value chain. Such organizations would be important to include in DIPs.

Consumers' interests in intercropping needs to be further explored. Based on information gathered in the survey, it seems that consumers do not have much knowledge about the benefits of grain legume and cereal intercropping, and that consumers' interests are mostly targeted at either "organic products" or "plant-based food". Therefore, a huge effort is needed to educate consumers to create more demand for mixed crops and intercropping practices.

Governments define the policies that may promote or hamper adoption of grain legume and cereal intercropping systems by farmers and other value chain actors. In practice, support measures that compensate the farmer financially for choosing intercropping practices instead of conventional farming methods could promote a change in farmers' behaviour. Also, support measures that promoted biodiversity enhancing farming practices, or stimulated the adoption of low-input farming systems could be relevant to consider.

4. Pulling the report together

The overall objective of the report is to create the Partnership Map and underpin the implementation of the multi-actor approach in the Leguminose project. The report is elaborated with dual purposes:

1) Elaboration of the Partnership Map about key market and value chain issues important for achieving a wider adoption of grain legume and cereal intercropping practices among stakeholders in Europe.
2) Provision of guidelines for how to create and manage Dynamic Innovation Partnerships (DIPs) in six countries.

All partners in the project have contributed with insights so, the report includes experiences, challenges and opportunities stemming from diverse systems of grain legume and cereal intercropping, organic and conventional systems, and representing several pedo-climatic zones across

Europe. Indirectly, the report also builds on past EU and national projects about legumes, intercropping, biodiversity and related topics (Appendix 2).

A very important finding stands out: There is a growing interest for intercropping and more sustainable farming practices in Europe, yet farmers are not taking on intercropping systems of grain legumes and cereals on a wider scale, and market demand for mixed crops seems vague. **This paradox calls for innovation and collaboration** to develop new practices, new technologies, new value chains, and capture new business opportunities for diverse actors.

Sustainable farming practices are high on the agenda of policy makers, see for example the European Commission's: Organic Action Plan, Farm to Fork Strategy, or the Green Deal. Similarly, the British Government has implemented the Environmental Land Management Scheme that promotes payments for environmental goods and services. Such documents underline the importance of adapting practices, value chains, technologies, and collaboration models to accommodate required changes in e.g., use of resources like farm chemicals, or planting more protein crops. This paves the way for investigating how to make the most of the opportunities that follow from planting, trading and processing mixed crops in conventional and organic systems.

Leguminous crops are well-known for their capacity to fix nitrogen from the air and by this, reduce the need to apply synthetic fertilizers to the soil. Other important features of leguminous plants are the ability to improve soil quality, stimulate presence of pollinators and, biodiversity. When growing legumes in combinations with cereal it is possible to increase the protein content of the cereal, which is highly relevant for wheat for bread. Also, when the soil is covered by crops, the prevalence of weeds is reduced so the need for agro-chemicals is less. Intercropping of grain legumes and cereals is interesting because of the positive impact on the environment. In organic farming systems, intercropping of legumes and cereals seems to be more common than in conventional farming systems. Organic farmers take to intercropping of legumes and cereals because of the fertilization effect and because the mixed crop can be used for animal feed, for example crops of peas and barley. In conventional farming systems, the farmers' motivation to adopt grain legume and cereal intercropping seems to be hampered by uncertainties about crop yield and stability, lack of appropriate technology for cultivation and post-harvest handling, and a vague market demand.

The market for mixed crops needs to be better defined and expanded. The market appears polarised in a feed market characterized by volumes and, a food market that is oriented towards niche products and specialities including organic food products. A significant market challenge for particularly mixed crops is the separation of cereals from pulses for the pulses to be certified as "gluten-free".

The Leguminose project will create six Dynamic Innovation Partnerships with the purpose of bringing together stakeholders that could make a difference, hence people who have knowledge, experience and insights about what could be done and whom to connect with to motivate the shaping of markets and value chains for mixed crops. This would in the long run induce the uptake of intercropping practices in conventional and organic agri-food systems in Europe. The growing interest in protein crops and sustainable farming practices is evident across Europe and in many other countries. The DIPs will therefore not only serve as innovation networks in their respective countries so, we will also organise joint events across the DIPs and international stakeholders to capture learnings and experiences from various agri-food systems. Together, the six Dynamic Innovation Partnerships with their stakeholder connections form the first edition of the Partnership Map.

A survey (Appendix 1) has been conducted in February 2023 to gain insights from six European countries about stakeholders' interests, needs, and opportunities in relation to intercropping, markets and business opportunities. The survey has identified a number of key issues that are essential to address, if a wider adoption of grain legume and cereal intercropping practices should be achieved. The main opportunities and needs are compiled in Table 5.

