

European Knowledge Repository for best Agricultural Practices



Summary

The main objective of D1.1 is to develop a map of all multi-actor projects by sector and macroregions with the link to the EIP-AGRI landscape. For this purpose, bilateral and declared networking were evaluated. The potential networking was analysed based on a desktop study where the networking activities of the EIP-AGRI, more specifically of the Multi-actor (MA), Focus Groups (FG) and Operational Group (OG) projects listed on the EIP-AGRI Projects webpage, were evaluated considering both the country and the sector. The real networking was evaluated by analysing the results from 54 surveys described in D1.2 (five sets of interview manuals) and after approaching 101 EU Multi-actor projects within the Horizon 2020 (2014-2020) and one EU project from the 2007-2013 FP7 framework, which wished to collaborate with EUREKA. We found that there is an excellent research network established across Europe, but it is mostly established in the Southern, Western and Northern regions. Therefore, strong efforts should be carried out to highly promote research networking in the Eastern part of Europe itself and with the rest of the EU countries, while enhancing the networking in the other parts of Europe through both MA and FG activities.

We also conclude from our analyses that EIP-AGRI operational groups are essential in the sharing the knowledge created within each country, and have the potential to serve as a network of living labs across Europe that foster the strong participation of farmers and their collaboration in the innovation process. Yet, many OGs harbour an untapped wealth of knowledge and data that has not yet been shared on the EIP-AGRI database; the National Rural Networks responsible for uploading this information should therefore be strongly encouraged and supported to do so as soon as possible.

Most of the relevant products, activities, topics, management and resources, and pest and diseases are tackled by the MA networking activities of the EIP-AGRI. However, a better structure of the gained information, with translation to different languages, will help to overcome current barriers to the communication and knowledge-sharing that helps to stimulate innovation.

Despite the large number of connections established within the different EIP-AGRI activities, the interconnection among them is rather poor. A more complete explanation of what FG, OG and TN are each essentially about should be provided, and project proposals should be required to include statements on specific public deliverables explaining at the mid-term review and at the end of the project the main networking activities carried out. Specific indicators such as number and type of interactions should be compulsorily provided to better structure the EIP-AGRI activities network. This will help to foster the interactions, which currently are rather below the potential interactions they may have.

The motivations for starting and maintaining collaborations among MA projects are clear. And although the EIP-AGRI promotes and tries to facilitate useful networking activities, the low implementation of such activities suggests that they should be more clearly established. Specifically, we recommend that National Rural Networks search for TN, FG and OG participants to share their experiences, for example in events meant to foster the exchange of knowledge and innovations. This information should be available for all people that wish to understand innovation in each specific sector.

UGENT

Planned Delivery Date



Tyler Arbour Sylvia Bursens

Actual Delivery Date

Deliverable Number	Work Package		
1.1	WP1		
Lead Beneficiary	Deliverable Author(S)		
USC	Mosquera-Losada, María Rosa Santiago-Freijanes, José Javier Rodríguez-Rigueiro, Francisco Javier Ferreiro-Domínguez, Nuria Romero Franco, Rosa Fernández Lorenzo, Juan Luis Gonzáles-Hernández, Mª del Pilar Rigueiro-Rodríguez, Antonio Taboada-Iglesias, María Jesús		
Beneficiaries	Deliverable Co-Author (S)		
AUA IFOAM KIS	Panoutsopoulos H Maria Gernert Candek-Potokar M Ilse A. Rasmussen Malene Jakobsen		
AU/ICROFS	Mine Silje Sanddal Lindemann Pieter Spanoghe		

31 /08/2020 17/12/2020

	R	Document, report (excluding periodic and final reports)	Х
Type of Deliverable	DEC	Websites, patents filing, press & media actions, videos	
	E	Ethics	

Dissemination Level	PU Public		Х
Dissemination Level	СО	Confidential, only for members of the consortium	



Content

1.		Obj	ectiv	res	4
2.		List	of a	bbreviations and acronyms	5
3.		Par	ticipa	ants	6
4.		Me	thod	ology	6
	4.	1.	Mul	ti-actor approach geographic synergies	6
	4.	2.	Mul	ti-actor approach sectoral synergies	7
		4.2	1.	Multi-actor approach potential sectoral synergies	7
		4.2	.2.	Multi-actor approach real sectoral synergies	9
5.		Res	ults.		12
	5.	1.	Mul	ti-actor approach synergies: Regions	12
		5.1	1.	Multi-actor projects	13
		5.1	.2.	Focus groups	23
		5.1	.3.	Operational groups	29
	5.	2.	Mul	ti-actor approach synergies: Sectors	30
		5.2	1 Ar	able crops	30
		5.2	.2 Pe	rmanent crops	32
		5.2	.3 Liv	estock and permanent grassland	32
		5.2	.4 Fo	restry	33
		5.2	.5 Cr	oss-cutting	33
	5.	3.	Mul	ti-actor EIP-AGRI declared networking	35
		5.3	.1 M	ulti-actor EIP-AGRI declared networking: synergies	35
		5.3	.2 Mı	ulti-actor EIP-AGRI networking: motivation	41
6.		Cor	nclusi	ions	47
7.		Rec	omn	nendations	49
8.		Ref	eren	ces	49
9.		ANI	NEXE	S	51

1. Objectives

The main objective of D1.1 is to develop a map of all multi-actor projects and the links they have by sector and macro-region with other projects or groups within the EIP-AGRI project landscape. This objective has been structured in a set of specific objectives aiming, firstly, to characterize the potential contacts by analysing the European Innovation Partnership on Agricultural Productivity and Sustainability (EIP-AGRI) activities landscape (Multiactor (MA), Focus Groups (FG), Operational Groups (OG)), and secondly to take



an inventory of the current actual, established contacts that multi-actor projects have from both a sectoral and geographical point of view.

2. List of abbreviations and acronyms

CAP: Common Agricultural Policy CSA: Coordination and Support Action

EIP-AGRI: Agricultural European Innovation Partnership

FG: Focus Group

FP7: 7th Framework Programme

H2020: Horizon 2020
IA: Innovation Action
MA: Multi-actor-Approach
MAP: Multi-actor Project
OG: Operational Group

RIA: Research and Innovation Action

NRN: National Rural Network

TN: Thematic Network UN: United Nations

USC: University of Santiago de Compostela

WP: Work Package



3. Participants

Task 1.1 is composed of five of the 19 core EUREKA consortium partners (UGENT, IFOAM, AUA, KIS and lead by the USC) as shown in Table 1.

UGENT **IFOAM** 3APTA UNITO IDELE HSRW LAAS NAIK CEJA AUA RAU NAK $\frac{1}{2}$ USC \mathbb{R} ΚIS Task

Χ

Table 1: Partners involved in the Task 1.1 of the WP1 (in green the task leader)

4. Methodology

Χ

1.1

Drawing the connections of the 120-150 MA projects of the H2020 Research and Innovation programme was based in both the geographic and the sectoral perspectives. From the geographic perspective, the analysis of the current international contacts of the projects and the international EIP-AGRI activities (Focus Groups) was developed to provide the countries and therefore the RDP with such information. From a sectoral perspective, we first developed a framework to understand the declared connections among the EU MA projects themselves, and also with other EIP-AGRI activities (Multi-actor (MA), Focus groups (FG) and Operational Groups (OG)) and secondly the existing geographic and sectoral connections.

For both the geographic and sectoral perspectives we used the MA, FG and OG data available from the EIP-AGRI and CORDIS official web pages. For the geographic analysis, the involved countries in each EIP-AGRI project type (MA, FG, OG) were evaluated. For the sectoral evaluation, the potential synergies study was carried out by developing an automatic analysis to scrutinise and identify keywords in the title and summary/objectives of the projects available in the CORDIS database (MA) and the EIP-AGRI web page (FG and OG); Thematic networks (TN) were excluded following an agreement reached among the WP1 task leaders. This agreement was reached to avoid excessive overlap between the EUREKA and the EURAKNOS projects. The EIP-AGRI activities (MA, FG and OG) were grouped based on the main topics they tackled according to different AGROVOC database sections such as products, activities, topics, resources and methods, and finally pest and diseases using the four sectors described by the Common Agricultural Policy according to the type of land used to receive direct payments (Arable crops, Permanent Crops, Permanent Grasslands) or Pillar II payments (Forestry) as shown by (Mosquera-Losada et al 2017). A fifth sectoral group was established with the "cross-cutting" activities due to the high relevance this will have in the forthcoming CAP.

The actual sectoral synergies were examined through the implementation of a global survey delivered in D1.2 (First set of interview manuals) to all multi-actor approach projects (101 H2020+ 1 FP7). We received an answer from 54 MA projects, which allowed us to assess the I activities carried out by ~half of the multi-actor projects and evaluate the potential vs. real degree of networking amongst them.

4.1. Multi-actor approach geographic synergies

The USC has assessed the regional synergies of MA and FG that were approved and running under the EIP-AGRI landscape until May 2020 (144 (101 excluding Thematic Networks) MA and 43 FG in total).



Operational groups cannot be analysed at the macro-region level because they are a type of EIP-AGRI activity which is not currently designed to provide networking among countries, but networking at the local level with a small number of connections.

The Macro-region connections were assessed thanks to the development of a desktop study, which allowed us to better understand the current country connections of MA projects within the EIP-Agri landscape at EU and abroad geographic scale. This was carried out by searching the countries of the partners involved in the MA projects and accounting the links they have among countries.

Mapping the 120 MA projects and the 43 FG listed on the <u>EIP-AGRI</u> /<u>CORDIS</u> database was carried out in two ways, firstly by developing a conceptual map based on the relationships of coordinators and the partners, and secondly based on all the interactions of the different partners of the projects by country.

EIP-AGRI and CORDIS websites were used as a source to develop a database of connections among institutions to understand the relationships among different countries mapped as part of the projects. The database was used to develop conceptual maps of synergies by using the $\underline{\text{yEd 3.20 tool}}$.

Maps were created by using Geographic Information System (GIS) mapping. To better understand the networking. Countries were first grouped into the geographic regions considered by the UN. The countries were then integrated into the four geographic regions of Europe (including both EU and non-EU; see Figure 1).

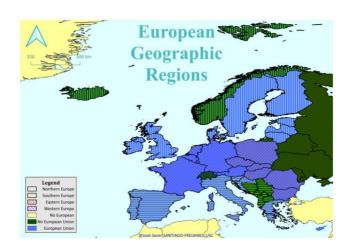


Figure 1. Countries identified within European geographic regions to perform the analysis

4.2. Multi-actor approach sectoral synergies

4.2.1. Multi-actor approach potential sectoral synergies

For the sectoral analysis associated to the potential synergies, the USC has assessed the MA, FG and OG that were approved and running under the EIP-AGRI landscape until May 2020 (144 (101 excluding Thematic Networks) MA, 43 FG and 1283 OG in total).

The web pages of the EIP-AGRI and CORDIS were used as a source to develop the database of connections among institutions to understand the relationships among different countries and institutions mapped as part of the countries by using the <u>yEd 3.20 tool</u>.



Mapping the 120-150 projects listed on the <u>EIP-AGRI/Cordis</u> databases was carried out by developing a desktop study to categorize them based on the sectors defined by the CAP (permanent crops, permanent grasslands, arable crops and forestry but also cross-cutting) sectors split by the content connections they have with other MAs, FGs and OGs within the multi-actor EIP-AGRI activities landscape.

The sectoral connections were assessed by a novel methodology designed by the USC for automating the classification process by exploiting an unsupervised approach to characterizing OG, FG and MA according to the concepts in the domain ontology of AGROVOC. This was carried out by classifying MA, FG and OG by exploring the main cluster linked to textual data (title plus objectives) using an unsupervised clustering method. Based on the clustering, MA, FG and OG were classified following the arable crops, permanent crops, livestock & permanent grassland, forestry and also cross-cutting agriculture.

From the textual descriptions of MA, OG and FG (covering Title and Objectives), key words and phrases were automatically extracted using the unsupervised method mentioned above and aligned to <u>AGROVOC</u> concepts, resulting in the following main categories:

- Products and Activities of AGROVOC: The information about products (for example type of meat, dairy, cereal, etc.) and activities (for example, meat production, water management, irrigation)
- Agricultural sectors: From the information about products and activities, agricultural sectors were deduced using a rule-based system according to FAO Classification.
- Topics (or properties of AGROVOC): topic traits or peculiarity about products or activities.
- Resources & methods of AGROVOC used in the activities.
- Pests and Diseases of AGROVOC.

The analysis carried out attempts to provide automatic networking at glance, which could lead to some mistakes due to the automated, unsupervised nature of the algorithm itself. The main challenges that have made the classification difficult were the following:

- Some terms were not found in AGROVOC. They can be detected by extracting frequent key
 phrases that were not mapped to AGROVOC. Examples are: 'circular agriculture' and 'organic'
 (as topics).
- 2) Some titles or descriptions were in the original language, not in English. In these cases, no key phrases were extracted.
- 3) The presence of incorrect descriptions, including typographical, lexical and grammatical errors that would require a prior spelling correction stage. In some cases, some titles were not informative.
- 4) The quality of the objectives and title of the projects

From the automatic classification, the total number and percentage of MA, FG and OG corresponding to each agricultural sector, as well as the precision, recall and the F-measure of the USC method, were calculated. The different sectors were classified by "products", it being possible that an OG may be classified as belonging to multiple product categories. A MA, FG or OG can be tagged with zero, one or





several products. For example, the OG titled "Natural dyeing - Use of natural dyes in natural fibres" is automatically tagged as both natural fibres and dye plants. Hence, the values in the different figures do not sum up to 100%.

4.2.2. Multi-actor approach real sectoral synergies

To better understand the real connections of MA projects, a survey was carried out. Mapping the MA projects' synergies with other MA projects and EIP-AGRI activities (TN, OG, FG) could not be carried out by analysing only a small number of projects, and for this reason the Task 1.1 EUREKA team decided to conduct a survey of all 101 MA projects active during the period 2007-2020 (Table 2). The survey process was carried out following the protocols indicated in Deliverable 1.2 and the contacts of coordinators provided by Deliverable 1.3. The questions were programmed considering the aims of the deliverable that were translated into research questions (Table 3).

Table 2. List of MA projects tackled by the surveys (Underlined: CSA/ Bold: RIA; Cursive: IA)

STARTING	ENDING	ACRONYM
	2017	<u>Agrispin</u>
	2018	FATIMA, TRADITOM
2015	2019	DIVERSIFOOD, EMPHASIS, LANDMARK, nEUROSTRESSPEP, PONTE, REFRESH, TREASURE
	2020	FEED-A-GENE, isQAPER
	2018	AgroCycle
2016	2020	AGROinLOG, ALTERFOR; GoodBerry, IMAGE, iSAGE, MycoKey, MyToolBox, NEURICE, NoAW, TomGEM, XF-ACTORS
	2021	SOILCARE, Strength2Food
	2019	PLAID
2017	2020	BOND, DYNAVERSITY, FARMERSPRIDE, InnoForESt, IoF2020, TomRes, WATERPROTECT
2017	2021	AgriLink, DIVERSify, AFirWAY, InnovAfrica, LEGVALUE, LIVESEED, MAGIC, MUSA, ReMIX, Robust, TROPICSAFE, TRUE
	2022	Diverfarming, GENTORE
	2021	COASTAL, LIAISON, LIVERUR, NEFERTITI, OPTIMA, RUBIZMO, SiEUGreen, SINCERE, SMARTCHAIN, VIROPLANT
2018	2022	CIRCULAR AGRONOMICS, HOMED, LIFT, NEXTFOOD, Nutri2Cycle, Organic-PLUS, RELACS, RUSTWATCH, SmartAgriHubs, SMARTER, Superpests
	2023	BRESOV, DEFEND, ECOBREED, ECOSTACK, FAIRshare, PoshBEE, SUPER-G
	2022	CONSOLE, PoliRural
2019	2023	AGRICORE, B-GOOD, ClearFarm, Contracts2.0, DESIRA, EFFECT, FF-IPM, FOX,LEX4BIO, MIND STEP, PRE-HLB, ROADMAP, RURALIZATION, SHEALTHY, SHERPA, STARGATE, FERTIMANURE
	2024	EXCALIBUR, IPM-Decisions, Ppilow, SOILDIVERAGRO, AVANT



Table 3. Questionnaire related to synergies. Blue letter questions were included in the initial online questionnaire, while black letter questions were only asked to those projects which positively answered to have collaboration with each specific EIP-AGRI activity.

Deliverable D1.1 Research topic	Research question	Questions
List of Focus Groups (FG),	FG synergies	List the FG your MAP collaborated with
Operational Groups (OG), Multi-	OG synergies	List the OG your MAP collaborated with (including web page)
actor (MA) and Thematic	TN synergies	List the TN your MAP collaborated with
Network (TN) projects linked to with MA	MA synergies	List the MAP your MAP collaborated with (
WITHWA	Rural Network (RN) Synergies	List the Rural Networks your MA collaborated with (including web page)
Origin of the collaboration	FG contact reason	What are the main reasons for linking to FG?
		a Specified in the grant agreement
Note: prioritize the answer: (1		b Casual
the most relevant)		c Dissemination and Communication activities d technical collaboration
		e geographical proximity
		f Already existing contact
		g others
		h. no contact developed
	OG contact reason	What are the main reasons for contacting OG?
		a Specified grant agreement
		b Casual
		c Dissemination and Communication activities
		d technical collaboration
		e geographical proximity
		f Already existing
		g others
		h. not developed
	MA contact reason	What are the main reasons for contacting other MA projects?
		a Specified grant agreement
		b Casual
		c Dissemination and Communication activities
		d technical collaboration
		e geographical proximity
		f Already existing contact
		g. contact not developed
		h others
	TN contact reason	What are the main reasons for contacting TNs?
		a Specified grant agreement
		b Casual
		c Dissemination and Communication activities
		d technical collaboration
		e geographical proximity
		f Already existing contact
		g. Contact not developed
		h others
	National Rural	What are the main reasons for contacting National Rural Development
	Development	Network?
	Network contact	a Specified grant agreement
	reason	b Casual
		c Dissemination and Communication activities
		d technical collaboration
		e geographical proximity
		f Already existing contact



		a Contact not developed
		g. Contact not developed
	FO 11 1	h others
Collaboration itself	FG collaboration	What was the aim of establishing links to FGs?
		a Defining challenges
Note: prioritize the answer: (1		b Defining innovations (solutions)
the most relevant)		c Developing dissemination materials
		d Using Dissemination channels
		e Networking
		f. Collaboration not developed
		g. others
	OG collaboration	What was the aim of establishing links to OGs?
	reason	a Defining challenges
	1003011	b Defining innovations (solutions)
		c Developing dissemination materials
		d Using Dissemination challenges
		e Networking
		f Collaboration not developed
		g. others
	MA collaboration	What was the aim of establishing links to MA projects? a Defining
	reason	challenges
		b Defining innovations (solutions)
		c Developing dissemination materials
		d Using Dissemination channels
		e Networking
		f Collaboration not developed
		g. others
		g. others
	TN collaboration	What was the aim of establishing links to TNs?
	reason	a Defining challenges
		b Defining innovations (solutions)
		c Developing dissemination materials
		d Using Dissemination challenges
		e Networking
		f Collaboration not applicable
		g others
	Rural Development	What was the aim of establishing links to RDN?
	Networks	a Defining challenges
	collaboration reason	b Defining innovations (solutions)
	22300144101111243011	c Developing dissemination materials
		d Using Dissemination challenges
		e Networking
		f Collaboration not developed
		g. others

The questionnaire was produced in Microsoft Forms and can be seen here. The survey required respondents only 10 minutes on average but provided valuable insights about the relationships among projects, including identification of those projects having meaningful connections within the EIP-AGRI landscape. Coordinators or other representatives of these projects were subsequently surveyed and personally interviewed to identify the concrete connections they have in order to accurately map them. We also sent up to 10 reminders to ensure high participation. The list of contacted projects can be seen in Table 4.

We sent invitation letters along with letters of consent to all MA project coordinators up to 4 times in order to ensure maximum collaboration. Thanks to this we received answers from 54 MA projects (53



from the H2020 period and 1 from the FP7 period). Table 4 shows the projects which were part of the survey process for task 1.1.

STARTING	ENDING	ACRONYM
2014	2016	ECODRY
	2018	FATIMA, TRADITOM
2015	2019	EMPHASIS, TREASURE
	2020	IsQAPER, FEED-A-GENE
2016	2020	ALTERFOR, MycoKey
	2019	DYNAVERSITY, PLAID
2017	2020	BOND, InnoForESt, PANACEA, IoF2020, TOMRES
	2021	LIVESEED, TRUE, TROPICSAFE, MUSA, LEGVALUE
	2022	Diverfarming, GENTORE, IWMPRAISE
	2021	LIVERUR, NEFERTITI, OPTIMA, SMARTCHAIN, LIAISON
2018	2022	RUSTWATCH, Organic-PLUS, NEXTFOOD, RELACS, CIRCULAR AGRONOMICS, SmartAgriHubs
	2023	DEFEND, ECOBREED, ECOSTACK, FAIRshare, SUPER-G, LEX4BIO
	2022	CONSOLE
2019	2023	DESIRA, RURALIZATION, SHERPA, ClearFarm, FF-IPM, AGRICORE, PRE-HLB
	2024	Ppilow, SOILDIVERAGRO, EXCALIBUR, IPM-Decisions

Table 4. Set of EU projects collaborating within the interviews provided by D1.1. Bold: RIA, italics: IA, underlined: CSA non-TN

Survey data results were integrated into a database following the ranking obtained in the survey and represented in graphs by using Microsoft Excel. Afterwards, each variable was categorized as categorical for each MA project, being the two top answers categorized as the primary category and the rest as secondary, meaning "prioritized reason" or "no prioritized reason", respectively. Afterwards, a chi-square analysis was carried out and the Fisher exact taken as a way to determine the significance of results. The SPSS programme was used to develop the analysis.

The results of the present deliverable were presented in the SCAR-AKIS meeting held last 24 January 2021. An open survey about the results of D1.1 of EUREKA was launched and included in the present document.

5. Results

5.1. Multi-actor approach synergies: Regions

The regional categorization of the project was conducted by evaluating the coordinators and partners whose initial results were shown in D1.2 (Five sets of interview manuals) and concluded that most of the coordinators and partners of the MA projects are based in Western Europe, whereas for RIA projects there is good participation of countries from all four regions.



5.1.1. Multi-actor projects

Figure 2 shows the number of coordinators of total, CSA, RIA and CSA MA projects per EU country. The figure makes evident that most MA project coordinating organisations are located in large countries such as France, Spain and the UK. On the contrary, Eastern countries are typically not involved in MA projects as project leaders, probably due to the lower degree of innovation development these countries have compared with the Western countries. This makes the collaboration of these countries in the MA projects essential to understand and adapt the new multi-actor approach schemes to Eastern Europe, and advance the multi-actor principles when developing innovations. UK and Belgium are leading the CSA projects while France and Italy are the leaders of RIA projects, and finally Spain, followed by The Netherlands and Denmark, are leading most of the MA IA projects.

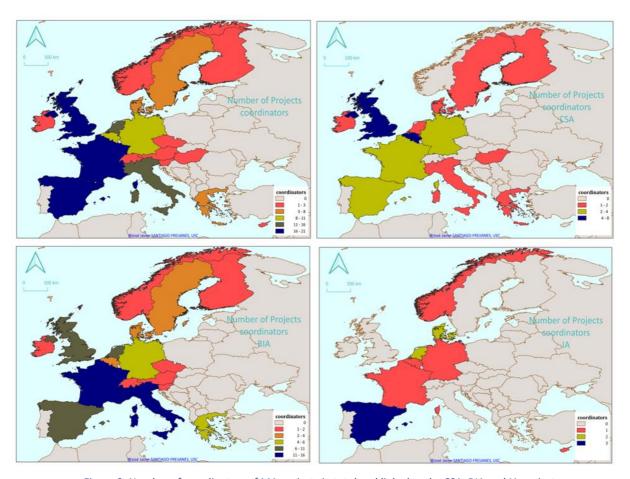


Figure 2. Number of coordinators of MA projects in total and linked to the CSA, RIA and IA projects

Figure 3 shows the degree of partners participation per country of the different MA projects in Europe. It can be seen that in Europe, large countries such as Spain, France and Italy are the countries with the greatest number of partners participating in MA projects in both percentage and absolute values.



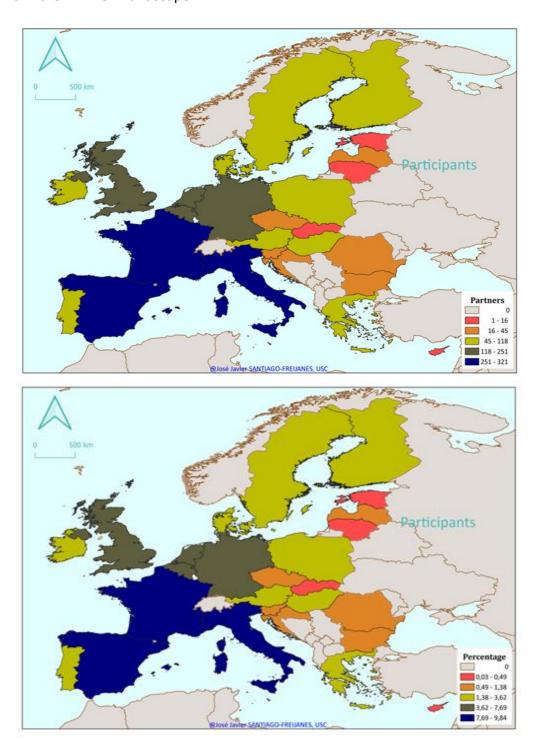


Figure 3. Number (above) and percentage (below) of participants of MA projects in total and linked to the CSA, RIA and IA projects at European scale

Figure 4 shows the networking establishment at the country level based on the connections that each coordinator of the different projects has with regard to other partners in the same consortium. It can be seen that The Netherlands is the country with the most connections, mainly with itself and other countries such as Italy, Germany, Portugal and Sweden.



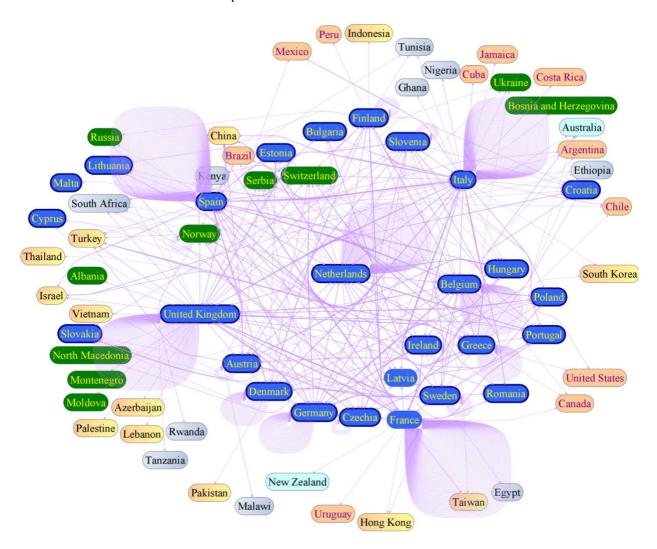


Figure 4. Number of contacts among MA coordinators of the projects and the partners they coordinate. In blue countries are from the EU, in Green those non-EU countries of Europe, Asia is in Yellow, the Americas in Pink, and Africa in light blue.

Figure 4 shows the four large poles of networking in Europe, usually associated with geographically large countries such as France, the UK, Spain or Italy, although The Netherlands and Belgium are smaller-country exceptions with more connections than the much-larger and more populous Germany, for example. Most of the EU countries are quite well connected, but others such as Croatia, Lithuania, Malta, Cyprus and Slovakia are not well connected. Germany seems to have low networking in spite of being a large country. The relative number of connections that a country has to foreign countries could be associated with the number of emigrants existing abroad (in a direct relationship), as is the case for Italy. MA projects connect a total of almost 40 countries all over the world, and almost 50 if we considered the non-EU European countries.

Figure 5 shows the number of connections among countries established by partner-partner interactions (See Annex I for the numbers of contacts per country and the connections they have among all the partners of the MA projects.). Amplifying the figure, it can be seen that the density of connections is increased when the countries belong to the European Union (H2020 framework) with a higher network around these countries. The network is composed of 73 different countries,



meaning that multi-actor approach projects are able to include on average 2.6 partners per country (considering 28 EU countries during the H2020 programme).

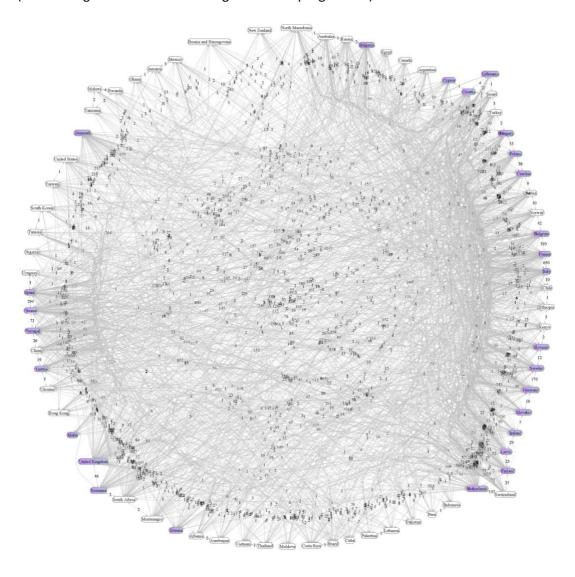


Figure 5. Number of bilateral interactions among MA partners. Coloured boxes are EU countries

Figure 6 shows the total number of contacts per country based on the sum of the table of Annex I. In total, almost 70000 bilateral contacts are established across Europe. There are 20 countries with more than 1000 contacts when participating in the EU projects, all of them European with the addition of China: This is due to the agreement between China and the EU to develop research together during the H2020 period. All EU countries have over 100 connections with the exception of Malta. All countries with more than 1000 connections come from South and Western Europe, which slows down the capacity of innovation transfer of the Eastern countries, with a lower degree of knowledge transfer development.



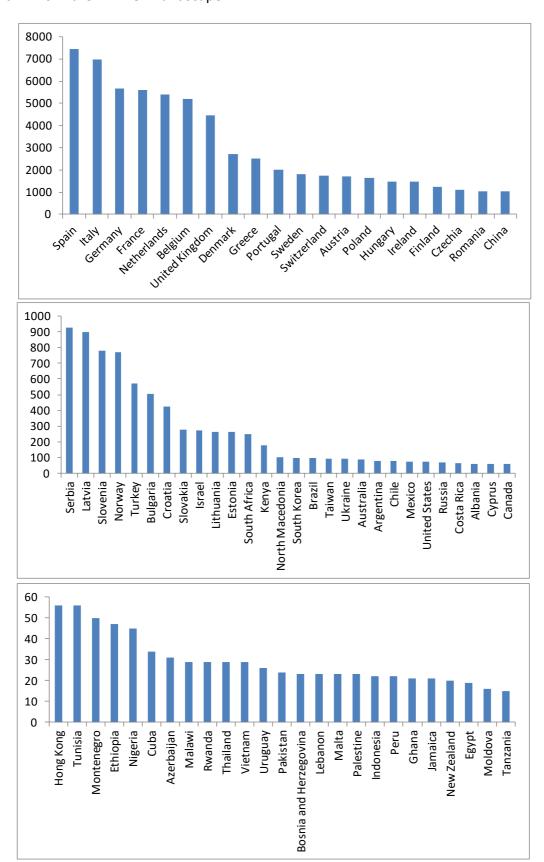


Figure 6. Number of contacts among MA partners.





Annex II shows the detail of the interactions developed per country through the MA projects with different countries that may be useful for the analysis of the different geographic synergies established per country if considered by the EIP-AGRI office of the Rural Development Networks. With the exception of Estonia, most of the countries of Europe made over 30 interactions with other countries, being this value higher in big countries like France, UK, Spain, Germany and Italy with more than 65, followed by Sweden, Greece and Portugal with more than 50 (Figure 7).

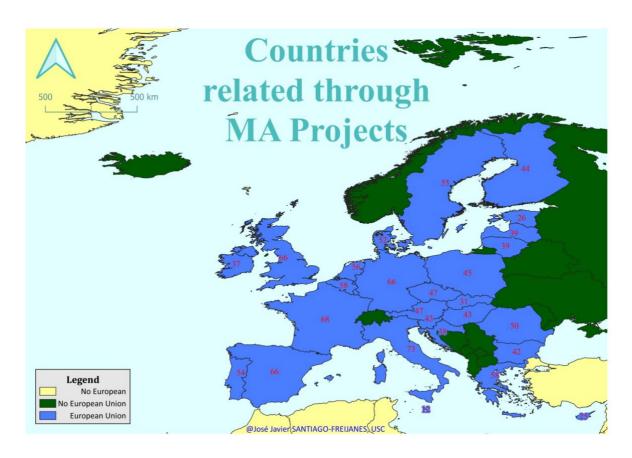


Figure 7. Number of different country interactions through MA projects per country

Figure 8 shows the number of interactions among MA partners within each UN geographic region. The Western EU region has the largest number of bilateral interactions followed by the Southern European Union Region. The interactions among Northern European Union countries are small even with the UK among them. The number of interactions within the Eastern European Union countries is very small compared with the other internal European Union groups. Within the Western EU countries, the combinations of France-Germany, France-The Netherlands and Belgium-The Netherlands and Germany-The Netherlands have the largest number of interactions. These four countries also have the largest number of within-country bilateral interactions. Austria is the Western country with the lowest rate of interactions, most of which are with Germany.

With regard to the South European Countries, we found almost half the number of country-to-country bilateral interactions than in the Northern areas with the exception of the connectivity between Italy and Spain. Spain and Italy had the highest number of bilateral country-to-country connections in the whole of Europe, followed by the connections between Spain and Greece, Italy and Greece and Spain and Portugal all them with over 200 bilateral interactions. On the opposite side, Cyprus and Malta are the countries with the lowest number of connections probably due to the small size of the country followed by Slovenia,



which is quite connected with Spain and Italy. The two countries with the greatest number of withincountry connections are Spain and then Italy, the countries with the largest size and population in this area of the world.

Northern EU countries are characterized by a high number of connections between Sweden-Estonia and Sweden-United Kingdom, with over 100 connections, followed by Sweden-Denmark. Latvia and Estonia had the lowest level of interactions with the rest of the countries in this UN geographic region. Finally, in comparison to the other regions, the Eastern EU countries have low connectivity among themselves. Poland has more than 30 bilateral connections each with Hungary, the Czech Republic and Romania, as do Hungary-Romania. There are three interactions with less than five connections: Slovakia-Hungary, Romania-Slovakia and the Czech Republic with Bulgaria.

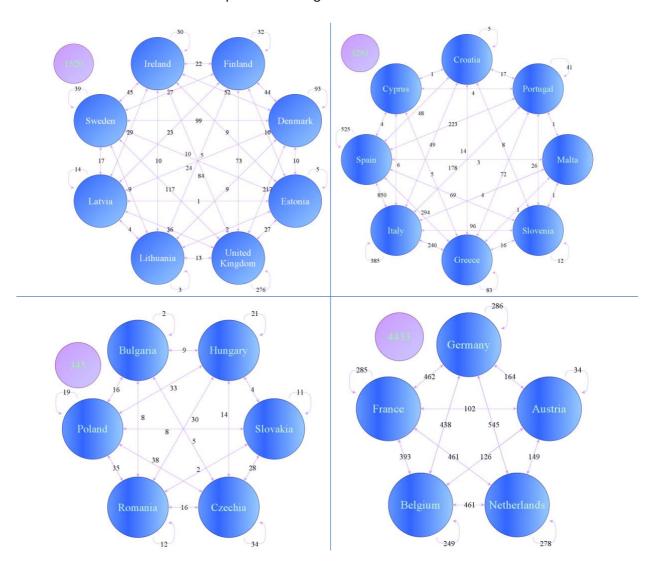


Figure 8. Number of bilateral interactions among MA partners within each UN European geographic region 7

Figure 9 shows the connections among the European countries and the rest of the world. Western and Southern countries have a higher number of connections than Eastern and Western countries within the European and non-European Union countries. The EU countries have the largest networking compared with the non-EU countries with regard to the MA project participation. The number of connections



between the EU regions is in the fourth quartile. The number of bilateral interactions among the Non-EU European countries and the EU European countries is low when we compare Northern EU and No EU countries with Non-EU Eastern countries. The lowest number of connections was found in between Non-EU European countries. The Western and the Southern EU European countries have the largest number of interactions with non-European countries than the Northern and Eastern EU European countries.

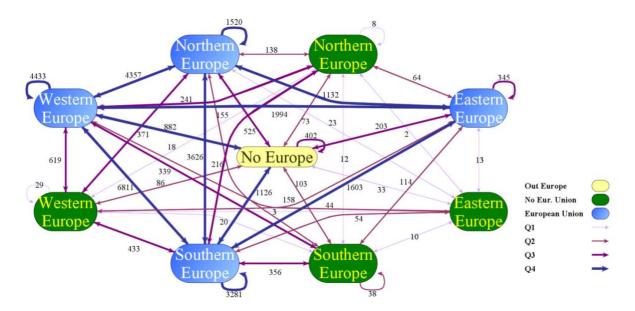


Figure 9. Number of different country interactions through MA projects per country. The line width represents the strength of the connections

Figure 10 shows the degree of bilateral interactions among the different UN regions of Europe and the other continents with regard to the MA projects. Western Europe followed by Southern Europe represents the largest amounts of interactions. Northern Europe and finally Eastern Europe has a lower number of interactions due to the lower amount of people of those countries in the first case and the probably the lowest research and innovation activity in the rest. All regions have a largest and lowest interaction with Asia and Oceania, respectively. The highest interaction with Asia may be probably explained due to the bilateral agreement between Europe and China to develop research together within the 2014-2020 period.



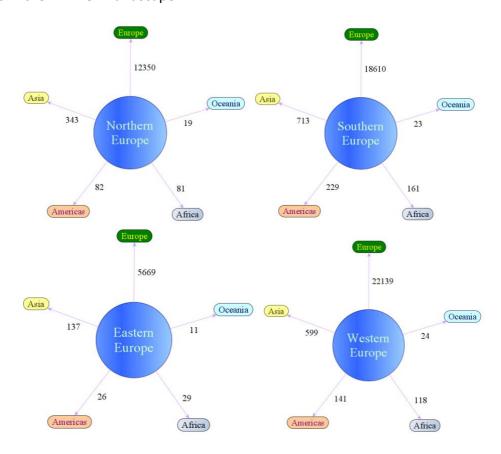
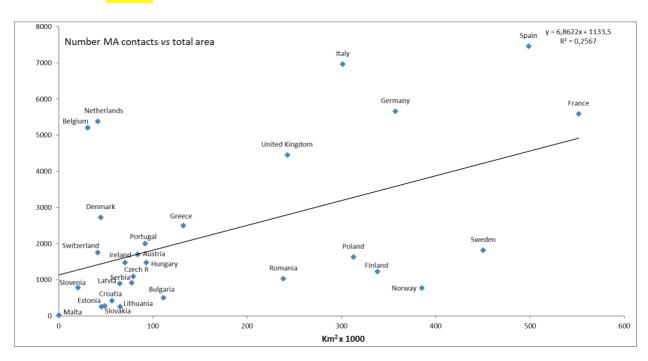


Figure 10. Number of International bilateral interactions among MA partners.



Figure 11 shows the relationship between the number of contacts per country and the country area and total population. It can be seen that the number of contacts established is more related with the number of inhabitants than with the area, which may reflect the fact of the human population impact on the rural areas as reflects the fact of the percentage of variance explained close to 60%.

ADD HERE FIGURE 11



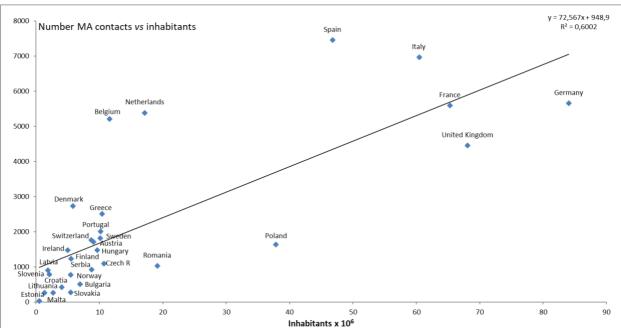


Figure 11. Regressions between the number of contacts among MA partners and the total area (km²) above and the total number of inhabitants (million people per country) below.

An important network based on MA Projects is described with almost 70000 connections among the different partners, being the coordination of the projects mostly associated to large countries like France





and Italy associated to RIAs, Spain to IAs and UK to CSA. The largest number of partners is associated with Spain, Italy and France. The networking analysis showed that these countries together with the Netherlands had the largest networks of Europe that involve in total 73 countries all over the world. Large countries of Europe contacted with more than 60 different countries all over the world. Western and Southern EU countries of Europe are the most connected regions with other EU regions, non-EU regions and the different continents all over the world. All regions have the largest and lowest interaction with Asia and Oceania, respectively. The highest interaction with Asia may be probably explained due to the bilateral agreement between Europe and China to develop research together within the 2014-2020 period. The total number of bilateral contacts was more related to the total population of the country than with the area it occupies, therefore relating the impact that human beings can have on surrounding agriculture.

5.1.2. Focus groups

The Focus groups are a type of activity developed by the EIP-AGRI within the European framework. They are temporary groups of selected experts focusing on a specific subject, sharing knowledge and experience. They are organized in two meetings and based on different countries selected by the European Commission.

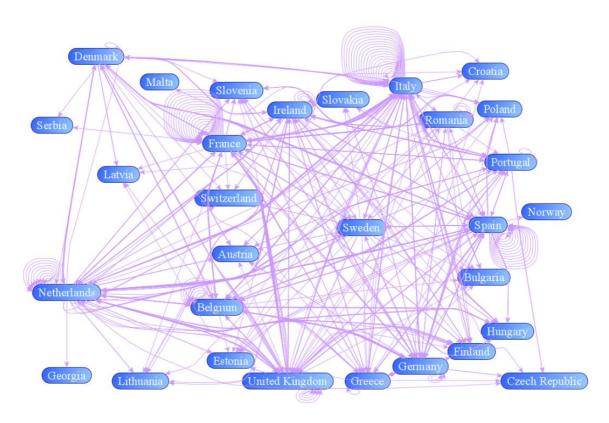


Figure 12. Number of contacts among FG experts and the FG participants they coordinate.

Figure 12 shows the number of contacts established among all participants of FG projects considering the origin of the expert while Figure 13 also shows all the contacts established among all the FG participants which can be detailed in Annex III. The form of the Figure 13 is more geometric than that provided for the MA connections (Figure 5), due to the fact of the EIP-AGRI control of the balanced countries participation.



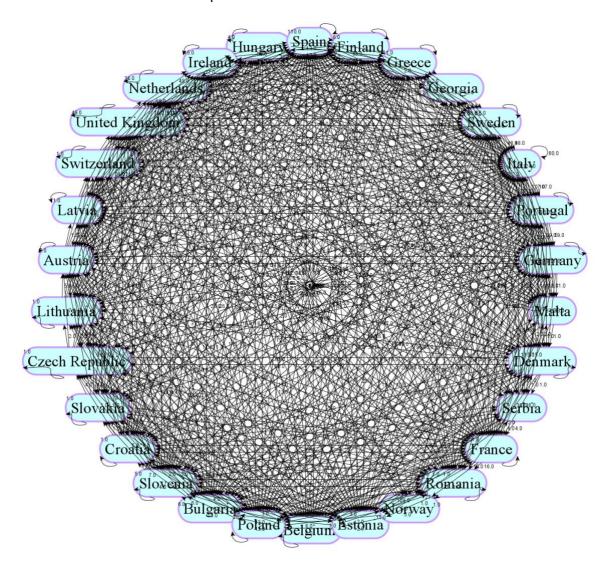


Figure 13. Number of

The total number of interactions among countries found in the FG is much smaller than with the MA because of the higher number of participants in the MA projects compared with the FG and also because the number of MA projects is higher than in the FG. As happened with the MA projects, the coordination was higher in large countries such as Spain, France or Italy, followed by The Netherlands and Belgium, which is in line with what was found in the MA projects. Only the UK has a less degree of coordination than before, probably due to the fact of the BREXIT. The BREXIT effects are not found in the MA projects because the UK still can be part of the projects, and the permanency period in the MA is longer than in the focus group. The number of bilateral contacts of the focus groups is 4.3 times lower than the number of bilateral interactions found in the MA projects (Figure 13) due to both the largest partnership and higher number of MA than FG.

Figure 14 shows the number of bilateral interactions per country within the FG. Again Spain, France, Italy and Germany are in the first positions. UK is in the seventh position in the MA projects but ranks fourth in the FG. The current bilateral interactions per countries within the FG framework can be seen in Annexe IV.



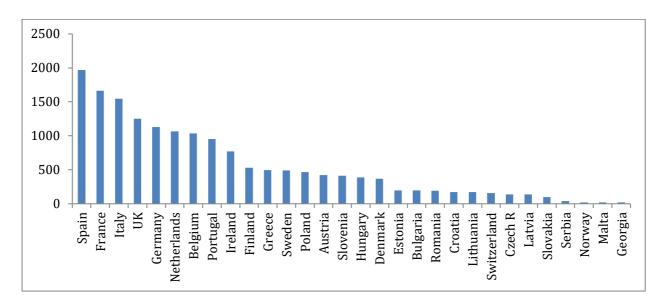


Figure 14. Number of bilateral interactions among FG partners

Figure 15 shows the number of interactions within each UN geographical regions of Europe. Differently to what happened with the MA interactions within these regions, the Southern region is the region with the largest number of bilateral contacts, followed by the Western region, being again the Eastern countries the less represented number of interactions. Within the Northern regions, the largest connected regions are the UK and Ireland with more than 60 contacts, being Spain and Italy, Spain and Portugal and Italy and Portugal are the countries with over 100 connections within the FG Southern EU countries framework. Only the Netherlands and France, the Netherlands and Germany and France and Belgium are the countries with the largest interactions in Western Europe with more than 100 interactions. Finally, only Hungary and Poland, the Czech Republic and Poland and Romania and Bulgaria are over 5 interactions in Eastern Europe.



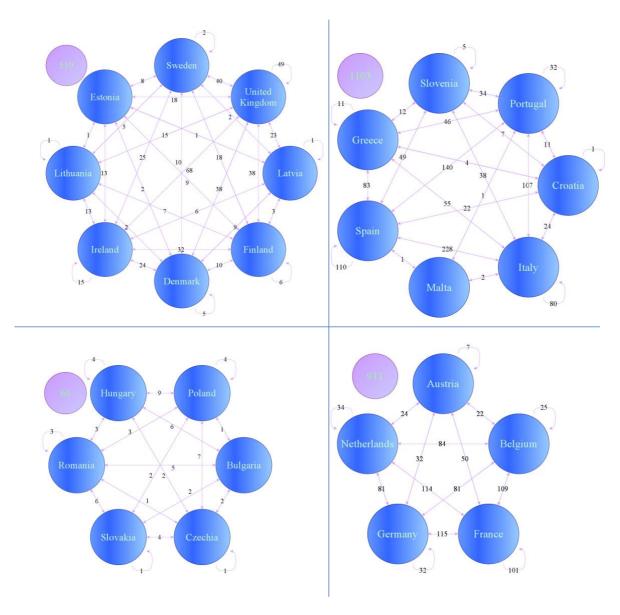


Figure 15. Number of bilateral interactions among FG partners within the EU UN geographic regions

Figure 16 shows the global interaction of the EU countries and the non-EU European countries as described by UN geographic regions; it also includes Asia as a person of Georgia took part in one FG. Non-EU Western European Countries (Switzerland) took part of a large number of times with Northern, Western and Southern Europe, while the connection of the rest non-EU countries of the UN European geographic regions was rather small. The design of FG was to develop the start of the art of the main focus groups topics in the European continent, with a rather small number of non-EU countries.