Table 5: Main opportunities and needs for a wider adoption of grain legume and cereal intercropping in a markets and value chain perspective

Value chain actor	Opportunities	Needs
Farmers	Grain legume-cereal crops for on-farm use for feed Extend practices from organic farming to conventional farming Establish new partnerships with food producers New business models centred round biodiversity	More knowledge about grain legume and cereal intercropping practices and systems Adapt farm machinery and post-harvest equipment to mixed crops Access to separation and cleaning technology for mixed crops Proper seed varieties for right crop combinations More certainty of economic outcome Access to value chains and markets
Food companies	New products made with mixed crops Niche markets and new value chains, especially for small-scale producers Build on learnings from organic products	Pulse-fraction guaranteed as gluten-free Larger volumes and stability in crop quality to produce food for mass market retailing
Feed companies	Local feed protein value chain	Significant increase in availability and volumes of mixed crops

The Dynamic Innovation Partnerships (DIPs) are, in principle, a structured approach to involving stakeholders in the project's design, implementation and uptake of results. This means that there are many opportunities for involving stakeholders and, that involvement could encompass e.g., workshops, testing of results, demonstrations, engage in data gathering or, otherwise. Each DIP is intended to count ca. 10 stakeholders selected for their knowledge and experience in relation to grain legume and cereal intercropping. It is important to keep in mind that the **DIPs are intended for particularly addressing challenges and opportunities connected with value chains, markets and business.** This way, the DIPs complement the on-farm living labs that are centred round farms and farming activities.

Table 5 provides a first overview of central issues that need to be addressed in the Dynamic Innovation Partnerships. It is evident that particularly the farming sector is challenged by the adoption of grain legume and cereal intercropping. Value chain actors in food or feed processing seem to experience other challenges, but across all actors, the volumes, technology and applications are of pivotal importance. It is up to each of the DIPs to organise those activities that are considered as relevant for achieving the project's goal however, those issues listed in Table 5 should be part of the implementation of the DIPs.

As the Leguminose project develops, it will be clarified what would be good practices for involving diverse stakeholders, and how to benefit from this. As stakeholder involvement builds on personal interaction it is essential that stakeholders feel welcome and appreciated when participating in project activities, and that consortium partners acknowledge the voluntary contribution from stakeholders. **By building strong personal relationships for mutual benefit the project has opened a pathway for change.**

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The multi-actor approach in thematic networks for agriculture and forestry innovation | Agricultural and Food Economics | Full Text (springeropen.com) The multi-actor approach in thematic networks for agriculture and forestry innovation | Agricultural and Food Economics | Full Text (springeropen.com)

Appendix 1 Questions asked to Leguminose partners

These questions were asked to all Leguminose partners through an email survey in February 2023:

1. What makes grain legume and cereal intercropping systems interesting for your location?

2. Would organic or conventional systems be most relevant for adopting grain legume and cereal intercropping systems in your location?

3. What needs to happen for grain legume and cereal intercropping systems to become more widespread in your location?

4. What would the opportunities or benefits be if grain legume and cereal intercropping systems become more widespread in your location?

5. What stakeholders are important to connect with to adopt grain legume and cereal intercropping systems? (As examples of stakeholders: seed providers, machinery provider, agricultural extension services, farmers, traders, researchers, banks, market actors (food or feed?), consumers, other stakeholders?)

6. Do you know any national or EU-funded projects about grain legume and cereal intercropping? Please provide a link to a website.

Appendix 2: Overview of EU and national funded projects of relevance to Leguminose