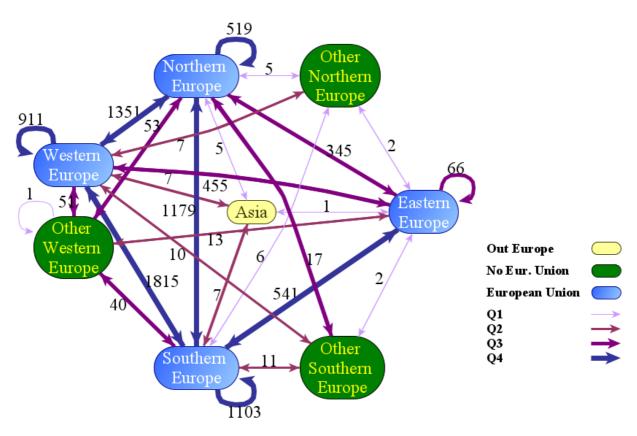
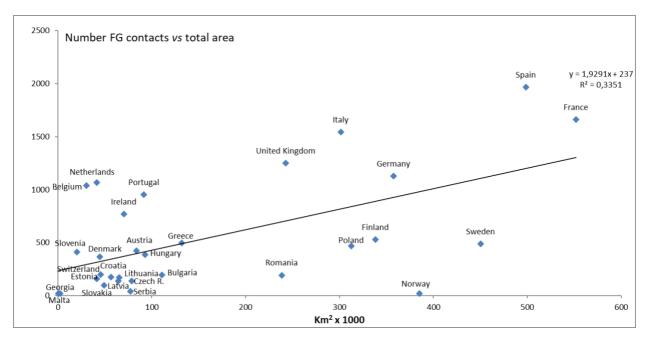


Figure 16. Number of bilateral interactions among FG partners within the UN geographic regions

Figure 17 shows the degree of relationship between the number of bilateral interactions per country in the FG and the country area and the population area. The relationship between the surface and the number of connections of the FG could be indicative of the potential of the use of the proposed innovations in the whole country, due to the fact of the largest amount of different environmental conditions as the area of the country is enlarged and the need of the innovations to be locally adapted. On the other hand, the comparison with the number of people is key to understand the potential of people to develop innovations in the area. Both, country size and number of people is key to foster innovation. The relationship of the participants in the FG with the area was rather minor as only 33 per cent of country participation in the FG is associated with the size of the countries. However, the relationship is increased when the population of different countries is considered. The fact that the presence of the innovators in the focus groups is explained around 60% by the population gives us an idea that the capacity of innovation is more reliable on the people. The FG participants are able to propose the main challenges along with the different topics but also the innovations while providing insights about those areas more affected by the human presence and therefore probably more impacted by unsustainable farming practices.





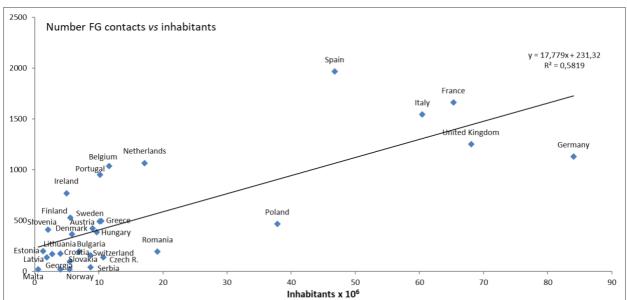


Figure 17. Relationship between the number of interactions and the surface (above) and number of inhabitants (below) of each country within the FG framework

We can conclude that the bilateral interactions developed in the FG are rather small than those described in the MA projects accounting over 16000 interactions. The expert leadership of the FG was based on large countries such as Spain, France and Italy followed by The Netherlands and Belgium, being citizens from these countries together with Germany those participating most in the FG activities. Focus groups are by definition composed by European Union members, however, some countries from Europe like Switzerland or Asia like Georgia are also present. Southern EU countries of Europe followed by Western have the most connected networks compared with Northern EU countries of Europe and mostly with Eastern countries of Europe. As happened with the MA projects, the participation in the FG is more related with the number of inhabitants of a country than with the number of km² that the country has, highlighting the relevance of the people.



5.1.3. Operational groups

Operational groups are a type of EIP-AGRI activity which is not currently designed to provide networking with other countries rather than Europe, as they are activities exclusively associated with National Rural Development Networks. The number of OGs appearing in the EIP-AGRI database is smaller than those currently existing. For example, Spain already developed close to 1000 operational groups, but they are not uploaded in the EIP-AGRI system. So, this analysis should be considered as an intermediate-term review of the information available on the EIP-AGRI website. Operational groups do not propose networking involving different countries in the period 2014-2020, so, this cannot be analysed. However, some countries like Spain do both regional and national networking level operational groups, the so-called "Supra National Operational Groups" which foster interactions among different regions of Spain besides those working at the regional level. The OG foster networking at local/regional level in most of the countries with many different institutions associated. The information of the partners involved is not directly available in the EIP-AGRI web page, and only those with web page luckily have this information available, which made difficult the analysis.



Figure 18. Relationship between the number of interactions and the surface (above) and number of inhabitants (below) of each country

Figure 18 shows the number of operational groups per country available in the EIP-AGRI web page by November 2020. Italy is the country with the largest number of operational groups available in the EIP-AGRI followed by Spain, Germany and France. Only 16 out of 28 EU countries have developed OG in the EIP-AGRI system.

We can conclude that Operational groups. In spite of the lack of update of the EIP-AGRI with regard to the operational groups, it is clear that the largest number of operational groups is linked to those



countries having Regional Rural Development Networks, besides the National Rural Development Network, excepting Portugal. Eastern countries, with a lower degree of innovation and research, has a lower number, while Sweden has a much higher number than Finland. This could be explained by the fact that different approaches have been taken by countries with some with a high number of projects with only 2 years for execution and others with long term execution period, which seems more appropriate if long-term sustainability aspects are going to be taken into account.

5.2. Multi-actor approach synergies: Sectors

A detailed description of the MA, FG and OG categorization linked to sectors, products, activities, topics, resources and methods considering the annual crops, permanent crops, livestock and permanent grasslands, forestry and cross-cutting activities can be seen in Annex V. Below we provide the summary of data described in this Annex.

All the EIP-AGRI multi-actor activities (Multi-actor-Projects, Focus Groups and Operational Groups) have a higher share of cross-cutting, arable crops and livestock & permanent grassland agricultural sectors than permanent crops or forestry. The cross-cutting agricultural sectors are more relevant in the operational groups (almost a 50%) than with the Multi-actor approach projects (38%) and Operational Groups (25%), showing the higher awareness of experts for the sustainability in the Multi-actor approach projects and focus groups when compared with the more practice-oriented activities associated to operational groups. A summary of the comparison among two of the EIP-AGRI activities (MA and FG) on the main products, activities, topics, resources, methods and pest management per type of land use is shown in Table 5.

5.2.1 Arable crops

The main **products** treated by the EIP-AGRI multi-actor activities are linked to vegetables in both Multi-actor approach projects (50%) and operational groups (40%), being focus groups mainly associated to industrial crops (100%).

The main arable crops **activities** were related to economic activities associated with different types of farming systems and agricultural practices but also to commercialization in the case of multi-actor approach projects. Management activities were another key activity identified in the multi-actor approach projects (logistics, rationalization and pest management) and the operational groups (waste management). Production was another arable crop activities associated with conventional and organic farming systems. Multi-actor approach projects are unique dealing with the processing, breeding, services and education activities while socioeconomic organization and processing are exclusively linked to focus groups.

The main **topic** associated with the different multi-actor EIP-AGRI activities is Productivity is the only mentioned topic in the multi-actor approach projects, focus group and operational groups. Both Operational groups and multi-actor approach projects also deal with sustainability and efficiency. For multi-actor approach projects, quality and resiliency are also important issues, while soil properties are relevant for focus groups and finally quality, climate change, environmental impact are key for the operational groups.

Table 5. Summary of the comparison among two of the EIP-AGRI categories (MA and FG) on main products, activities, topics, resources and methods and pest management per type of land use.

FG // MA // Both	Products	Activities	Topics	Resources and methods	Pest and diseases
Arable Crops	Vegetables (tomatoes and fruit vegetables), cereals (wheat and rice), legumes / Processed products (vegetable products and processed food) / Industrial Crops	Farming system & agricultural practices, production, Commercialization / Management activities (logistics, razionalization and pest management) / Processing, breeding, services and education activities	Productivity / Sustainability and efficiency / Quality and resiliency / Soil properties	Innovation / Pest control / Natural resources related to biodiversity / Food processing, farm inputs and methods (cultural methods besides pest control)	Invasive species / Weeds
Permanent Crops	Fruit trees (Olive, citrus and soft fruits) / No processed products coming from permanent crops	Horticulture (viticulture) / Pest and diseases	Sustainability / Productivity and resiliency	Integrated pest management and innovation	Specific pests and plant diseases.
Livestock & Permanent Grassland	Milk and meat, pork / Cattle, sheep, goats, swine, poultry	Farming systems and practices / Production associated with milk and meat / Water and integrated management /Animal feeding, data analysis and ecosystem and information services delivery / Grassland management / Grazing systems	Sustainability and productivity / Quality and resilience / Efficiency / Profitability and pollution	Innovation, farm inputs and natural resources	Pests of permanent grasslands and animal diseases
Forestry	-	Forest management: forestation, pest management, Sustainable forest management / Ecosystem services	Sustainability / Climate change	Innovation / Control methods, covering biological control and insecticides	Forest pests and insect pests and Insecta
Cross-cutting Agriculture	-	Economic Activities (Farming Systems – commercial farming, Nutrient Management and Sustainable Agriculture – , Urban Agriculture, Fisheries and Commercialization) / Management (Resource management –natural resources management, water use and resource conservation –, decision making and water management / Production (crop production and food production)	Sustainability / Quality / Efficiency / Resilience / Productivity / Covering pollution / Climate change / Profitability	Innovation / Natural resources / Farm inputs, covering fertilizers / Substances, covering soil organic matter / Control methods	Insecta: Apidae / Diseases: fungal disease

With regard to the main **resources and methods** highlighted in the EIP-AGRI multi-actor activities are related to innovation, pest control, and natural resources related to biodiversity in all types of EIP-AGRI multi-stakeholder activities. Multi-actor approach projects mainly dealt also with topics related to food processing, farm inputs and methods (cultural methods besides pest control), while operational groups were also related with propagation materials, farm inputs and fertilizers.

About the themes treated by the EIP-AGRI multi-actor activities within the AGROVOC section **pest and diseases**, we found that the multi-actor approach projects worked with invasive species while focus groups and operational groups were more related with pest and diseases and weeds.

5.2.2 Permanent crops

The large number of operational groups allowed to identify 62 different **products** including 21% of processed products and 13% of foods (alcoholic beverages and olive oil). Fruit trees were the main topic found in multi-actor approach projects, focus groups and operational groups, highlighting olive and citrus as well as soft fruits. No processed products coming from permanent crops are evaluated in detail in both focus groups and multi-actor approach projects.

The **activities** associated with the multi-actor activities of the EIP-AGRI are linked to the economy, management and production. Economic activities associated with horticulture (viticulture) are worked in multi-actor approach projects and focus groups, and more extensively in operational groups where farming systems and commercialization are tackled. Management associated with pest and diseases is treated in both focus groups and multi-actor approach projects, were soil management and resource conservation. Production is mostly associated with operational groups covering plant protection and production.

There are several **topics** associated with permanent crops by the EIP-AGRI. For permanent crops, sustainability is the unique topic associated with FG and OG. Focus groups also tackled productivity and resiliency while operational groups dealt with food quality, pollution, organoleptic properties, processing quality and keeping quality as well as climate change, efficiency, productivity and soil properties including soil fertility.

Concerning the **resources and management** AGROVOC category tackled by the multi-actor activities of the EIP-AGRI, the permanent crops Pest control included integrated pest management and innovation were tackled by all EIP-AGRI multi-stakeholder activities. Operational groups tackled also biological and non-renewable resources use and monitoring techniques.

Only the multi-actor approach projects work on the **Pest and diseases** section with specific pests and plant diseases.

5.2.3 Livestock and permanent grassland

The product categorization of the livestock and permanent grasslands identified animal **products** and different types of livestock as key. As animal products, all of them cover milk and meat and pork while the livestock treated cattle, sheep, goats, swine and poultry in all of them with the exception of sheep in the focus groups. A large number of operational groups has a larger number of products (up to 86) than the two other EIP-AGRI multi-actor activities (focus groups and multi-actor approach projects) including chickens and turkeys.

The **activities** associated with the EIP-AGRI multi-actor activities are various. The economic activity is the most relevant activity within the livestock and permanent grassland multi-actor approach projects, focus



groups and operational groups including farming systems and practices. In the case of the operational groups, product development and commercialization are also included. Production associated with milk and meat is also the main activities associated with livestock and permanent grassland sector. With regard to management, the multi-actor approach is associated with water and integrated management, focus groups with grassland management and finally operational groups with livestock management besides the grassland and resource management. Multi-actor projects are exclusively linked with animal feeding, data analysis and ecosystem and information services delivery, while focus groups are associated with grazing systems.

Sustainability and productivity are the two main **topics** for multi-actor approach projects, focus groups and operational groups. Quality and resilience are tackled in multi-actor approach projects and operational groups. Efficiency is mostly cited in the multi-actor approach projects, profitability and pollution in the focus groups while animal welfare is exclusively mentioned in the operational groups.

For livestock and permanent grassland sectors, the multi-actor approach projects and operational groups dealt with innovation, farm inputs and natural resources if we evaluate the **resources and management** section.

Both multi-actor approach projects and operational groups were working with pests of permanent grasslands and animal diseases within the **pest and diseases** sections.

5.2.4 Forestry

The forestry sector is treated in the operational groups but not extensively treated in focus groups or multi-actor approach projects concerning the **product** section which is associated to cork and non-wood forest products including cork and pinus and eucalyptus, so those species highly productive due to their short stand life.

With regard to the **activities**, the forestry multi-actor projects were mostly associated with both management (87%) pest and covering forest management and ecosystem services while focus groups were only linked to management. However, OG were mostly related to management but also economic activities production and processing.

Sustainability and climate change are the main **topics** tackled by both focus groups and operational groups in forestry. Moreover, operational groups are associated with quality, efficiency, productivity, soil properties, soil fertility and environmental impact.

Finally, with regard to the **resources and methods**, innovation was the most important activity linked to forestry while multi-actor projects also dealt with control methods and operational groups worked with natural resources, and fertilizers.

5.2.5 Cross-cutting

The main **activities** associated with cross-cutting multi-actor projects, operational groups and focus group dealt with economic activities, production and management activities, being the number of issues tackled large in the case of operational groups.

All types of EIP-AGRI activities (multi-actor approach projects, operational groups and focus groups) are working with the following topics sustainability, quality, efficiency and productivity, while climate change



is tackled by both operational groups and focus groups. Resilience is a keyword for the multi-actor approach project, while profitability is for focus groups and soil properties and environmental impact is for the operational groups.

The most important **resources and management** tackled in the cross-cutting section by multi-actor approach projects, operational groups and focus groups were innovation, natural resources, farm inputs. Both multi-actor projects and focus groups also dealt with substances (soil organic matter) and control methods, while marketing techniques were only treated by multi-actor approach projects. Operational groups also dealt with the farm inputs.

Pest and diseases are mainly associated with Fungal diseases were the main topic of multi-actor projects while pests were treated in the focus groups and both in operational groups.

With regard to the main content evaluated by the different MA, FG and OG EIP-AGRI networking activities in the five sectors we can conclude that All the EIP-AGRI analysed activities (MA projects, FG and OG) highlighted the importance of cross-cutting agriculture more related with sustainability, followed by permanent grasslands and livestock and arable crop, both Permanent crops and forestry are the less relevant activities for the MA projects, which may hinder sustainability in the future as the incorporation of woody perennials (either forest or permanent crops trees/shrubs) is key to foster adaptation and mitigation against climate change at the same time that increases biodiversity and all the associated ecosystem services. The cross-cutting agricultural sectors are highly relevant in the operational groups (almost a 50%) than with the Multi-actor approach projects (38%) and Operational Groups (25%), showing the higher awareness of experts by the future sustainability in the Multi-actor approach projects and focus groups when compared with the most practice-oriented activities associated to operational groups. Main products of arable and permanent crops are linked to vegetables (MA and OG) and fruits (MA and OG) and exclusively to FG the topics of industrial (arable) and processed foods (permanent crops). All types of animals and derived products (eg. 86 products in OG) are linked to livestock EIP-AGRI multi-actor activities, while forestry is usually working with profitable products associated to fast-growing tree species, cork and non-wood forest products. The main activities tackled by all evaluated sectors (arable crops, permanent crops, livestock and permanent grassland and cross-cutting sectors) excepting forestry are firstly related with the economic (commercialization, evaluation...), management (fertilization, irrigation, pest and disease control...) and production system (organic vs. conventional). However, forestry is firstly dealing with management and secondly with economic aspects mainly related to timber and non-timber forest products. Keywords for arable crops AGROVOC topics were productivity, product quality and resiliency for the MA projects, sustainability and efficiency for the FG and OG, and soil properties (FG) and finally climate change and environmental impact are key for OG. For the permanent crops, main topics are associated to sustainability (Ma, FG and OG) and quality (MA), productivity and resiliency (FG) and food quality, pollution, organoleptic properties, processing quality, climate change, efficiency, productivity and soil fertility are key for OG. Sustainability and climate change is key for the forestry sector focus groups while quality, efficiency, productivity, soil properties and fertility and environmental impact are key for the OG. The keywords for resources and management are those associated with innovation, pest control, natural resources in all EIP-AGRI networking activities of arable crops being both innovation and pest control relevant in the case of permanent crops and innovation, farm input and natural resources the most important for the livestock and permanent grassland sector. Innovation was the most important activity linked to the forestry sector while multi-actor project also dealt with control methods and operational groups worked with natural resources, and fertilizers. Similar keywords were found in those EIP-AGRI networking activities related to the cross-cutting sector: innovation, natural resources and farm inputs. Finally, with regard to the pest and diseases, MA projects were more related with weeds while OG and FG are also more associated to diseases in the case of arable crops, while only pest and diseases are treated by MA projects in permanent crops, and MA and OG work



with permanent grassland pests and animal diseases. There are no MA, OG and FG dealing with forest pest and diseases, while the cross-cutting sector is associated with fungal diseases in MA projects and pests in FG and OG.

5.3. Multi-actor EIP-AGRI declared networking

5.3.1 Multi-actor EIP-AGRI declared networking: synergies

Figure 19 shows the declared Networking of the projects about the different EIP-AGRI activities. Most of the networking of the MA projects were with other MA projects followed by operational groups, focus groups and thematic networks with a similar percentage. This means that around 18% of the MA projects did not establish synergies with other MA projects while this number reaches the 60% when we are speaking about the synergies of MA projects and the EIP-AGRI networking activities (FG and OG).

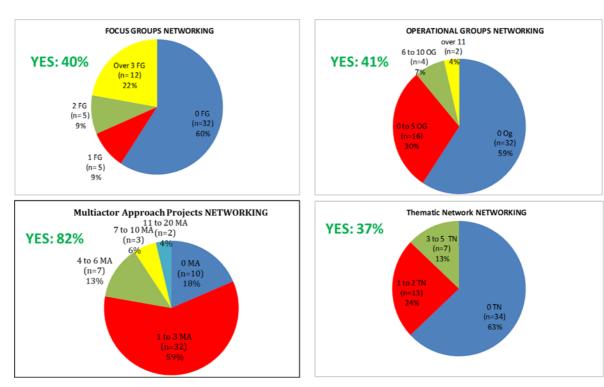


Figure 19. Declared networking of the interviewed MA-Projects with the EIP-AGRI Focus groups, Operational groups, MA and Thematic Networks

When we evaluate the synergies of MA projects with the National Rural Development programmes, the connection is rather low with only a 20% of the projects establishing some connection with the NRN, in spite of the large number of countries involved in the overall MA projects. Hereby, we will analyse the reasons behind the connections or the lack of them.

Figure 20 shows the conceptual map of the connections within the EIP-AGRI landscape declared by the MA Projects answering the EUREKA survey. MA project networking is structured by topics with five groups of independent networking which can be grouped in three: agricultural management, pest and diseases (including to groups working in tropical and European areas), policies and the microbial biodiversity use at field scale. The bigger group associated with agricultural management and is composed by six subgroups being one related with innovation development (LIAISON and EUREKA centred) associated with other groups such those associated through (i) TRUE dealing with the optimization of the resources by





developing nature-based solutions (Diverfarming and LegValue centre), through (ii) Organic-PLUS associated to the reduction of external inputs (RELACS, LANDMARK and FATIMA) and (iii) the optimization of the agri-food sector (SMARTCHAIN and SMART AGRIHUBS). Finally, the last two subgroups associated with LIAISON through the Irish National Rural Network is dealing with (iv) rural development programmes (RURALIZATION centred) and through the (v) socio-economic subgroup (NEXTFOOD centred). There are also other 4 smaller project networks linked to Tropical insect-borne diseases (MUSA and TROPICSAFE), integrated pest management (OPTIMA and FF-IPM) and with the Microbial biodiversity at field scale (EXCALIBUR and SIMBA) and policies (AGRICORE, MINDSET and BESTMAP).

5.3.1.1 Agricultural Management

The agricultural management network is composed by a set of subgroups connected across subgroups like those related with external inputs reduction (ORGANIC-PLUS, RELACS and PPILLOW), innovation transformation (LIASON and EUREKA), resource optimization linked to nature-based farming systems (LegValue and Diverfarming) as shown in Figure 20. There are some MA projects acting as connectors between the subgroups such as TRUE connecting the legume-based farming systems subgroup and the innovation subgroup. There are some networks connected by Focus groups such as those connecting aiming at external inputs reduction (ORGANIC-PLUS and FATIMA) connected through the Organic farming focus group. Also, the National Rural Development Programmes can act as connectors, in this case between LIAISON and RURALIZATION centred MA project networks. The Thematic network OK-Net Ecofeed is linked RELACS and PPILOW joining aspects of crop productions pest and diseases with livestock farming systems (ICT, Antibiotics reduction, genetics...) The subgroups of Innovation, nature-based solutions and input reduction are associated with thematic networks and operational groups. However, the one associated with Rural Development programmes is only associated with a thematic network. Only LIAISON the innovation subgroup is associated with National Rural Networks.

5.3.1.1.1 Innovation transformation

Innovation transformation is a subgroup of the agricultural management network associated with the reduction of the external input through ORGANIC-PLUS, with the crop diversification through LegValue Multi-actor project, with the socio-economic aspects through RUBIZMO, DESIRA and RURALIZATION and with the short value chains through SMARTCHAIN. The central projects (LIAISON and EUREKA) dealing with the optimization of innovation interactions are well aligned with the EURAKNOS project analysing how the innovation should be fostered across different farmers of Europe by providing a common database for the information delivery related to thematic networks (EURAKNOS). Besides these connections they deal with FAirWAY, AgroCycle, both working with the governance of water and wastes, respectively, and XF-ACTORS associated with an olive pest. The innovation transformation network is also related to two TN EURAKNOS and AFINET. This specific network is also associated with three different NRN (Germany, UK and Ireland), five operational groups. This subgroup is unique with all types of connections excepting focus groups, but probably they could have more operational groups relationships. Therefore LIAISON is the centre of projects trying to move information to facilitate the adoption of sustainability by farmers. LIAISON is therefore the centre of projects promoting good innovation development, governance and external inputs at EU level. EUREKA is a central project analysing all MA projects and it is connecting the topics of TRUE (connecting the legume-based farming systems subgroup), NEXTFOOD (connecting with a subnetwork of socio-economic aspects associated to business model development, education, etc.), SMARTCHAIN (Short food supply chains) but not organic farming systems but not with the nature based solutions which are linked through LIASON.

5.3.1.1.2. External inputs reduction



This subgroup is centred in ORGANIC-PLUS working with the promotion of sustainable management in organic farms and it is connected with those MA projects aiming at reducing the external inputs in soils (RELACS), croplands (FATIMA) and multiple geographic scales (LANDMARKS). They are connected with two important Thematic Networks (Nutriman and OK-NET-ECOFEED) and six focus groups, being the unique subgroup directly linked to focus groups. ORGANIC PLUS is connected with innovation network centred in LIAISON.