- **IntercropValues**: aims to exploit the benefits of intercropping to design and manage productive, diversified, resilient, profitable, environmentally friendly cropping systems acceptable to farmers and actors in the agri-food chain. https://intercropvalues.eu/
- **Legumes Translated:** Expanding and exploiting the genetic diversity of legume crops for sustainable agricultural systems https://www.legumestranslated.eu/
- **DiverIMPACTS:** Diversification through Rotation, Intercropping, Multiple Cropping, Promoted with Actors and value-Chains towards Sustainability https://www.diverimpacts.net/
- **LegumeGap:** This project **aims to enhance the productivity and sustainability of legume-based cropping systems in Europe** and to close the yield gap in European legume production. It focuses on **improving crop management practices,** the efficiency of nutrient use, r**educing greenhouse gas emissions, developing new legume varieties, and promoting sustainable legume-based cropping systems.** https://legumegap.eu/
- **TRUE:** The TRansition paths to sUstainable legume-based systems in Europe (TRUE) project, aims to **increase the production and consumption of legumes in Europe**. The project **focuses on developing innovative value chains for legume-based products, promoting knowledge exchange among stakeholders, and addressing barriers to legume production and consumption**. https://cordis.europa.eu/project/id/727973
- **DIVERSIFOOD**: The DIVERSIFOOD project, focuses on **promoting the diversity of crops in European agriculture, including legumes.** The project **aims to develop new crop varieties, promote agroecological practices, and foster local seed systems to enhance crop diversity and resilience.** https://diversifood.eu/cultivated-biodiversity/
- **LegValue:** The Legume Value Chains for Food Security, Nutrition, and Income in East Africa (LegValue) project aims to improve food security, nutrition, and income in East Africa by promoting sustainable legume-based value chains. The project focuses on **developing new varieties, promoting sustainable practices, and strengthening value chains for legume-based products.** https://www.legvalue.eu/
- **TRUE-FOOD**: The TRansition paths to sUstainable Food systems (TRUE-FOOD) project, focuses on promoting sustainable food systems in Europe. The project **aims to develop new food systems that are healthy, sustainable, and equitable**. Legumes are one of the key crops targeted by the project, which **seeks to promote the consumption of plant-based foods and reduce the environmental impact of food production.** https://cordis.europa.eu/project/id/727973
- **ReMIX:** The Redesigning European cropping systems based on species MIXtures (ReMIX) project, **aims to promote the use of crop mixtures to improve the sustainability and resilience of European cropping systems.** Legumes are one of the key crops targeted by the project, which seeks to **promote the use of diverse crop mixtures to enhance ecosystem services**, **reduce pest and disease pressure, and improve soil health**. https://cordis.europa.eu/project/id/727217
- **DIVERSify:** The Designing InnoVative plant teams for Ecosystem Resilience and Agricultural Sustainability (DIVERSify) project, focuses on **promoting the use of crop diversification to enhance the sustainability and resilience of European agriculture**. Legumes are one of the key crops targeted by the project, which seeks to **promote the use of diverse crop rotations and**

intercropping systems to enhance ecosystem services, reduce pest and disease pressure, and improve soil health. https://plant-teams.org/#guidestoolboxes

- **EuroLegume:** Enhancing legume-based farming systems in the European Union. The project aimed to sustainable use of Leguminous plants and soil resources in order to ensure European citizens with balanced and safe food, ensuring the high-quality protein sources in their daily diet by increasing competitiveness and cultivation of legumes for food and feed. https://cordis.europa.eu/project/id/613781
- **LEGATO**: The Legume Futures for Europe (LEGATO) project, funded by the European Commission's Directorate-General for Agriculture and Rural Development, aims to promote the production and consumption of legumes in Europe. The project focuses on **developing new varieties, promoting sustainable practices, and fostering cooperation among stakeholders to enhance the competitiveness of European legume production**. http://www.legato-fp7.eu/
- **Legume-Futures:** This project, funded by the European Commission's Directorate-General for Agriculture and Rural Development, aims to develop sustainable legume-based cropping systems in Europe. The project **focuses on improving the productivity and sustainability of legume-based cropping systems, developing new varieties, and promoting the adoption of sustainable practices.** http://www.legumefutures.de/

Examples of national projects

Germany

IMPAC³ Novel genotypes for mixed cropping allow for IMProved sustainable land use ACross arable land, grassland and woodland https://www.uni-goettingen.de/en/528191.html

Leguminosen-Getreide-Gemenge, intercropping of rye, vetches and peas, focus on organic farming https://www.tfz.bayern.de/rohstoffpflanzen/einjaehrigekulturen/170184/index.php

United Kingdom

Raising the pulse, the project will look at increasing fibre in white bread and understanding the benefits of pulse-enhanced food https://research.reading.ac.uk/ifnh/2022/05/05/new-research-funding-to-boost-healthy-uk-diets/

Italy

MA4SURE, Mediterranean agroecosystems for sustainability and resilience under climate change, project includes living labs ma4sure – Welcome to the MA4SURE project (uab.cat)

Il progretti B.A.L.T.I. leguminose, Introducing the intercropping of cicerchia and cerals as a strategy for agriculture sustainable; the project has also the goal to promote and disseminate intercropping application at farmer level. www.progettobaltileguminose.it

Innovalegumi, promoting grain legume selection to increase productivity and select cultivar for intercropping with grain cereal. www.innovalegumi.it

Denmark

GrainLegsGo, Fresh grain legumes for a greener future, fresh pulses for human consumption https://icrofs.dk/forskning/dansk-forskning/organic-rdd-6/grainlegsgo

Peas & Love, Local, organic, taste heritage varieties of peas for human consumption https://icrofs.dk/forskning/dansk-forskning/organic-rdd-7/peas-love