5.3.1.1.3 Legume based and crop diversification farming systems

The Leg value subgroup is highly relevant for the EU sustainability. Protein production is one of the most critical factors associated to feed and food production and quality and the improvement of the soil. This network is linked to the operational group of SOS PROTEIN and the Thematic Network Legumes Translated. We realized that, for example, the focus groups of "protein crops" could have been useful for this network. Both LegValue is connected with the topic of Diverfarming dealing with the promotion of the biodiversity Diverfarming directly connected with the use of temporal biodiversity through crop rotation (DIVERIMPACTS) or spatial biodiversity through the best crop combinations highlighted by DIVERSIFY and REMIX also dealing with genetic diversity.

5.3.1.1.4 Rural Development promotion

RURALIZATION is the centre of the subgroup of projects associated with rural development programmes more linked to social aspects and aiming at linking urban and rural areas. RURALIZATION is connected with PoliRural aiming to protect the landscape of rural areas, DESIRA aiming to analyse the impact of digitization in Rural Areas and SHERPA dealing with policies in rural areas. RURALIZATION is associated with the socio-economic network promotion centred in Nextfood through the thematic network NEWBIE.

5.3.1.1.5 Socio-Economic Network

NEXTFOOD is the centre of the socio-economic network linked to the digitalization of rural areas (DESIRA), business models (RUBIZMO), food systems (FOODSHIFT2030 and FOOD TRIALS) and transport networking (TERMINET). The Nextfood is associated with the EUREKA project and therefore with the innovation network.

5.3.1.1.6 Agri-food sector

The Smart-Agri Hubs project associated with the digital transformation of the European agri-food sector which is connected with SMARTCHAIN dealing with short food supply chains. SMARTCHAIN is the centre of a network associated with 6 MA projects but only with the Thematic Network of EURAKNOS. SMARTCHAIN is associated with Stregth2food a project improving the effectiveness of EU food quality schemes, the public sector food procurement and stimulate short food supply chains. SMARTCHAIN is also associated with the improvement of food systems through digitalization (SMART AGRI-Hubs), balanced distribution of value chains (FAIRCHAIN), integrative innovative approaches to improve agrifood value chains (CO-FRESH), interlinking of EU food chains (FOODRUS), food west reduction (LOWINFOOD) and value chain rebalance (PLOUTOS).

5.3.1.2 Pest and diseases

The pest and disease network is composed of two micro-networks. One of the micro-networks is based in the EU pest and diseases challenges and related to integrated pest management (OPTIMA and FF-IPM)



and the other is associated to tropical areas through the evaluation of tropical insect-borne diseases (MUSA and TROPICSAFE) which is associated to an Operational group named COPLACA.

5.3.1.3 Policies

There is another group of three projects associated with policies, which are connected among them, they are AGRICORE whose ICT tools are used to optimize policies, BEST-MAP which aim to support the Green Deal and Mind-step aiming to include agricultural and biophysical data to evaluate policy impacts.

5.3.1.4 Microbial biodiversity at field scale

Two projects are composing this network: EXCALIBUR aiming at exploring multifunctional microbial inoculants in horticulture and SIMBA aiming at interconnect food chains related with crop production and aquaculture through the identification of microbioma and optimize its use.

We can conclude that in spite of over 100 declared connections, the analysis of the current networking of the MA projects showed some areas well-structured and connected, such as those related with innovations, nature-based solutions and external input reduction, with others more incipient such as the pest and diseases and the agri-food sector. The connectivity of these MA projects with other EIP-AGRI networking activities (FG, OG or TN) is rather low in most of the cases, therefore not exploiting the potential of the NRN resources to be connected with the farming systems in Europe.

This reduced connectivity among the MA projects with the other EIP-AGRI activities (Focus groups or Operational groups) limits the potential synergies to benefit the research and innovation in Europe. Another worrying aspect is the lack of connection of the project results with the National Rural Networks, which reduces the possibility of performing more targeted policies based on research results in agriculture. This fact was presented in the SCAR-AKIS group whose members declared that they had the feeling that these connections are rather small, in spite of the particular efforts they are carrying out, mainly because of the lack of an appropriate organization. SCAR-AKIS members proposed several actions to improve the lack of connection among EU research and the National Rural Networks, where the National contact points may play a key role (NCPs).

More connections between the NRNs and the EIP-Agri service point/EC and the MAs. In general, some procedures on information flows between NRNs from the EIP-Agri service point/EC and NRNs should be set up to be applied at systematic basis, beyond the on-spot information on workshops. Among them:

Systematic Information to the NRN about the work-in-progress/results of the FGs and more seriously engagement of national experts in dissemination activities through the NRNs. Almost all the experts participating in FGs have been not in contact with NRN and the information on the results of the FGs had to be gathered like we were other citizens.

Information on MAs and other H2020 projects by NRN should be part of the respective action plans.

NCPs should be "forced" to stay in contact with the NRN as part of their mandate and the collaboration among NCPs and NRNs should be explicitly part of the respective mandate.

For certain research MAs the collaboration with NRNs should be explicitly asked within the Work programme with the plan of act as connectors between research and productive worlds at national level.



This would be important also to overcome the limitations on languages (i.e. the MAs deliverables are very often not translated in national languages).

Actions for managing authorities and OGs. Here the problem is simply that the requirement for promoting the connections with OG is only for the NRNs. Instead, it should be set also for OGs, promoting reciprocal communication and interaction. This is particularly important because in regionalized countries the managing authorities tend to "filtrate" the relations among the two of them.

Identification and dissemination of practical examples of communication, dissemination, and information activities on projects. Managing authorities and OGs are lacking guidelines, examples, or lists of possible effective communication actions which help the dissemination and the socialization of the projects activities and results.

Space of common actions between MAs should be promoted when they are selected. At the level of the Horizon Europe Work Programme this is sometimes already asked: "linkages with the call...". Maybe, the effective application of the requirement should be ascertained during their implementation. Besides, a similar obligation should be set for OGs.

Practice abstracts are sent directly from OGs/ managing authorities to the EC. NRNs are excluded from this information and very possibly are informed from the EIP AGRI service point on the selection of OGs. In the case of Italy it was developed a monitoring system, which implementation however encountered some difficulties from the managing authorities, and at regime it can be asserted that the NRN is very timely informed on the selection of new OGs for some countries.

Dissemination of updated information throw official EC working groups (Leader, Bioeconomy, Innovation);

USE the different specific Events organised by EIP-AGRI or ENRD. For example: EIP-AGRI workshops "How to build strong EIP-AGRI in Europe?", where each country normally is represented by persons from Managing authority, Paying Agency and NRN.

Continuously strong cooperation with EIP-AGRI SP in terms of Newsletters, Brochures, flash-news, articles, videos. Usually, a majority of MA representatives are EIP-AGRI info-space passive subscribers or followers.

Use assistance of Horizon2020 national Contact Points. In case of Estonia – Estonian Research Council (https://www.etag.ee/en/). We know that they are providing some sort of information (concerning new calls for applications, strategic documents) directly to the ministries. Still, modalities for connections (common actions) between different types of MAs are not known by NRNs and managing authorities, neither MAs.

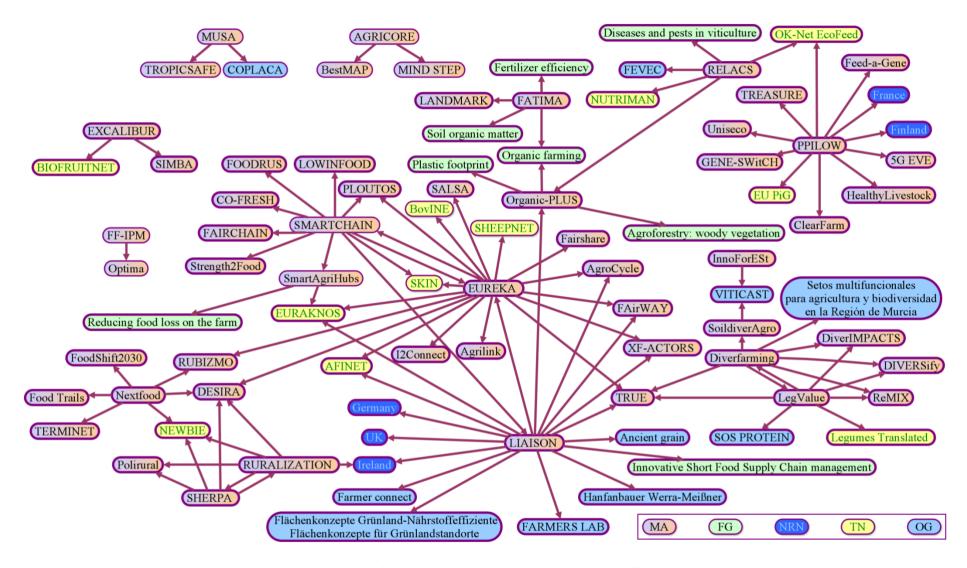


Figure 20. Conceptual map of the MA project declared connections among the different MA projects.

5.3.2 Multi-actor EIP-AGRI networking: motivation

5.3.2.1. Multi-actor/Multi-actor

Figure 21 shows the main aim to start links with other MA projects. The answer highlights that the initial reasons were to develop dissemination and communication as well as technical collaborations in second place but also fulfil the grant agreement contract and to get advantage from already existing contacts. However, geographical proximity is not seen as a reason to network, probably due to the already established geographic networks within the MA project consortium. There were other declared reasons behind to start to make networking with other Multi-actor projects such as being a sister project in the same call, so somehow a forced collaboration by the EC but also the fact to have common research projects with different or similar countries.

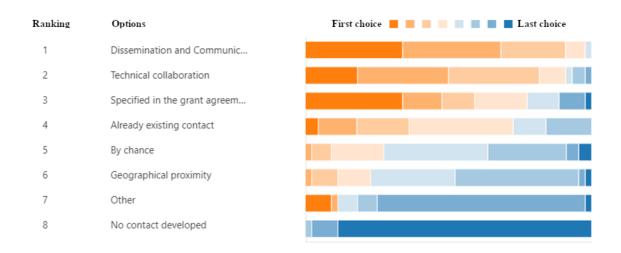


Figure 21 Reasons behind to initiate MA projects links

Figure 22 reflects the reasons behind the connections of MA projects among them, with a very low proportion of projects that do not have connections. Networking and defining innovations were the main aims to establish links with other MA projects, followed by using dissemination channels and defining challenges and developing dissemination materials. Therefore, searching for the best content (defining of challenges and finding innovations) are seen as a priority over dissemination as a reason behind to develop a network among multi-actor projects, which was the opposite when they initially intended to contact. Moreover, the MA project coordinators identified other regions such as foster policy, share knowledge which may be linked to the defining challenges and innovations but also avoid duplications, which is a way of optimizing the use of the EU resources.





Figure 22. Final aims behind to link MA projects

We can conclude that even if the initial intention to contact a MA project was to search for technical collaboration and initiate Communication and Dissemination activities, finally they found more relevant to carry out networking and define innovations. Geographic proximity is not seen as a reason to work together for the MA.

5.3.2.2 Multi-actor/Operational groups

When answered about the purpose of MA to contact with Operational Groups (OGs), dissemination and communication highlights as the main one, clearly followed as the first choice by grant agreement requirements. Technical collaboration outstands as another important point, being selected as the second reason to start OGs linkage by a significant proportion of participants (Figure 23). Geographical proximity and already existing contact are other options not so relevant for the MA coordinators.

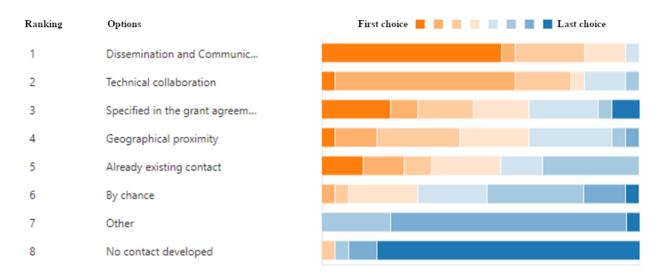


Figure 23. Linking with Operational Groups main movers

Defining challenges, networking and defining innovations are the main reasons for linking with OGs (Figure 24) since these were selected in a major proportion as first and second choice by respondents. Being it expected since OGs are implemented in the field and should provide key inputs to MA projects. In addition, using dissemination channels was significantly selected as the first choice but for a more



reduced number of participants. On the other hand, developing dissemination material was the less selected goal claimed as prime by MA respondents.

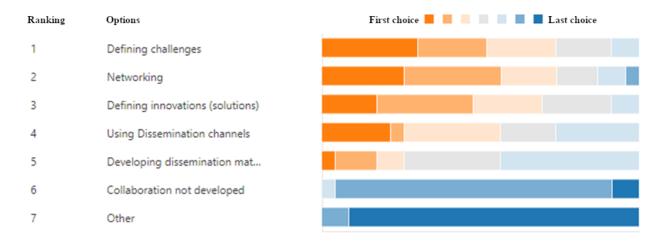


Figure 24. Aims for the linkage of MA projects and OGs.

As happened with the relationship MA/MA, the main reason to start a relationship among a MA project and OGs was to search for technical collaborations, foster Communication and Dissemination and because it was part of the grand agreement. However, defining challenges, innovations and networking was the main reason once the link was established, as happened with the MA/MA interactions. Geographic proximity is not seen as a reason to work together for the MA with the OGs.

5.3.2.3 Multi-actor/Focus groups

When dealing with the main reasons for linking to FG the most influential point for entailment referred by MA project respondents is that it was specified in the grant agreement. A similar weighing present both dissemination and communication purposes and technical collaboration (Figure 25). Already existing contact was a reason referred in a minor proportion while geographical proximity was one of the less influential reasons for establishing networking with FGs which indicates it is a real collaboration flow to enrich MA outputs.

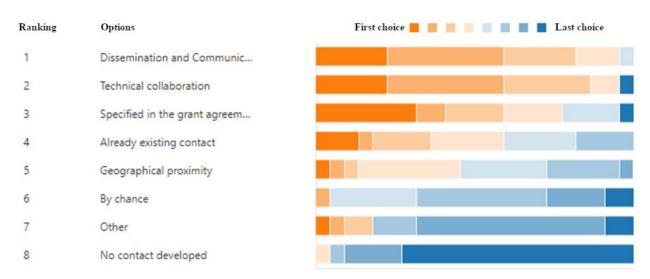


Figure 25. Reasons for MA projects linking with Focus Groups.





Regarding the purpose of MA to establish links with FGs, two options outstand among all, defining both challenges and innovations. Thus, these two options were clicked first or second option by the majority of respondents (Figure 26). It seems clear that a linkage for defining objectives and establishing a framework was sought by MA project coordination teams in order to achieve its goals. On the other hand, developing dissemination materials, but also networking were less influential reasons to bond MA and FGs.

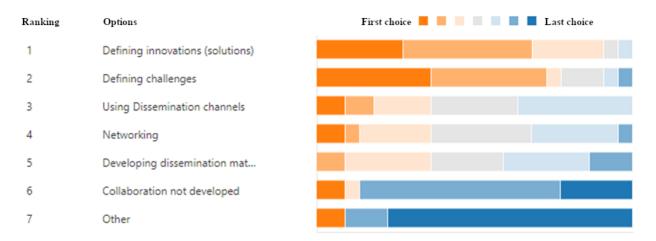


Figure 26. Aims to link MA projects with FGs.

Focus groups are a group of experts joining together a couple of times to discuss about the state of play of practice and research in the field listing challenges and opportunities, identifying research and practice needs and suggest innovations to be developed at local level through the use of operational groups. This makes clear the fact that they could be an inspiring forum if the participants of the projects are part of the focus group where an interaction with dissemination and communication from the project results is seen as essential. Moreover, MA can be helped to identify both challenges and innovations when reading the initial and final report as well as the mini-papers created within the FG framework.

5.3.2.4 Multi-actor/Thematic networks

The predominant motivation expressed by MA projects to establish contact with Thematic Networks (TNs) was related to dissemination and communication purposes, while technical collaboration was referred in heading positions also by a significant proportion of respondents (Figure 27). Already existing contact and the specification of this linkage need in the grant agreement were also pointed out by some of the participants as important reasons for establishing connections. On the opposite, geographical proximity seems to have had a minor role for most of the interviewees.



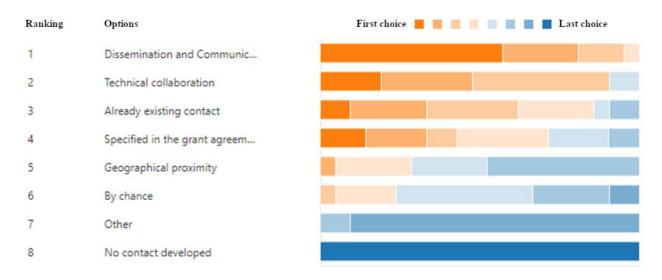


Figure 27. Drivers for linking MA projects with TNs

The main reasons for establishing links to TNs were using dissemination channels and networking while defining innovations and defining challenges stand in a lower position for most of the survey respondents (Figure 28). Developing dissemination material was not selected as the first option by any MA but still, some MA projects have identified it as an important motivation for linkage with TNs.

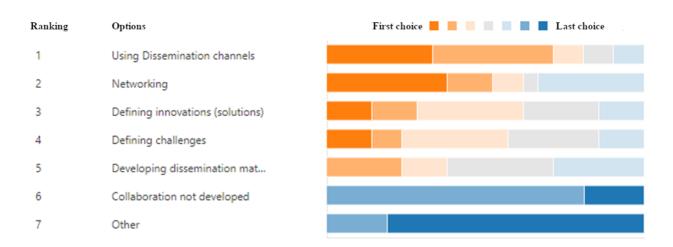


Figure 28. Main purposes when establishing links between MA projects and TNs

We can conclude that as happened with most of the interactions among the MA projects and the EIP-AGRI networking activities (MA, OG, FG), the TN initial purpose was to perform communication and dissemination activities and pursuing technical collaborations, but once this connection is established the interaction MA/TN is sees as a way of using dissemination channel for a specific purpose and develop networking, which is different when compared with the relationships MA/MA, MA/OG and MA/FG searching for defining challenges and innovations.



5.3.2.5 Multi-actor/National Rural Network

Dissemination and communication appear as the main reason for contacting National Rural Network (Figure 29), while technical collaboration and already existing contact are also remarkable reasons for setting collaboration up. It seems clear the linking between MA projects and NRNs needs of geographical proximity being, therefore, this and specified in the grant agreement less relevant motives for linking with NRNs.

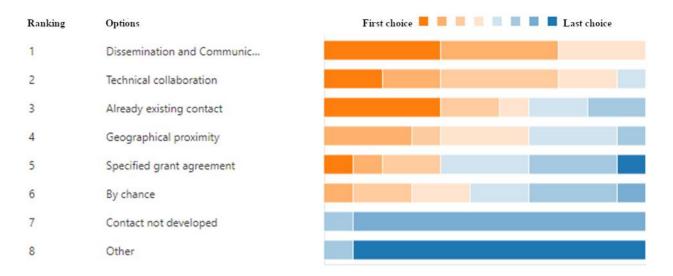


Figure 29. Reasons for establishing linkage between MA projects and NRN

The purposes for establishing links with NRNs were various in similar proportion. Thus, using dissemination channels, defining challenges, defining innovations and networking were the main aims for this linkage, while developing dissemination materials and just being specified in the grant agreement were the reasons why MA projects considered the MA/NRN interaction at least extent (Figure 30).



Figure 30. Main purposes when establishing linkages between MA projects and NRN

As happened with most of the contacts established by the MA projects with the other EIP-AGRI activities, the reason to start the activities was also searching for Communication and Dissemination and Technical collaboration, but in the specific case of the MA/NRN interactions already existing contact is seen as essential to establish the interaction. This means that it is not an easy task to start. Once the contact is



established defining challenges/innovation and networking are the reasons behind the interaction as happened with the other EIP-AGRI activities but also to use the NRN dissemination channels.

6. Conclusions

This deliverable describes an important network of connections between 101 Horizon 2020 multi-actor projects, which includes almost 70000 bilateral connections among the different partners. The coordination of the projects is mostly associated to large countries like France and Italy linked to RIAs, Spain to IAs and UK to CSA. The countries having the largest number of MAP partners are Spain, Italy and France. The networking analysis showed that these countries together with the Netherlands had the largest networks of all European countries, involving in total 73 countries all over the world. Some of the large individual countries in Europe themselves had established project contacts in more than 60 different countries worldwide.

Western and Southern EU countries are the most connected regions, with networks that connect Europe and extend to many countries beyond. For all four EU defined regions, the largest number of interactions outside of Europe is with countries from Asia, and the least with those in Oceania. The high interaction with Asia may be largely explained by the bilateral agreement between Europe and China to develop joint research projects within the 2014-2020 period. The total number of bilateral contacts was more related to the total population of the country than with the area it occupies, highlighting the importance of people themselves in driving agricultural innovation.

The number of bilateral interactions developed in FG are rather low compared to those in MA projects, accounting for only around 16000 interactions compared with the 70000 of the MA connections. Most FG were based in large countries such as Spain, France and Italy followed by The Netherlands and Belgium. While FG membership is technically restricted to European Union members, some additional countries such as Switzerland and Georgia were also present. Western EU countries, followed by Southern, have the most connected networks compared with those in the Northern EU. As with MA projects, the participation in FG is more related to the number of inhabitants of a country than with the land area the country has, highlighting that people are the key factor.

Despite the lack of update of the EIP-AGRI with regard to the operational groups, it is clear that the largest number of OG are linked to those countries having Regional Rural Development Networks, additional to the National Rural Development Network, with Portugal being the one exception. Eastern countries, with a lower degree of innovation and research activity, have relatively low OG representation. This could be explained by the fact that different approaches have been taken by countries in terms of the types of projects implemented: some have pursued a high number of projects that are shorter (~2 years) in duration, while others opted for a longer-term execution period. In our view, the latter approach seems more appropriate if long-term sustainability aspects are taken into account and prioritized.

All the EIP-AGRI analysed activities (MA projects, FG and OG) highlighted the importance of cross-cutting agriculture more related with sustainability global concept, followed by permanent grasslands and livestock and arable crop. Moreover, permanent crops and forestry are the less relevant activities for the MA projects, which may hinder sustainability in the future as the incorporation of woody perennials (either forest or permanent crops trees/shrubs) is key to fostering adaptation and mitigation against climate change and at the same time increases biodiversity and all the associated ecosystem services. The cross-cutting agricultural sectors are more highly represented in the OG (nearly 50%) than in MA projects (38%) and OG (25%), perhaps indicating a higher awareness by experts of the future sustainability in the MA projects and FG when compared with the most practice-oriented activities associated to OG.



The major **products** tackled within arable and permanent crops are vegetables (MA and OG) and fruits (MA and OG). FG are more related to the topics of industrial (arable) and processed foods (permanent crops). All types of animals and derived products (e.g. 86 products in OG) are linked to livestock EIP-AGRI multi-actor activities, while forestry is usually working with profitable products associated to fast-growing tree species, cork and non-wood forest products. The main **activities** tackled by all evaluated sectors (arable crops, permanent crops, livestock and permanent grassland and cross-cutting sectors) excepting forestry are first related to the economic (commercialization, evaluation...), management (fertilization, irrigation, pest and disease control...) and production system (e.g., organic vs. conventional). However, forestry is firstly dealing with management and secondly with economic aspects mainly related to timber and non-timber forest products.

Key words for arable crops AGROVOC topics were productivity, product quality and resiliency for the MA projects, sustainability and efficiency for the FG and OG, and soil properties (FG) and finally climate change and environmental impact are key for OG. For the permanent crops, main topics are associated to sustainability (Ma, FG and OG) and quality (MA), productivity and resiliency (FG) and food quality, pollution, organoleptic properties, processing quality, climate change, efficiency, productivity and soil fertility are key for OG. Sustainability and climate change is key for the forestry sector focus groups while quality, efficiency, productivity, soil properties and fertility and environmental impact are key for the OG. The key words for **resources** and **management** are those associated with innovation, pest control, natural resources in all EIP-AGRI networking activities of arable crops being both innovation and pest control relevant in the case of permanent crops and innovation, farm input and natural resources the most important for the livestock and permanent grassland sector. Innovation was the most important activity linked to the forestry sector while multi-actor project also dealt with control methods and operational groups worked with natural resources, and fertilizers. Similar key words were found in those EIP-AGRI networking activities related to the cross-cutting sector: innovation, natural resources and farm inputs. Finally, with regard to the pest and diseases, MA projects were more related with weeds while OG and FG are also more associated to diseases in the case of arable crops, while only pest and diseases are treated by MA projects in permanent crops, and MA and OG work with permanent grassland pests and animal diseases. There are no MA, OG and FG dealing with forest pest and diseases, while the crosscutting sector is associated with fungal diseases in MA projects and pests in FG and OG.

The analysis of the current networking of the MA projects showed some innovation areas well-structured and connected, such as those related with innovations, nature-based solutions and external input reduction, with others more incipient such as the pest and diseases and the agri-food sector. The connectivity of these MA projects with other EIP-AGRI networking activities (FG, OG or TN) is rather low in most of the cases, therefore not exploiting the potential of the NRN resources to be connected with the farming systems in Europe.

The interaction among MA projects and OG, FG, TN and NRN was initially thought to enhance communication and dissemination activities and pursuing technical collaborations. Once the interaction is initiated, most of the activities are developed to define challenges (MA/OG, MA/FG, MA/TN and MA/NRN) and innovations (MA/MA, MA/OG, MA/FG, MA/TN and MA/NRN) being also the NRN used because of the already developed dissemination challenges. Networking was also a reason to maintain contact among MA/MA, MA/OG, MA/TN and MA/NRN). A clear development of systematic connections should be provided to enhance the synergies among the different EIP-AGRI landscape.



7. Recommendations

There is an excellent research network established across Europe, but it is mostly between countries in the Southern, Western, and Northern regions. Strong efforts should be carried out to promote research networking in Eastern Europe, both within the region and with other EU countries, while enhancing the networking in the other parts of Europe through both MA and FG activities.

Operational groups' fast data update in the EIP-AGRI database is essential to share the knowledge created within each country. This activity should therefore be promoted as a network of living labs across Europe fostering the strong involvement of farmers and their collaboration in the innovation process. Moreover, it is recommended to foster cross-country operational groups.

Most of the relevant products, activities, topics, management and resources, and pest and diseases are tackled by the MA networking activities of the EIP-AGRI, however, a better structuring of the information gained, with translation to different languages, will help to overcome some of the highest barriers to innovation.

In spite of the large number of potential connections established within the different EIP-AGRI activities, the MA project declared interconnection among them is rather poor. A better explanation of the purpose of FG, OG and TN connection activities should be provided and searched in the proposals when they are evaluated and approved and before project funding to ensure these connections happen when the projects are approved. For example, specific public deliverables (at the mid-term review and at the end of the project) should include a summary of the main networking activities carried out. Specific indicators such as number and type of interactions should be compulsorily provided to better structure the EIP-AGRI activities network. This will help to foster the interactions, which currently fall short of their full potential in scope and number.

The reasons behind the establishment of MA projects connections and the EIP-AGRI activities are clear, meaning that MA project partners and coordinators know these connections are essential. However, the low actual implementation of such connections should be overcome by establishing clear aims and timing along the project life. Specifically, we recommend that events be organized between the NRN and TN, FG and OG participants in order to share their experiences and to foster knowledge exchange and innovation. This information should be available for all people that wish to understand innovation in each specific sector.

In general, procedures to facilitate information flows between NRNs from the EIP-AGRI service point/EC and NRNs should be set up to be applied systematically, going beyond the current on-the-spot information provided in workshops. This would help to link all EIP-AGRI programs and activities (FG, OG, MA and TN). The requirement for promoting the connections with OG is currently only applied in the NRNs, while this interaction should be an important component of all EC/EIP-AGRI projects.

8. References

Mosquera-Losada, M.R., Santiago Freijanes, J.J., Pisanelli, A., Rois, M., Smith, J., den Herder, M., Moreno, G., Malignier, N., Mirazo, J.R., Lamersdorf, N., Ferreiro Domínguez, N., Balaguer, F., Pantera, A., Rigueiro-Rodríguez, A., Gonzalez-Hernández, P., Fernández-Lorenzo J.L., Romero-Franco, R., Chalmin, A., Garcia de Jalon, S., Garnett, K., Graves, A., Burgess, P.J. (2016). Extent and success of current policy measures to





promote agroforestry across Europe. Deliverable 8.23 for EU FP7 Research Project: AGFORWARD 613520. (8 December 2016). 95 pp.

Pedregosa et al. Scikit-learn: Machine Learning in Python, JMLR 12, pp. 2825-2830, 2011.

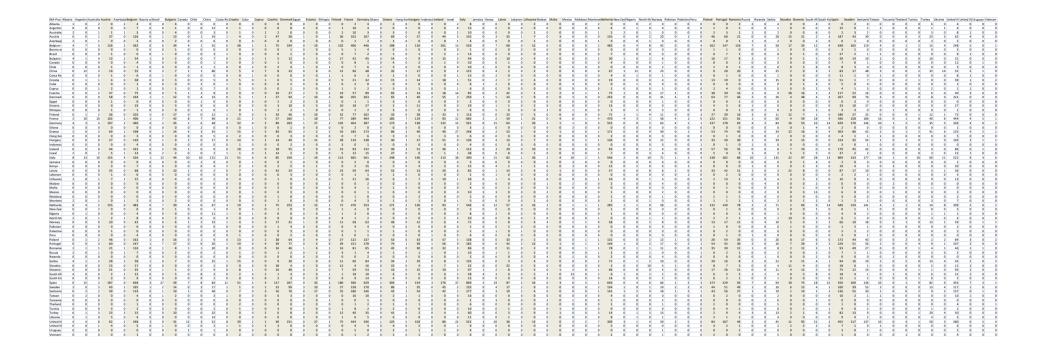
Tharwat A . "Classification assessment methods". Applied Computing and Informatics, 2018. doi:10.1016/j.aci.2018.08.003



9. ANNEXES

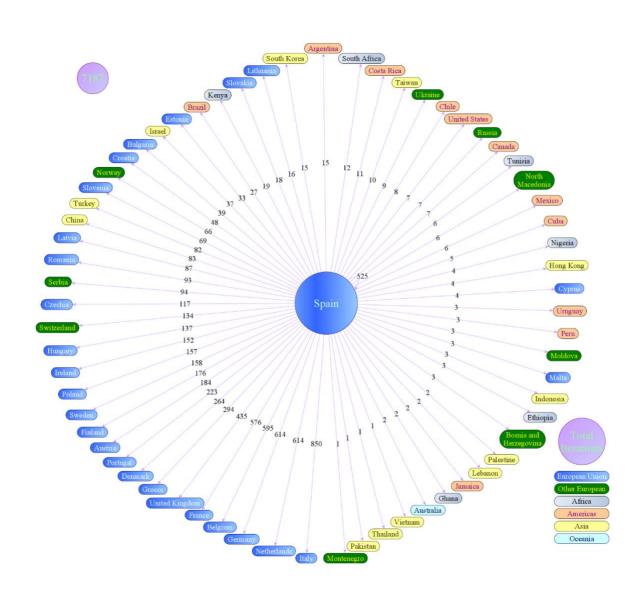


ANNEX I: Number of synergies established between the countries with regard to the MA projects

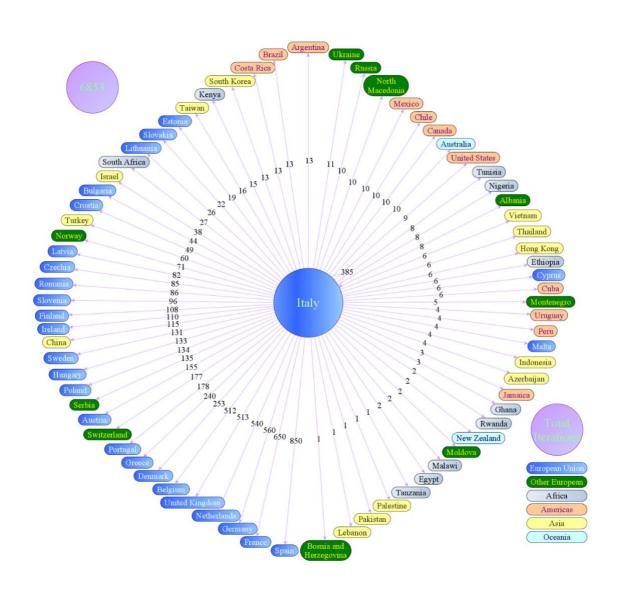


ANNEX II: Conceptual maps of MA interactions per country

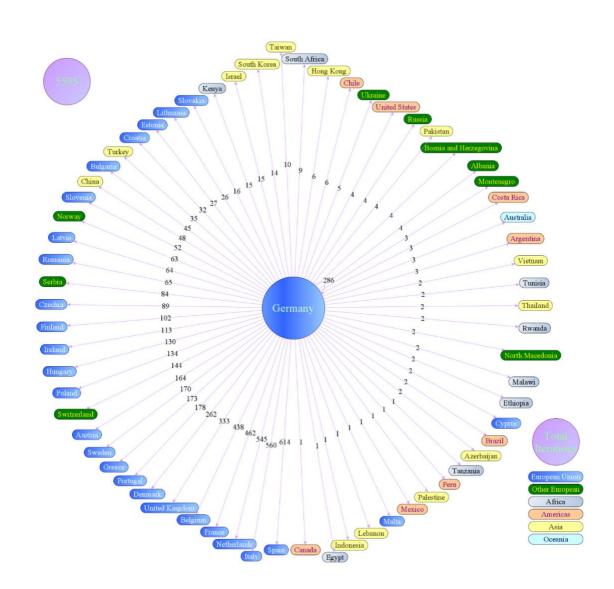




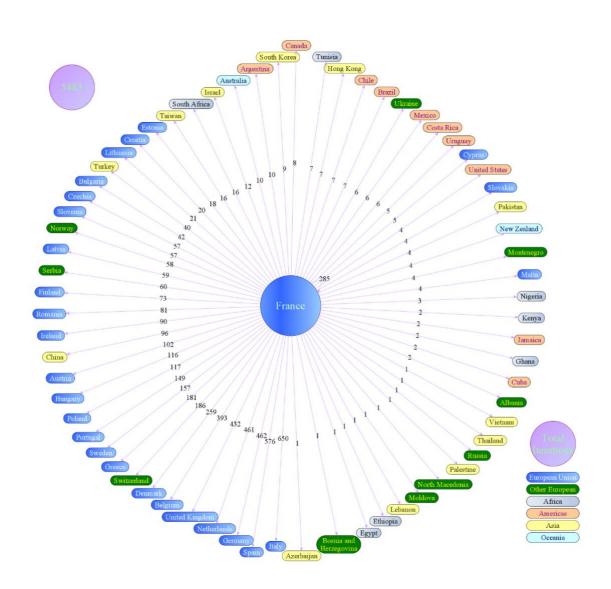




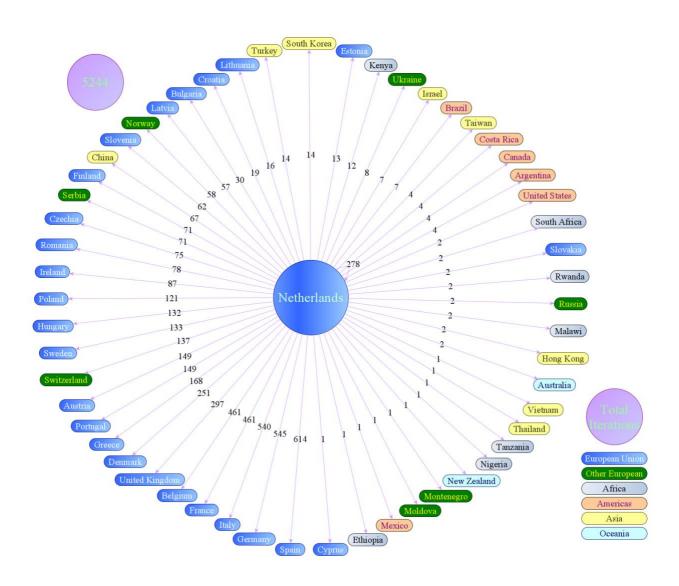




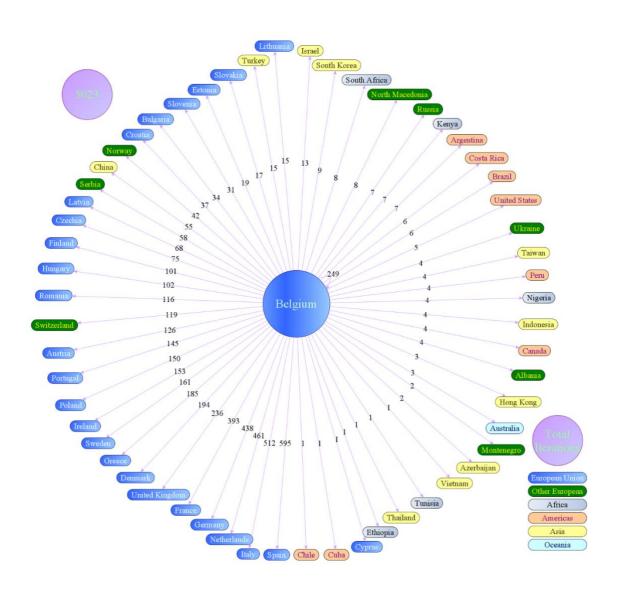




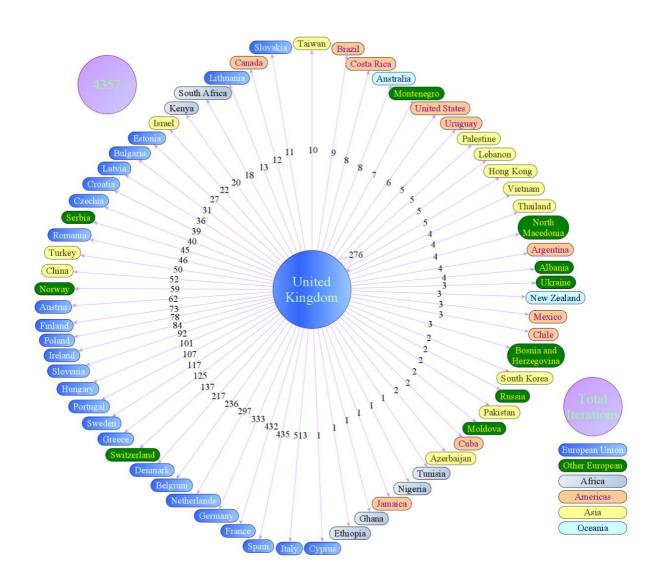




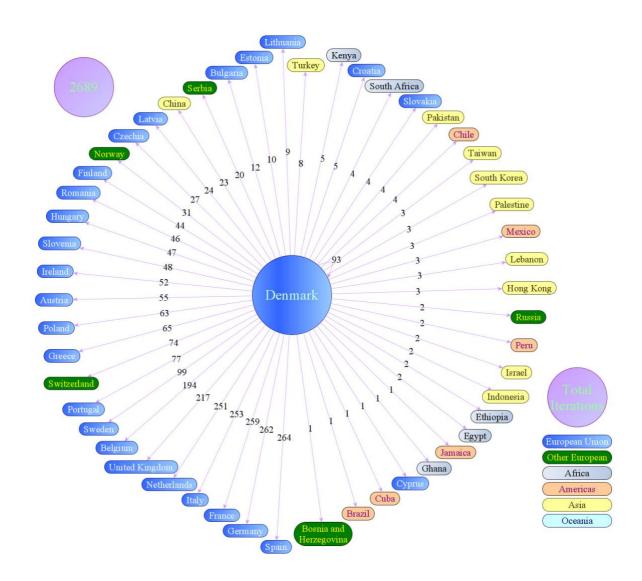




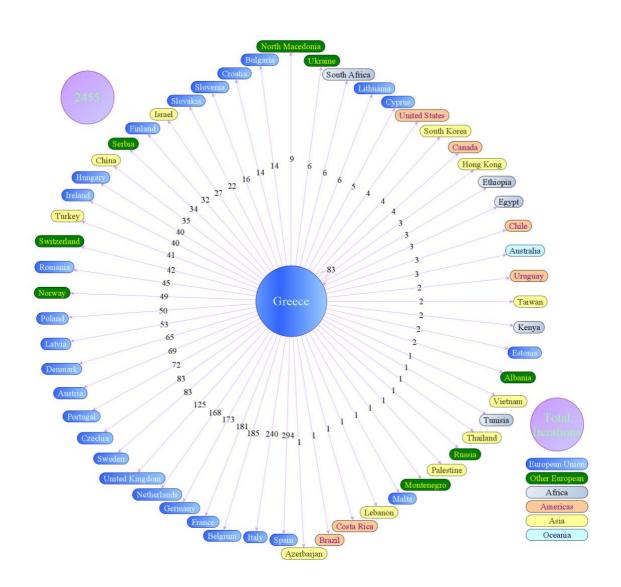




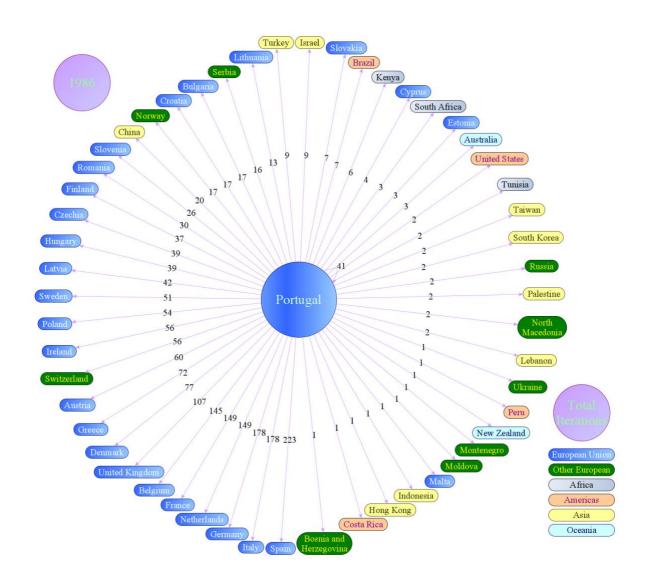




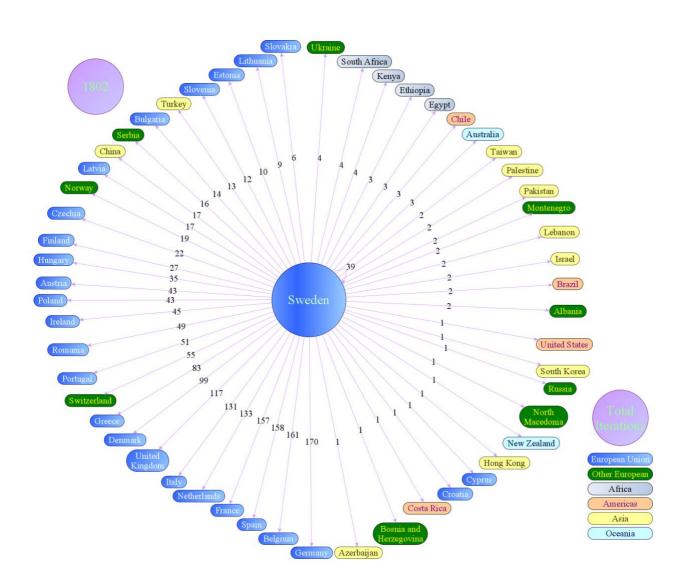




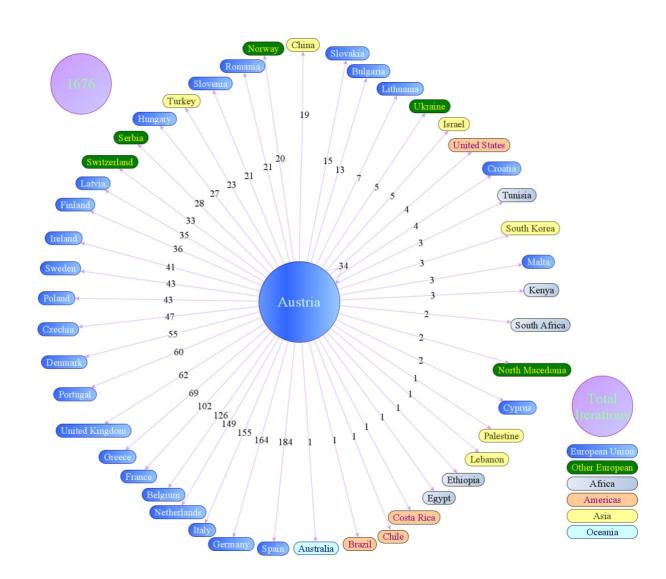




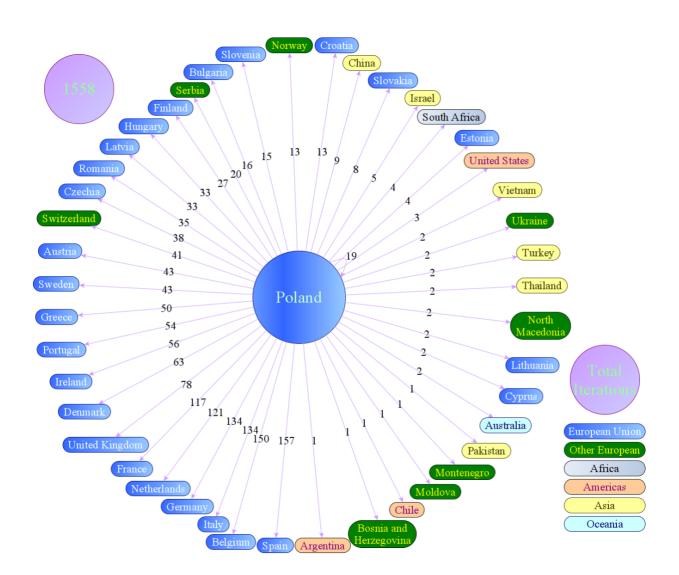




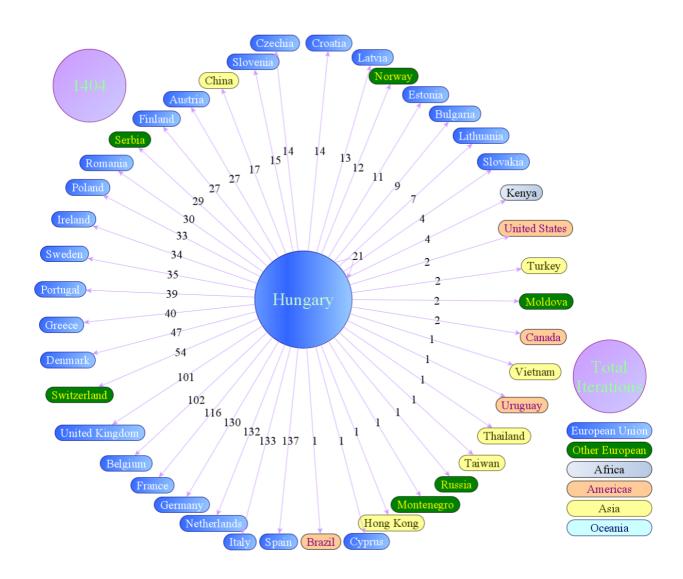




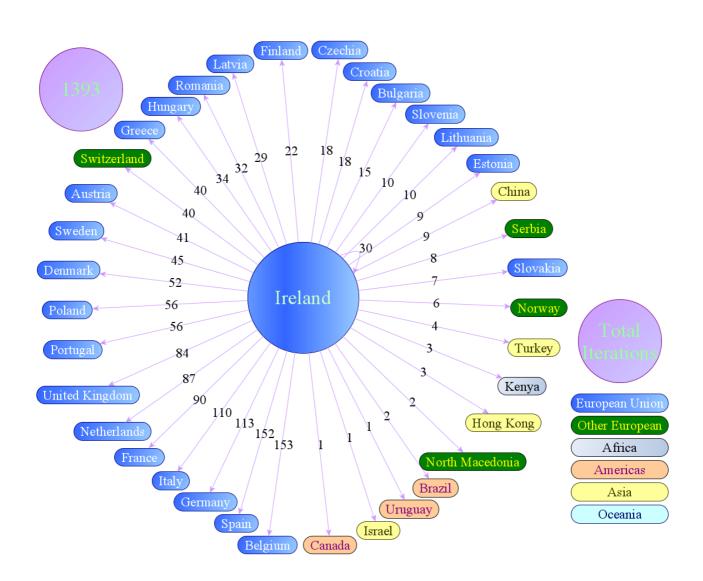




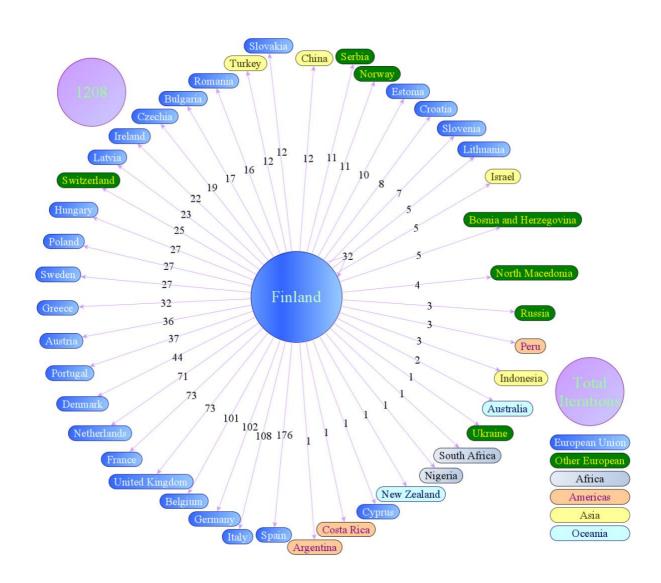




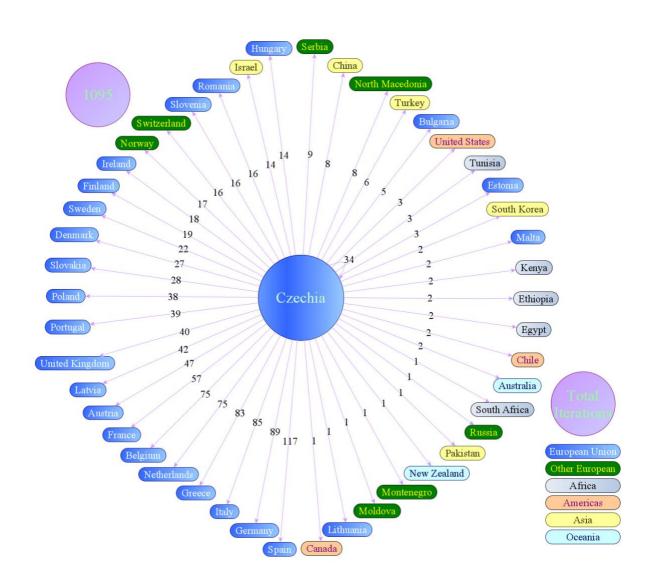




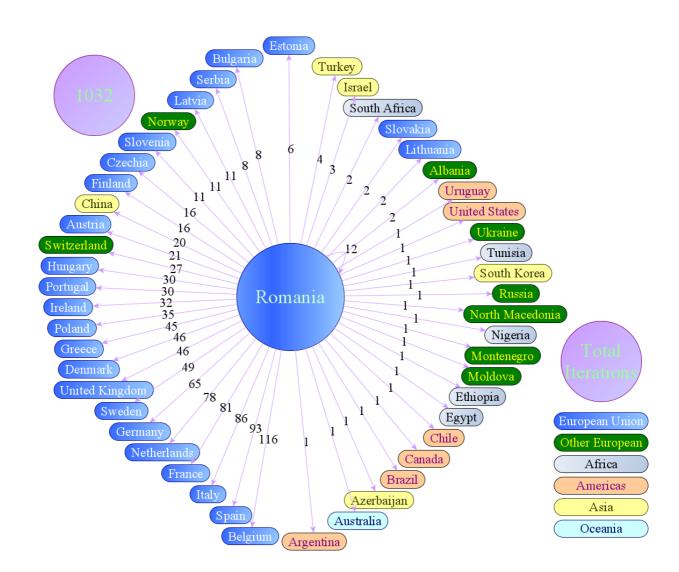




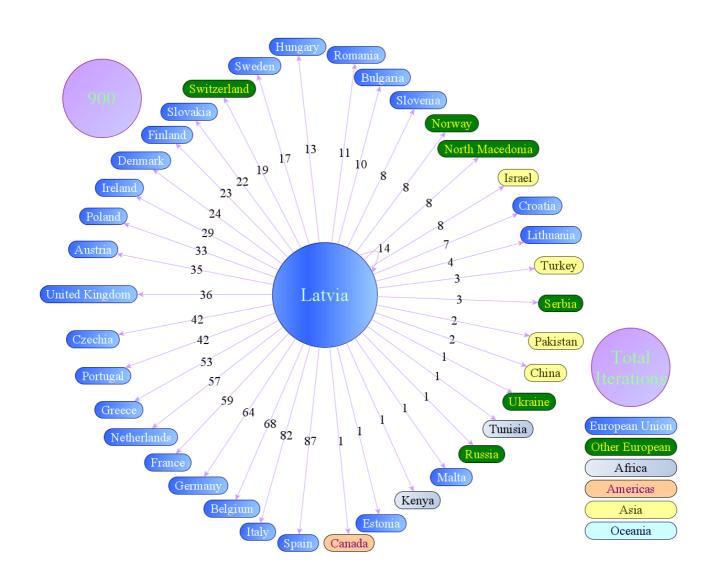




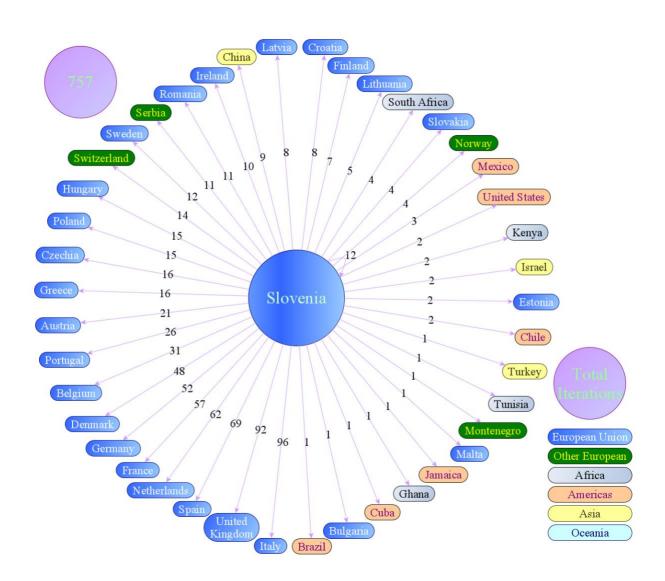




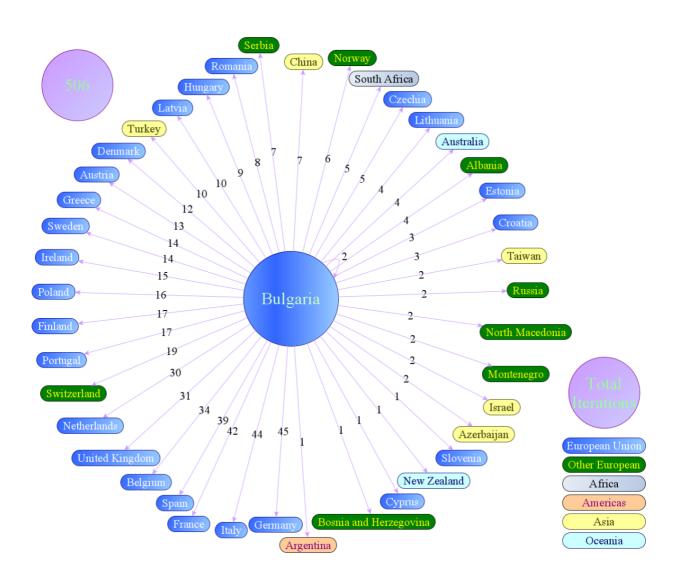




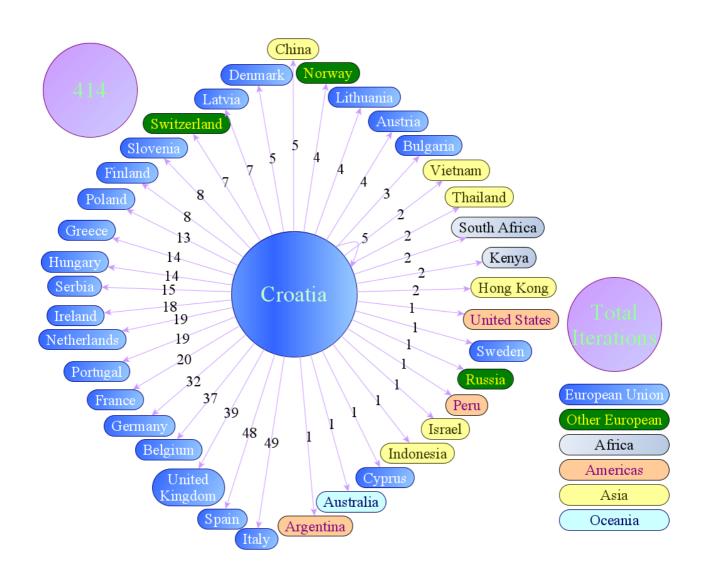




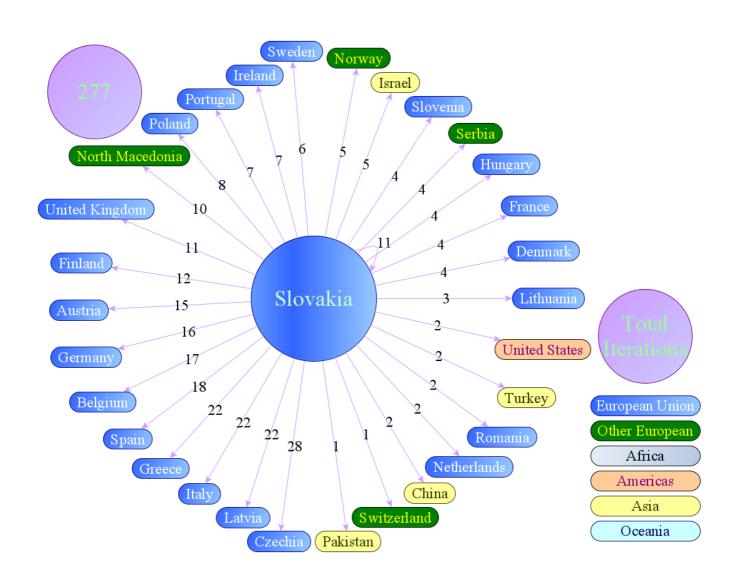




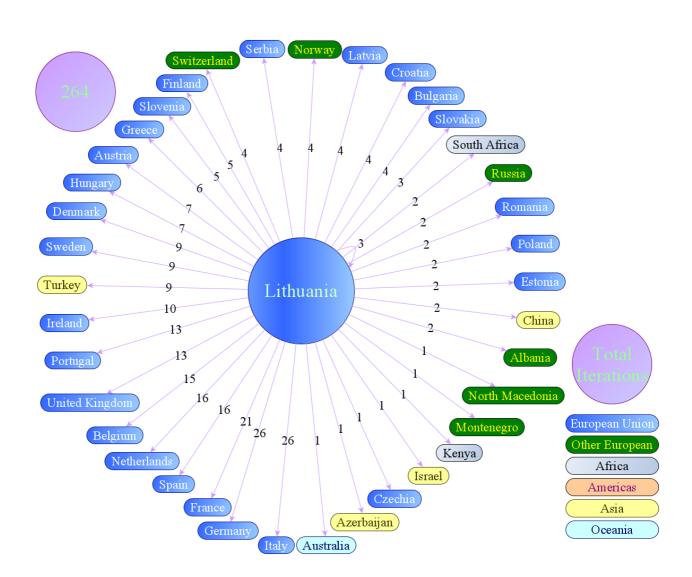




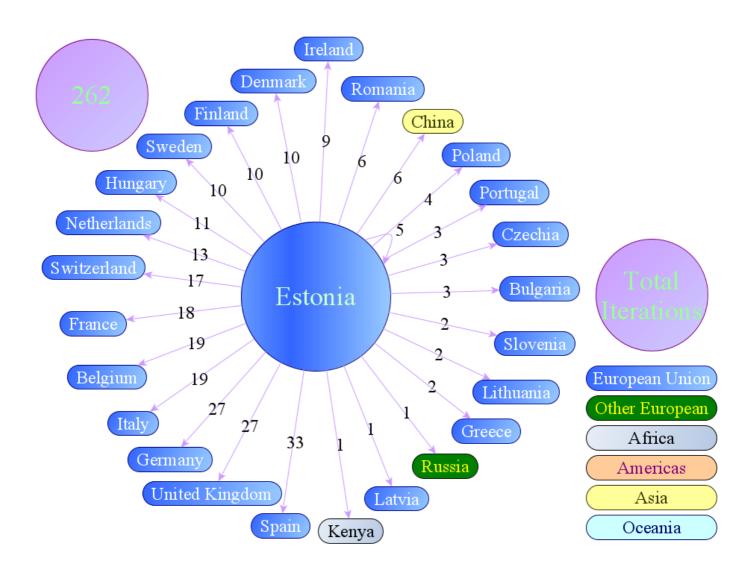




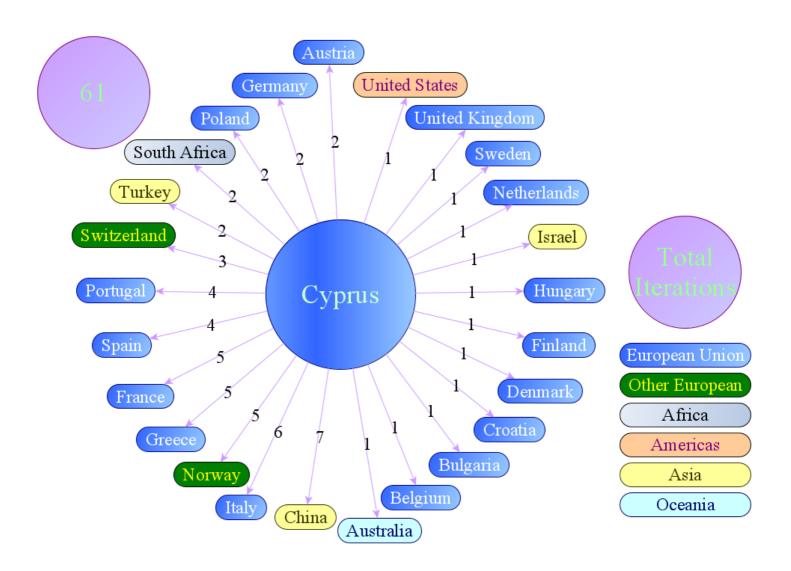




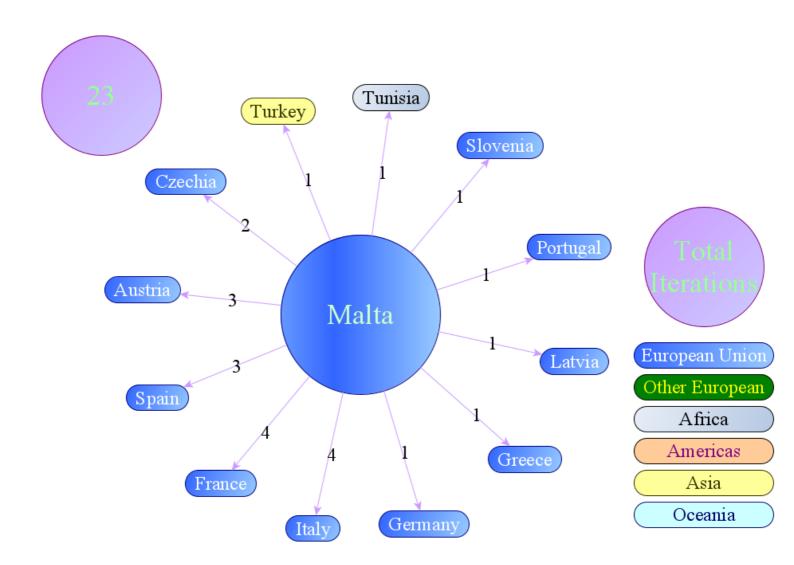














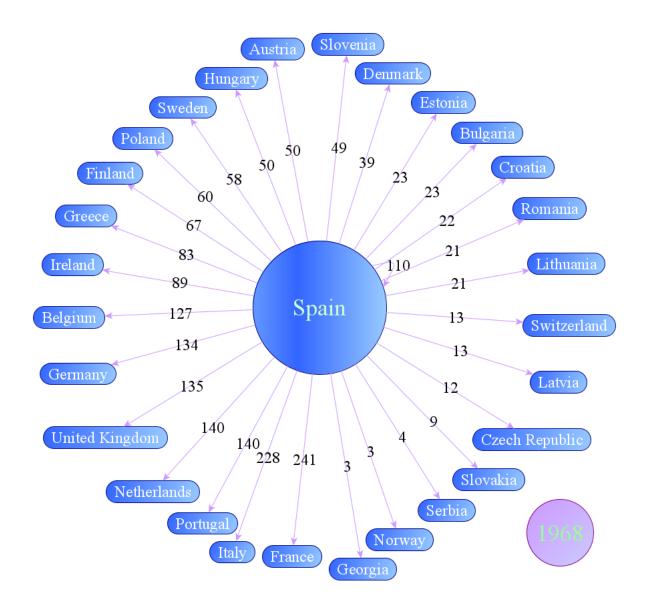
ANNEX III: Number of synergies established between the countries with regard to the Focus Groups

					Czech				1							1						1		1					Switzerlan	
	Austria	Belgium	Bulgaria	Croatia	Republic	Denmark	Estonia	Finland		Georgia	Germany	Greece	Hungary			Latvia	Lithuani	a Malta	Netherlands		Poland	Portugal	Romania	Serbia	Slovakia	Slovenia		Sweden	d	Kingdom
Austria	7	7 2	2 5	Š	7	7	2	ç	50	(0 32	9	13	3 2			1	5	0 24		14	1 27	7 (5	0 4	13	50	12	3	5 28
Belgium	22	2 2	5 13	4	1 8	26	14	35	109	2	2 81	27	23	3 5	7		0 1	4	1 84		29	_		1	1 5	26	127		11	. 95
Bulgaria		5 1	3 (4	1 2	2	2	(5 15	(0 10	5	(6	7 2		2	1	1 10	(1	16	5 .	5	0 2	6	23		4	16
Croatia	ç	9	4 4	1	1 1	3	3	(5 17	(0 6	4		8	8 2	4	2	0	0 4	(7	11	1 (5	1 1	. 7	22	5	- 0	10
Czech																													l	
Republic	7	7	8 2		1	1	1	2	2 14	(0 11	6		2	7	7	0	2	0 4	(7	15	<u> </u>	1	0 4	10	12	2	0	10
Denmark	7	7 2	5 2	3	3 1	5	2	10	, 50	(0 33	-	10	0 2		0	9	2	1 34		11	13	3 2	2	1 (7	39		6	38
Estonia	2	2 1	4 2	3	3 1	2	. 0	9	21	1	1 15	, ,		7 1.	3 1	0	1	1	0 15		ϵ	6	5 .	5	1 1	. 3	23		1	. 18
Finland	9	9 3	,	(5 2	10	9	(5 57	2	2 42		13	3 3		_	3	7	2 29		16	5 26		8	2 4	14	67		6	38
France	50	0 10	9 15	17	7 14	36	21	57	7 101	1	1 115	56	31	7 8	1 15	6	2 1	3	1 114	1	47	7 108	3 10	5	4 8	42	241	43	17	7 130
Georgia	(U	2 ((0	0	1	2	2 1	(2	2	(0	U	1	0	0	0 2	(1	1	()	0 (0	3	- 1	0	1
Germany	32	2 8	1 10		11	33	15	42		2	2 32		20	6 6			7 1	-	1 81		33			5	2 11	22	134		10	99
Greece	9	7 A	,	4	1 6	5	3	12	50	2	2 34			7 1.	,		2 1	0	0 25		14	46		5	0 5	12	83		3	3 28
Hungary	13	3 2	,	8	3 2	10	7	13	, ,,	(0 26			4 2			2	3	1 27		9	20		3	0 (6	50		5	5 28
Ireland	20			8	7	24		32	- 01	(0 61		2.	Z 1.	-		6 1	7	1 49		24			1	3 3	20	89		10	68
Italy	44	4 9	5 26	24	1 7	30	16	49	150	1	1 101	55	40	6 5	,	_	1 1	7	2 109		49	107	16	5	2 4	38	228		12	110
Latvia	1	1 1) 2	2	2 0	9	1	3	3 12	(0 7	2		2	6 1	1	1	0	1 15	(4	4	()	1 (2	13	2	3	3 23
Lithuania	5	5 1	4 1	() 2	2	1		7 13		0 13	10		3 1	3 1	7	0	1	0 11		7	, 6	5 1	1	0 (2	21	5	1	1 15
Malta	- (0	1 1	(0	1	0	2	2 1	(0 1	0		1	1	2	1	0	0 1	(0) 1	. (0	0 (0	1	1	2	2 2
Netherla																														
nds	24	4 8	4 10	4	4	34	15	29	114	2	2 81	25	2"	7 4	9 10	9	5 1	1	1 34	2	26	5 55	5 .	5	3 1	19	140	32	10	102
Norway	(0	2 ((0	0	1	() 1	(0 2	0	(D	1	2	0	0	0 2	(1	1	1	1	0 (0	3	1	0	2
Poland	14	4 2	9 1	7	7 7	11	6	16	5 47	- 1	1 33	14	9	9 2	4 4	.9	4	7	0 26	1	4	25	5 3	3	2 2	16	60	17	1	31
Portugal	27	7 5	1 16	11	1 15	13	6	26	5 108	1	1 59	46	20	0 3	2 10	7	4	6	1 55	1	25	32	12	2	2 10	34	140	24	6	62
Romania	- 6	6 1	1 5	(5 1	2	. 5	8	3 16	(0 16	6		3 1	1 1	6	0	1	0 5	1	3	3 12	2 3	3	0 6	5	21	10	2	12
Serbia	(0	1 (1	0	1	1	2	2 4	(0 2	0	(0	3	2	1	0	0 3	(2	2 2	2 (0	0 (2	4	2	0	7
Slovakia	4	4	5 2		4	0	1	4	1 8	(0 11	. 5	(0	3	4	0	0	0 1	C	2	2 10) (5	0 1	. 5	9	4	1	7
Slovenia	13	3 2	5 <i>6</i>	7	7 10	7	3	14	42	(0 22	12		6 2	0 3	8	2	2	0 19	(16	5 34	1 5	5	2 5	5	49	15	4	28
Spain	50	0 12	7 23	22	12	39	23	67	7 241	3	3 134	83	50	0 8	9 22	8	3 2	1	1 140	3	60	140	21	1	4 9	49	110	58	13	3 135
Sweden	12	2 3	2 6		5 2	10	8	18	3 43	1	1 37	13	9	9 2	5 4	8	2	5	1 32	1	17	7 24	1 10	0	2 4	15	58	2	. 8	40
Switzerla																														
nd	3	3 1	1 4	. (0	6	1	- 6	5 17	(0 10	3		5 1	0 1	2	3	1	2 10	0	1	1 6	5 2	2	0 1	4	13	8	1	. 18
United Kingdom	28	8 9	5 16	10	10	38	18	38	130	1	1 99	28	28	8 6	8 11	0 2	3 1	5	2 102	2	31	62	2 12	2	7 7	28	135	40	18	3 49

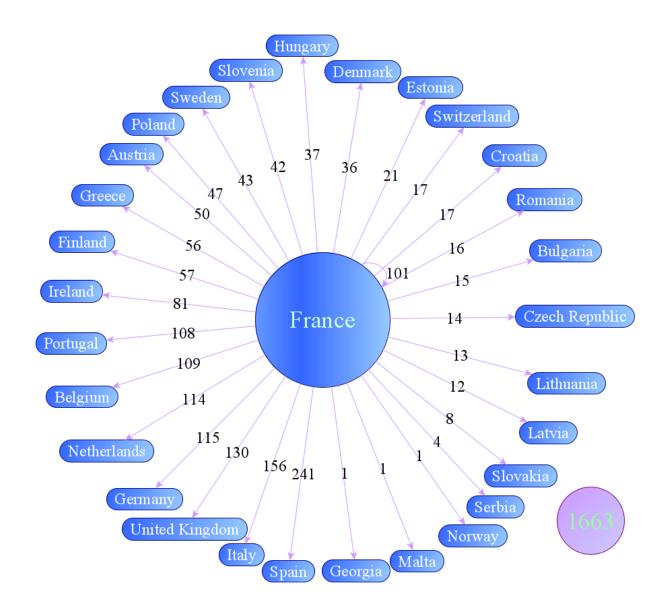


ANNEX IV: Conceptual maps of FG interactions per country

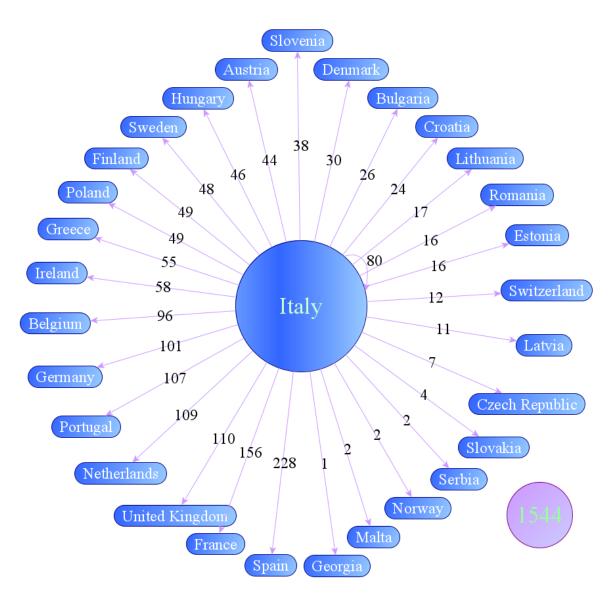




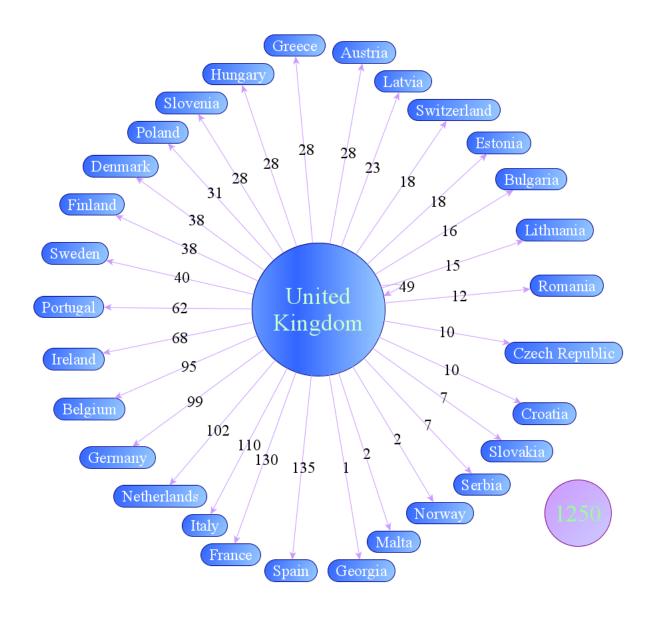




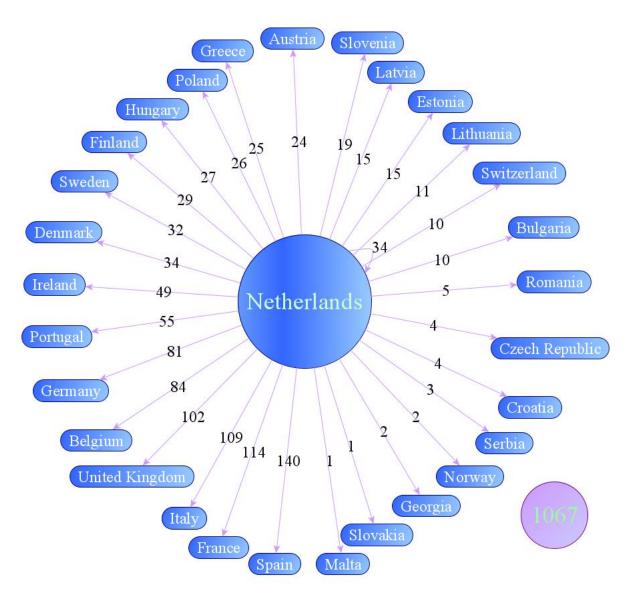




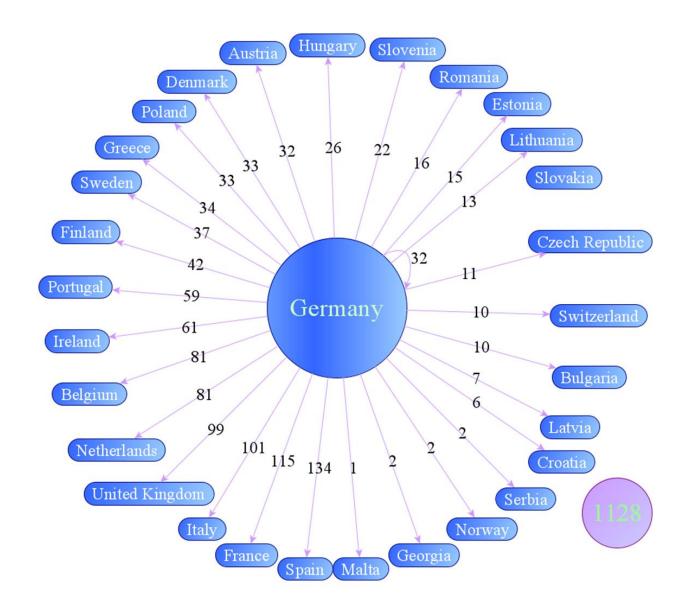




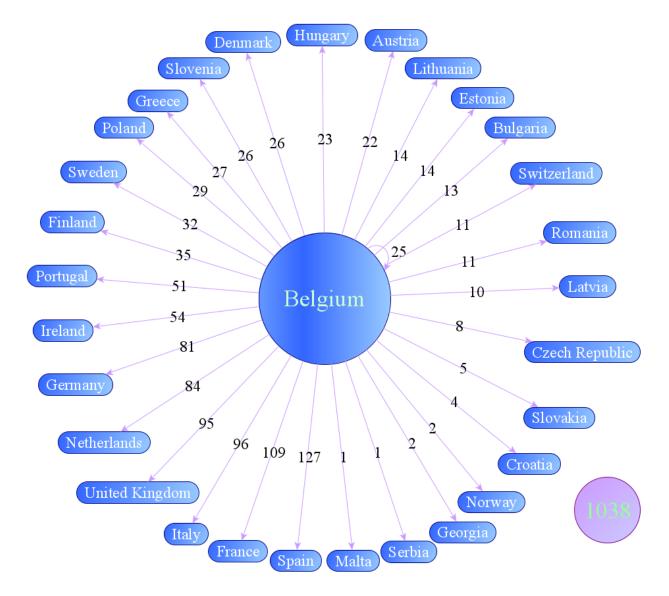




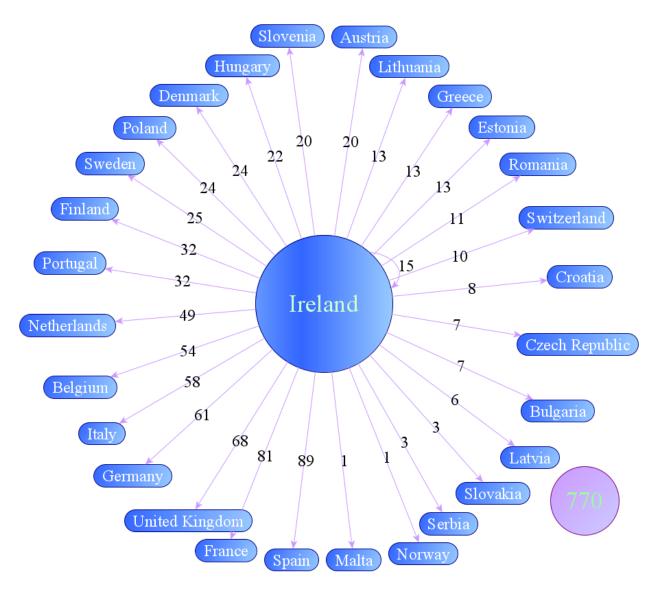




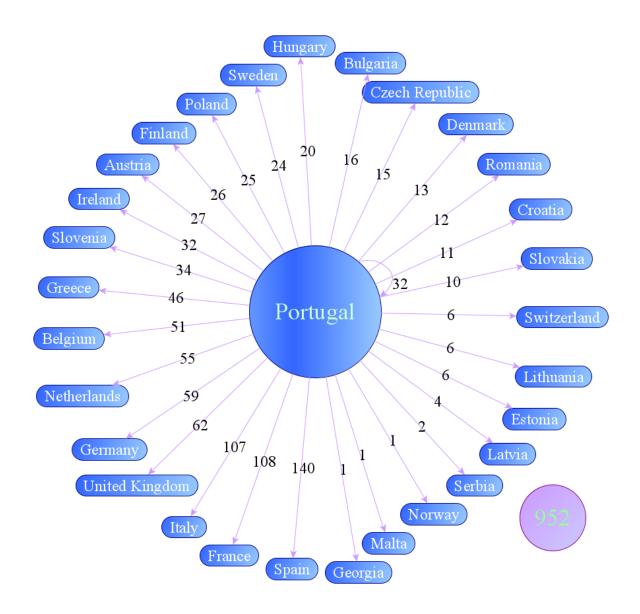




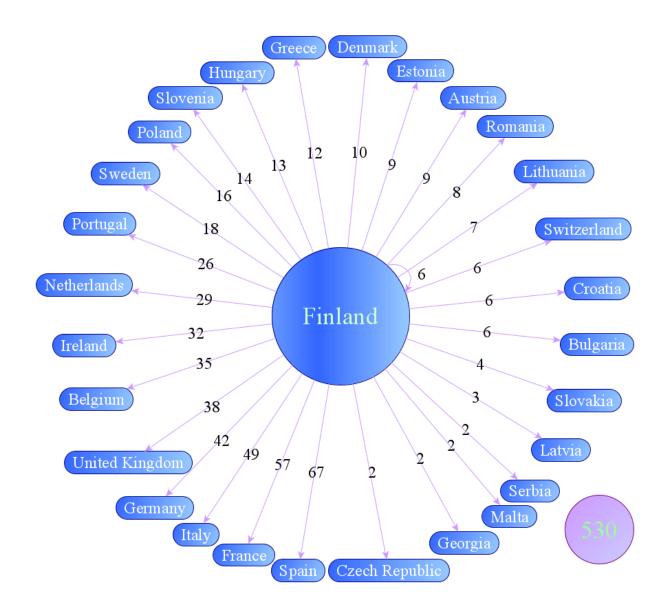




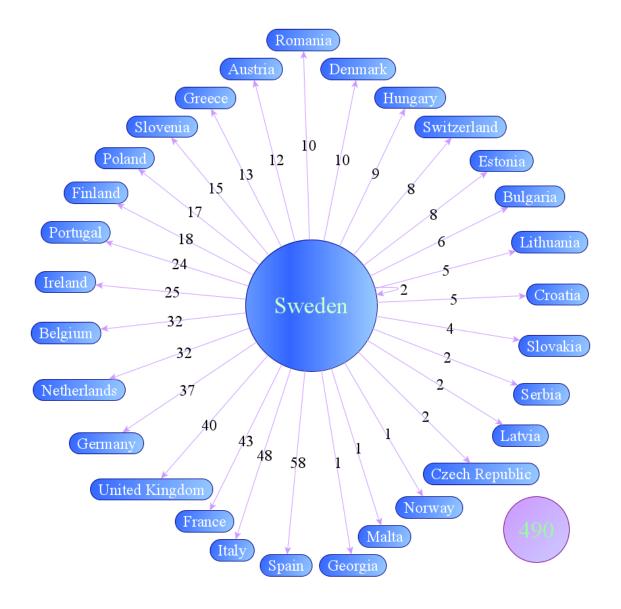




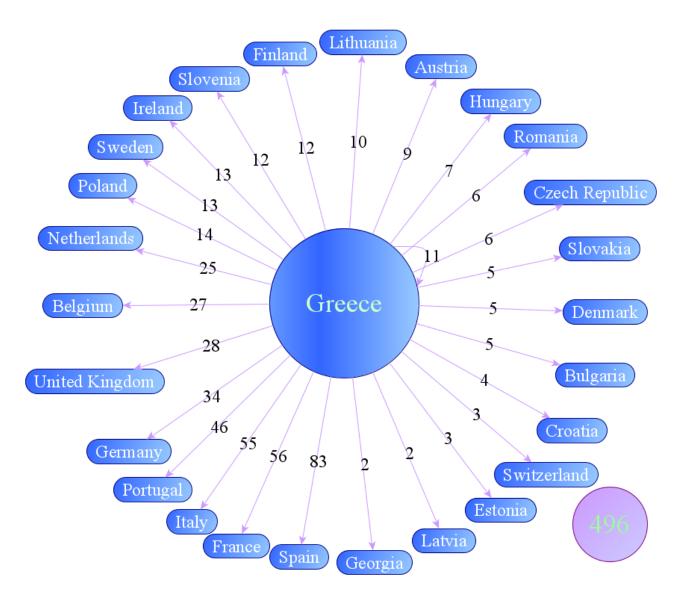




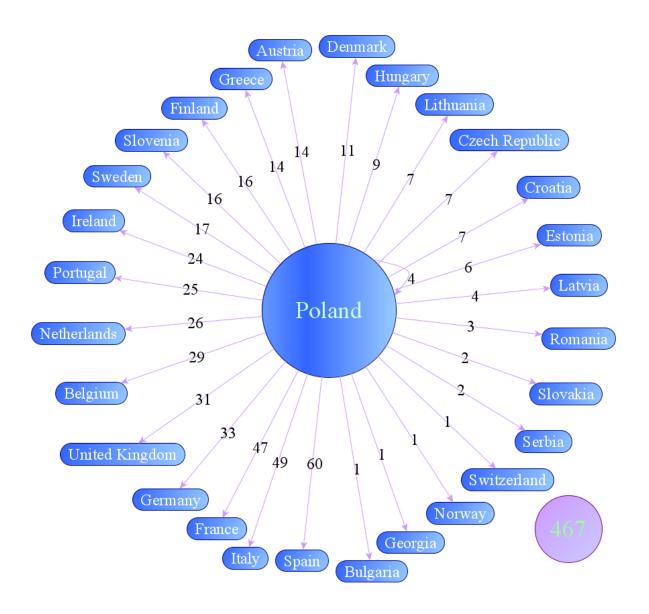




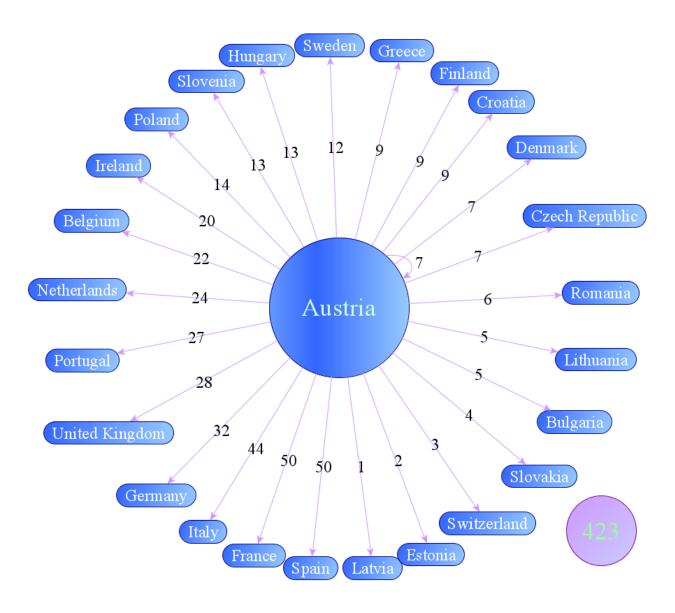




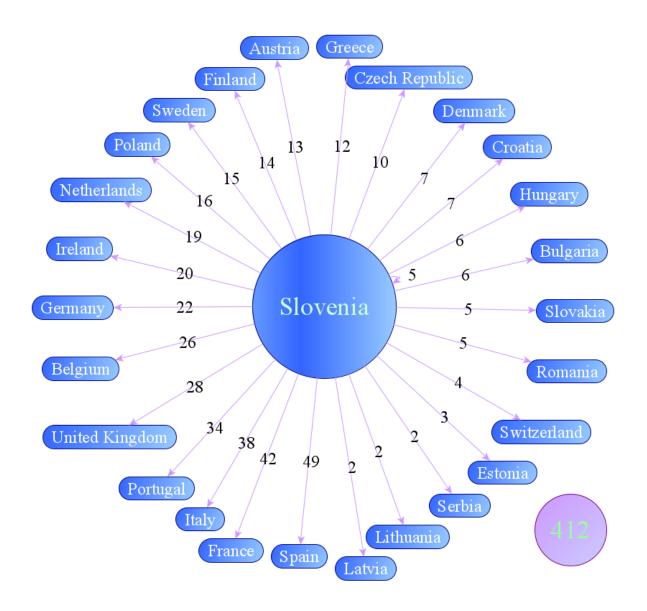




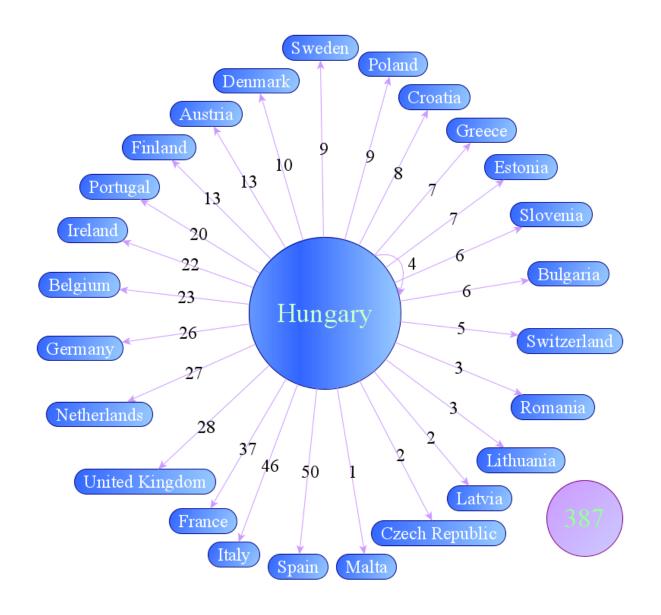




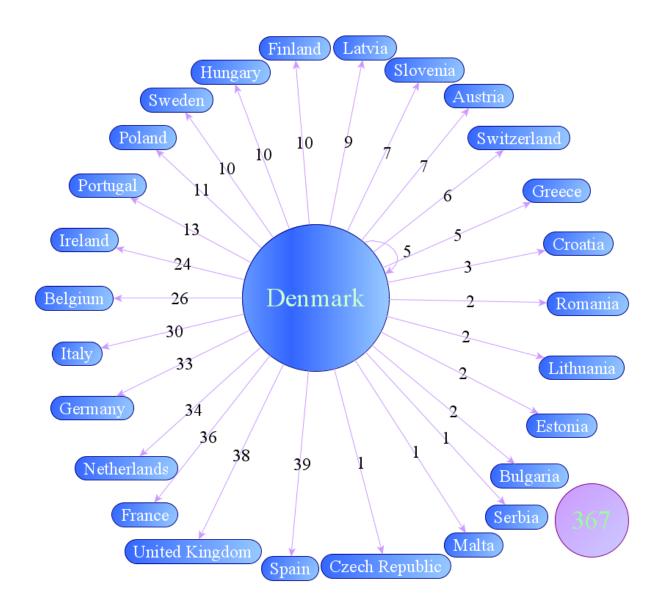




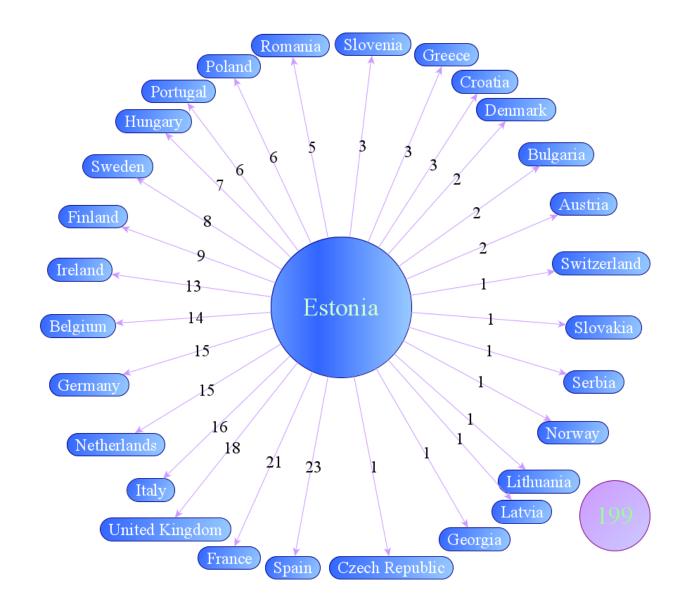




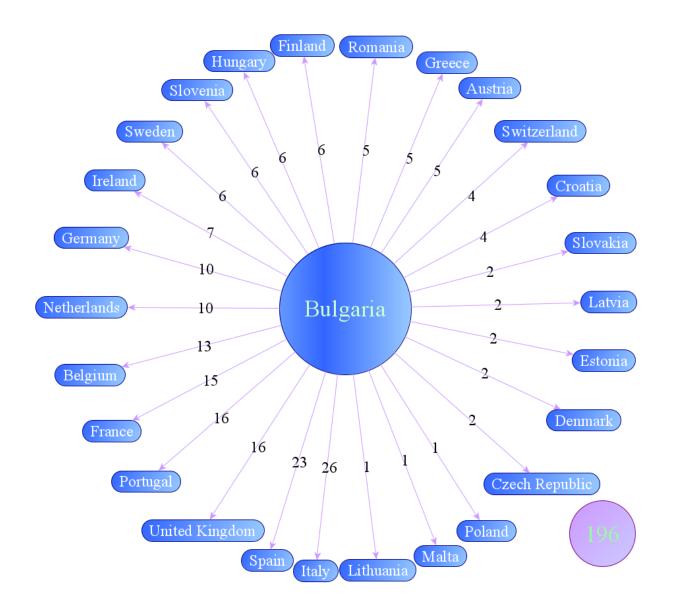




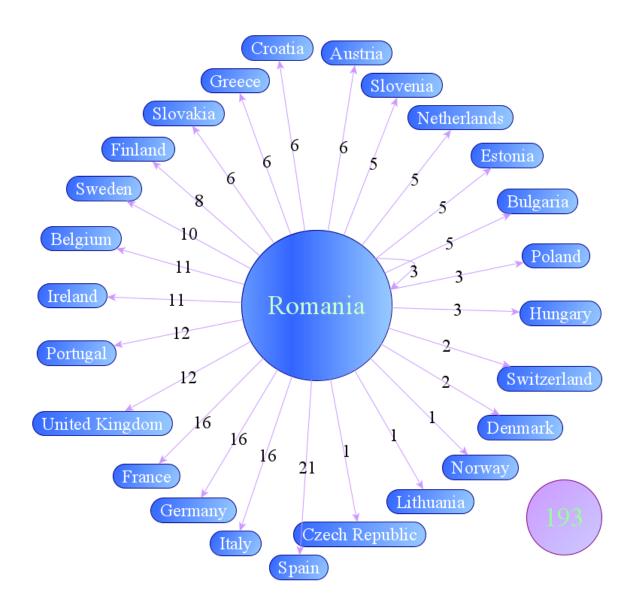




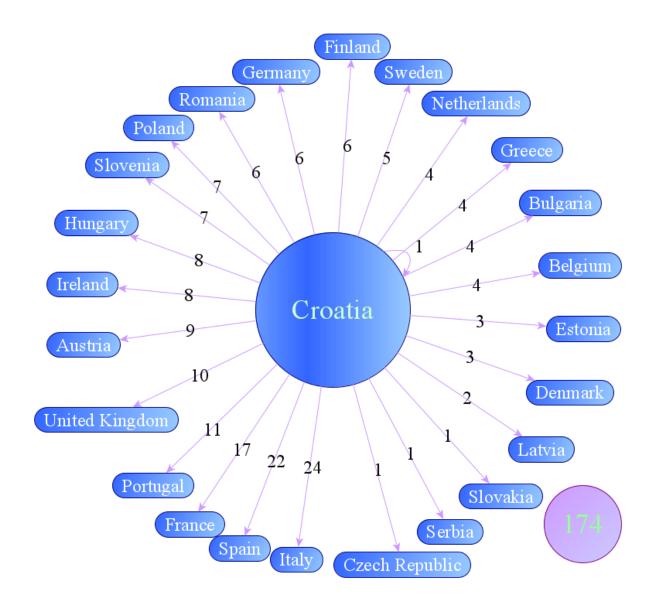




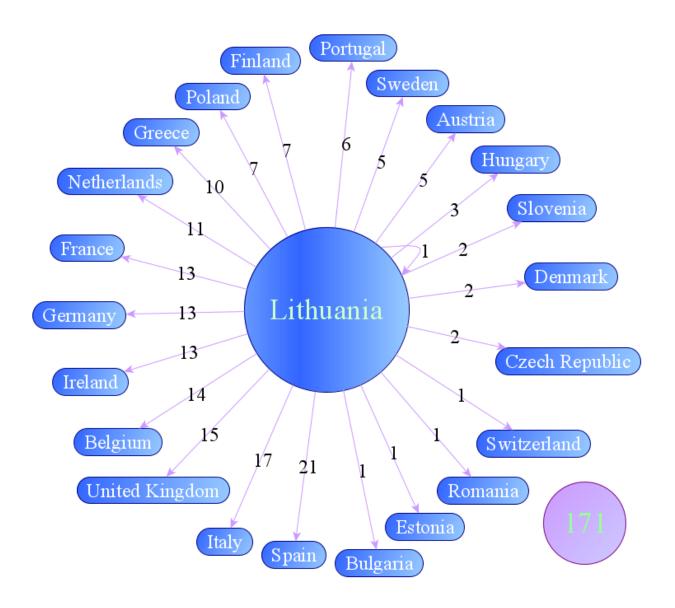




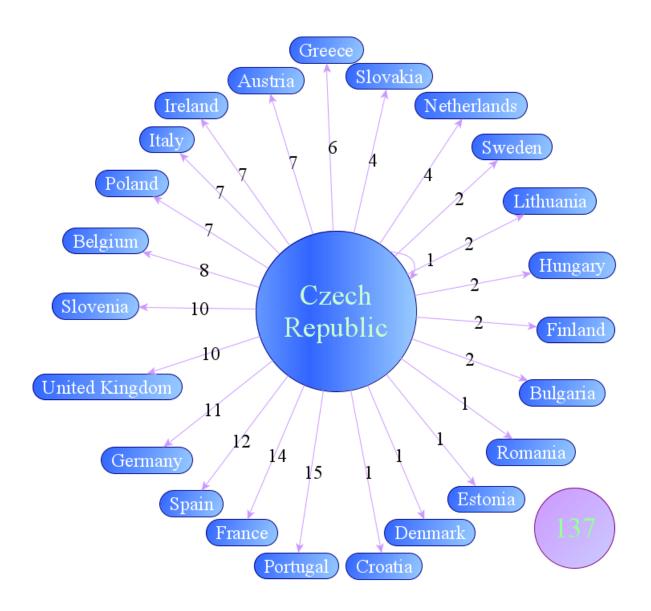




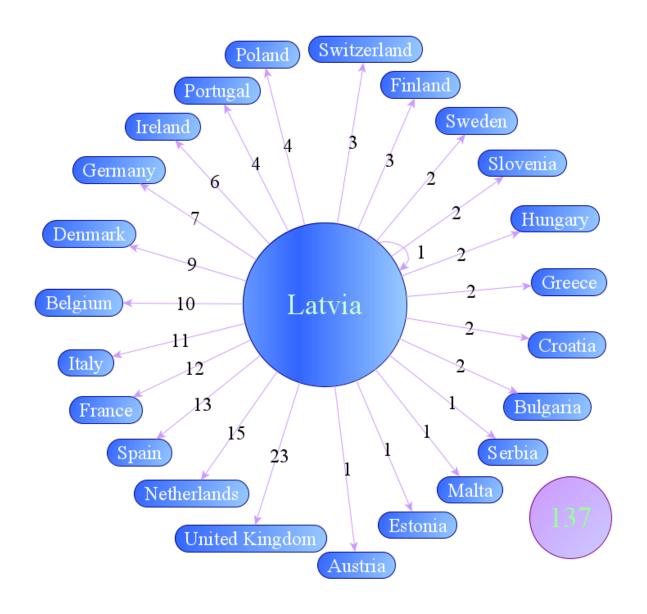




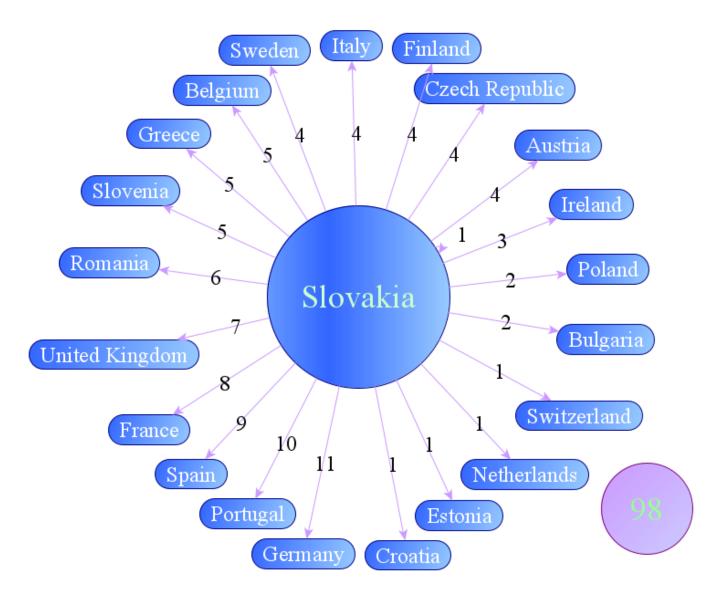




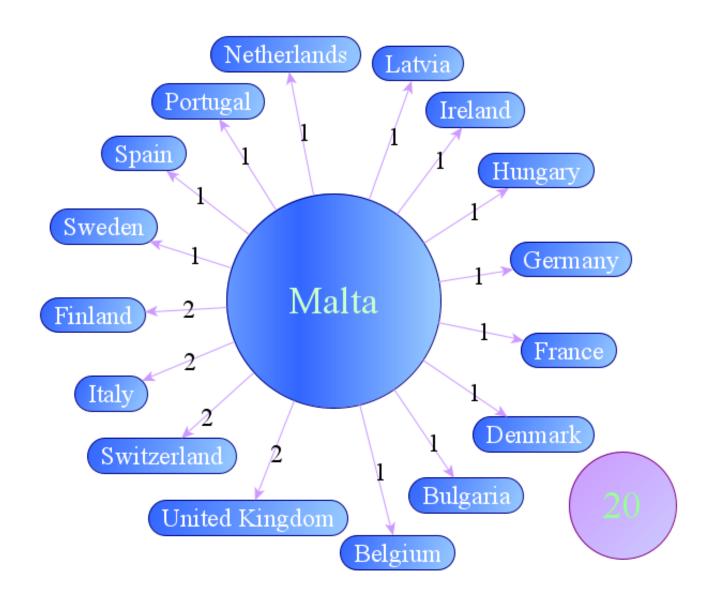
















- 1 MA projects
- 1.1 MA Project agricultural sectors

Table 1 reports the total number and percentage of MA projects corresponding to each agricultural sector. Most of the MA projects are related to cross-cutting agriculture, followed by livestock & Permanent Grassland and with a very low share of permanent crops and forestry.

Table 1. Total number and percentage of the MA projects per agricultural sector

Agricultural Sector	Number of MA	Percentage of Total
Arable Crops	29	20.1%
Permanent Crops	9	6.3%
Livestock & Permanent Grassland	40	27.8%
Forestry	11	7.6%
Cross-cutting Agricuture	55	38.2%

- 1.2 Multi-actor approach projects by products
- 1.2.1 Multi-actor approach projects by arable sectors

The organization of the MA were associated with crops (arable and permanent crops), livestock but there are not MA exclusively dealing with the forestry sector.

1.2.2 Multi-actor approach projects by annual crops products

The main Plant Products associated with the MA projects are related to vegetables (5), covering tomatoes and fruit vegetables, cereals (3), covering wheat and rice and legumes. The main processed products (2) are vegetable products and processed food.

1.2.3 Multi-actor approach projects by permanent crops products

The permanent crops products in the MA projects were mainly associated to plant Products, covering fruits in general (2), soft fruits (1), and citrus trees (1).

1.2.4 Multi-actor approach projects by permanent grassland and livestock products

In total, different products of livestock, animals and permanent grassland were identified and covering animal Products (7) mainly milk and meat (pork and poultry meat). The livestock products (17 MA) covered cattle, sheep, goats, swine and poultry animals.

- 1.3 Multi-actor approach projects by activities
- 1.3.1 Multi-actor approach projects by activities: arable crops



There were different activities were detected in Arable Crops such as (i) production (3 activities in Arable Crops), (ii) economic (8 activities in Arable Crops), covering Agriculture – farming systems (5) and agricultural practices (1) – horticulture (1) and commercialization (1), but also (iii) Management (3) was another activity associated with three activities covering logistics, rationalization and pest management. There are other activities like (iv) processing (2 projects) (including preservation), (v) Breeding (2 projects), (vi) services (1), covering ecosystem services and (vii) education (1), covering training.

1.3.2 Multi-actor approach projects by activities: permanent crops

In total, four different activities were detected in Permanent Crops: Economic Activities and Management, covering integrated management and disease management.

1.3.3 Multi-actor approach projects by activities: livestock and permanent grassland

Nine multi-actor projects can be associated to Economic Activities, covering Agriculture, which includes Farming Systems (8)- agroforestry, precision agriculture, organic agriculture and sustainable agriculture - and agricultural practices (1) – apiculture -. Finally, five projects covered mainly animal production, three management (3), covering integrated management, water management and decision making, two analysis, covering data analysis and system analysis, two Services (2), covering ecosystem services and information services and 1 animal feeding

1.3.4 Multi-actor approach projects by activities: forestry

Seven projects are dealing with Management, covering forest management –forestation- and pest management, while only one project is related to services, covering ecosystem services.

1.3.5 Multi-actor approach projects by activities: cross-cutting activities

A set of 21 projects are related to Economic Activities, covering Farming Systems (15)— commercial farming, Nutrient Management and Sustainable Agriculture -, Urban Agriculture, Fisheries (3) and Commercialization. Around nine projects are associated with management covering resource management –natural resources management, water use and resource conservation-, decision making and water management. Finally, five projects are linked to Production, covering crop production and food production.

- 1.4 Multi-actor approach projects by topic
- 1.4.1 Multi-actor approach projects by topic: arable crops

In total, 8 different topics were detected in Arable Crops related with quality (1), covering food quality, Sustainability (2), Productivity (2), Resilience (1) and Efficiency (2).

1.4.2 Multi-actor approach projects by topics: permanent crops

In total, Sustainability and quality were detected in Permanent Crops.

1.4.3 Multi-actor approach projects by topics: livestock and permanent grasslands



In total, seventeen topics were detected in Livestock and permanent grassland associated to Quality (1) – product quality, Sustainability (6), Productivity (6), Resilience (2) and Efficiency (3).

1.4.4 Multi-actor approach projects by topics: cross-cutting activities

Around 16 different topics were detected in Cross-cutting Agriculture which are linked to Sustainability (7), Quality (4), covering food quality and water quality, Efficiency (1), Resilience (2) and Productivity (2).

- 1.5 Multi-actor approach projects by resources and methods
- 1.5.1 Multi-actor approach projects by resources and methods: arable crops

In total, 4 different resources and methods were detected in Arable Crops related with Innovation (7), Food processing (2), Natural resources (5): genetic resources and biodiversity, Farm inputs (4), covering propagation materials—seeds—and fertilizers, and Methods (4), covering Control methods—pest control and Integrated Pest Management—and cultural methods.

1.5.2 Multi-actor approach projects by resources and methods: permanent crops

Main multi-actor projects are dealing with Control methods (2) - Integrated pest management- and Innovation (1).

1.5.3 Multi-actor approach projects by resources and methods: livestock and permanent grasslands

Different resources and methods were detected in Livestock & Permanent Grassland such as Innovation (11), Natural resources (6), covering biological resources (animal resources and genetic resources) and feed resources (1) and Farm inputs (1), covering organic fertilizers.

1.5. 4 Multi-actor approach projects by resources and methods: forestry

The following resources and methods were detected in agroforestry Innovation (5) and Control methods (2), covering biological control and insecticides.

1.5.5 Multi-actor approach projects by resources and methods: cross-cutting activities

Different resources and methods were detected in Cross-cutting Agriculture associated to Innovation (15), Natural resources (12), covering non-renewable, biological, soil and food resources, Farm inputs (2), covering fertilizers and propagation materials, Substances (1), covering soil organic matter, Control methods (1), covering Integrated Pest Management and Marketing techniques (2).

- 1.6 Multi-actor approach projects by pest and diseases
- 1.6.1 Multi-actor approach projects by pest and diseases: arable crops

Only 2 concepts regarding pests & diseases were detected in Arable Crops: Pests linked to invasive species and Plant diseases.

1.6.2 Multi-actor approach projects by pest and diseases: permanent crops





Only two concepts regarding pests & diseases were detected in Permanent Crops: Pest (Tephritidae) and Plant diseases.

1.6.3 Multi-actor approach projects by pest and diseases: livestock and permanent

Different concepts regarding pests & diseases were detected in Livestock and Permanent Grassland such as Pests (1), Diseases (9), covering infectious - viruses-, organic and systemic diseases and Insecta (2): Culicoides and Bombus.

1.6.4 Multi-actor approach projects by pest and diseases: forestry

Different concepts regarding pests & diseases were detected in Forest associated with Pests (2), covering forest pests and insect pests and Insecta (1).

1.6.5 Multi-actor approach projects by pest and diseases: cross-cutting activities

Only 1 concept regarding pests & diseases were detected in Cross-cutting Agriculture: Diseases (1): fungal disease.

2 Focus groups

2.1 Focus group agricultural sectors

Table 2 reports the total number and percentage of FG corresponding to each agricultural sector. As happened with the MA projects most of the Focus groups are classified under the Cross-cutting agriculture sector followed by arable crops and livestock & Permanent Grasslands.

Table 2. Total number and percentage of the FG per agricultural sector

Agricultural Sector	Number of FG	Percentage of Total
Arable Crops	9	21%
Permanent Crops	3	7%
Livestock & Permanent	8	18.6%
Grassland		
Forestry	2	4.7%
Cross-cutting Agricuture	21	48.8%

2.2 Focus groups by product sectors

The organization of the focus groups were associated with crops (arable and permanent crops), livestock but there are not focus groups exclusively dealing with the forestry sector.

2.2.1 Focus groups by arable crop product sector

Only 2 focus groups were dedicated to specific arable crops, being both of them industrial crops.

2.2.2 Focus groups by permanent crop product sector



Permanent crops are focused on Plant Products, covering fruits in general (1), olives (1) and grapes (1).

2.2.3 Focus groups by livestock and permanent grassland product sector

In total, different products of livestock, animals and permanent grassland were identified (i) Animal Products, mainly covering milk, meat, pork and (ii) Livestock, covering cattle, swine and poultry.

2.3 Focus groups by activity sectors

2.3.1 Focus groups by activity arable crop sector

In total, 9 different activities were detected in Arable Crops, including (i) Production (4 activities in Arable Crops), covering agricultural, food and crop production, (ii) Economic Activities (2 activities in Arable Crops), covering Agriculture, (iii) Processing (1), covering carbonation and (iv) Socioeconomic organization (1), covering cooperation.

2.3.2 Focus groups by permanent crop activity sector

In total, 3 different activities were detected in Permanent Crops: Economic Activities covering Horticulture – viticulture- and Management, covering pest management and disease management.

2.3.3 Focus groups by livestock and permanent grassland activity sector

Different activities (9) were detected in Livestock & Permanent Grassland associated to (i) Economic Activities, covering Agriculture, which includes Farming Systems (2) and agricultural practices (2) (ii) Production, mainly covering animal production (2)— milk and meat (iii) Feeding (2), covering grazing systems (1) and finally (iv) Management, covering Grassland management (1)

2.3.4 Focus groups by forestry activity sector

Different activities (2) were detected in Forestry associated with Management, covering forest management –forestation and sustainable forest management.

2.3.5 Focus groups by cross-cutting activity sector

In total, different activities were detected in Cross-cutting Agriculture associated to (i) Economic Activities, covering Farming Systems (8)— Agroforestry, Precision Agriculture, Sustainable Agriculture, Organic Agriculture and Mixed Farming-, Agricultural Practices (1)-Apiculture, Horticulture (ii), Production (4), covering crop production, biological production and agricultural production and (iv) Management (1), covering Waste Management—Recycling-

2.4 Focus groups by topic

2.4.1 Focus groups by topic arable crop sector

In total, 2 different topics were detected in Arable Crops associated with (i) Productivity (2) and (ii) Soil Properties: Soil salinity (1)

2.4.2 Focus groups by topics permanent crop sector





In total, Sustainability, Productivity and resilience were detected in Permanent Crops

2.4.3 Focus groups by topics permanent crop sector

Different topics were detected in Livestock: Pollution(1), Animal health (1), Sustainability (1), Productivity (2), Profitability (1)

2.4.4 Focus groups by topics forestry sector

In total, 2 different topics were detected in Forestry: Sustainability and Climate change

2.4.5 Focus groups by topics cross-cutting sector

Different topics were detected in Cross-cutting Agriculture associated to (i) Sustainability (2), (ii) Quality (1), covering pollution, (iii) Efficiency (1), (iv) Productivity (5), (v) Climate change (1) and (vi) Profitability (2)

- 2.5 Focus groups by resources and methods
- 2.5.1 Focus groups by resources and methods arable crop sector

In total, four different resources and methods were detected in Arable Crops linked to (i) Innovation (2), (ii) Natural resources (1): genetic resources, and (iii) Control methods (2): pest control

2.5.2 Focus groups by resources and methods permanent crop sector

The main methods linked to the permanent crop sector of the focus groups were (i) Control methods (1) - Integrated pest management, and (ii) Innovation (1)

2.5.3 Focus groups by resources and methods cross-cutting crop sector

Different resources and methods were detected in Cross-cutting Agriculture mainly associated to (i) Innovation (6), (ii) Natural resources (2), covering renewable energy and biological resources, (iii) Farm inputs (1), covering fertilizers, (iv) Substances (1), covering soil organic matter and (v) Control methods (1)

- 2.6 Focus groups by pest and diseases
- 2.6.1 Focus groups by pest and diseases arable crop sector

Only 1 concept regarding pests and diseases was detected in Arable Crops associated with Pests: weeds

2.6.2 Focus groups by pest and diseases cross-cutting

Only 1 concept regarding pests & diseases were detected in Cross-cutting Agriculture linked to Insecta (1): Apidae





3 Operational groups

The unsupervised clustering method obtained from textual data (title plus objective) allowed us to cluster the operational groups in 10 clusters (Table 3). Sector 0 could be linked to a holistic approach of the farms, while the sector 1 is related to water management aspects, and sector 2 is associated with forestry. Clusters, 3, 4, 5, 6, 7 and 8 are related to fertilization, wine, dairy production, extensive livestock systems, pest control, value chains. Finally, permanent crops and wheat combination (silvoarable) are evaluated in cluster 9 and meat livestock is considered in cluster number 10.

Excepting clusters 1 and 6, most of the operational groups are related to intensive farming systems which are those that are creating more concerns from a productive and environment point of view and more farmers are involved.

Table 3. Operational groups wording classification clusters

Cluster 0	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	Cluster 7	Cluster 8	Cluster 9	Cluster 10
soil	soil	forest	System	wine	farm	agricultural	control	food	production	Pig
organic	crop	product	manure	vineyard	milk cow	sheep	risk	supply chain	variety	Feed
crop	water quality	wood	farm	grape	milk product	sustainable	pest	product	quality	animal welfare
production	agricultural	development	management	quality	farmer	farming	disease	producer	cultivation	Antibiotic
farm	water management	production	precision agriculture	yeast	cheese	economic	potato	market	plant	Sheep
sustainable	efficiency	timber	information	sustainability	milk production	environmental	crop	innovation	yield	Cow
climate change	irrigation system	sustainable	data	Rioja	milk farming	area	management	added value	olive	quality
environmental	soil water	management	technology	management	economic	habitat	protection	regional product	wheat	Fattening
agricultural	water resource	high added value	decision support tool	production	sheep	model	treatment	cheese	seed	Meat
yield	sustainable	energy	innovative development	cellar	milk sector	biodiversity	bee	vegetable	oil	breeding



3.1 CAP operational groups sectors

From the automatic classification the total number and percentage of OG corresponding to each agricultural sector, as well as the precision, recall and the F-measure of the USC method can be seen in Table 4. Operational groups are almost equally classified as cross-cutting, livestock and permanent grasslands and arable crops, with a much low share of cross-cutting agriculture share than in the focus groups or the multi-actor projects.

Table 4. Total number, percentage, precision, recall and F-Measure of the Operational Groups linked to the main agricultural sectors funded by the CAP

Agricultural Sector	Number of OG	Percentage of Total	Precision	Recall	F-Measure
Arable Crops	289	22.5%	86%	80%	83%
Permanent Crops	224	17.5%	89%	83%	86%
Livestock & Permanent Grassland	376	29.3%	86%	87%	86%
Forestry	68	5.3%	81%	77%	79%
Cross- cutting Agriculture	326	25.4%	80%	83%	81%

3.2 Operational groups by product sectors

The organization of the operational groups were associated with crops (arable and permanent crops), livestock and forestry.

3.2.1 Operational groups by crop product sector

Around 121 different products linked to arable crops were identified (Figure 1). The main products detected in OGs with regard to arable (in blue) and permanent (in orange) crops associated with the AGROVOC database.

<u>Arable Crops</u> are mainly focused on Processed products (11% of arable crops) Plant Products and Plantae (nearly 74% of arable crops) as the taxonomic name of plants. The main plant products are vegetables (covering potatoes, grain legumes, tomatoes, among others) represented by the 40% of the plant products and Cereals (33%) mainly covering wheat/Triticum and maize, among others. With regard to the processed products, they are associated with cereal (20% of processed products) and sugar (14% of processed products).

With regard to the <u>permanent crops</u>, around 62 different products of permanent were identified associated with plant (76%) and processed products (21%). Plant Products (76%) are mainly covered by Fruits (72% of Plant Products), which are subsequently split into stone fruits (38% of Fruits) -mainly olives (23% of stone Fruits)-, pome fruits (18% of Fruits) and soft fruits (10% of Fruits). Processed products (21% of permanent crops) and Foods (13 % of permanent crops) are





mainly alcoholic beverages (56% of Processed products and Foods) and olive oil (23% of Processed products).

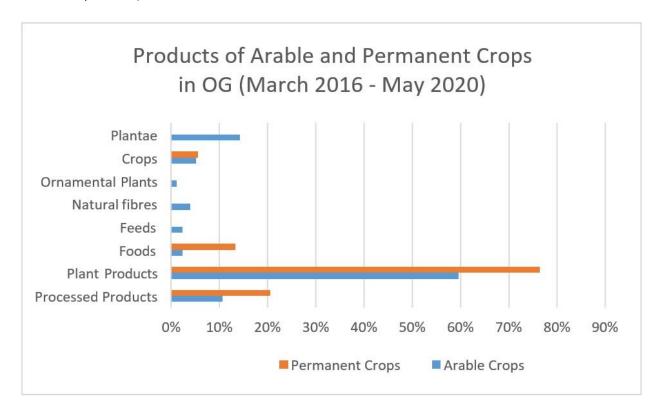


Fig 1. Main Products of Arable Crops and Permanent Crops in OG

3.2.2 Operational groups by products livestock and permanent grassland sector

For the livestock and permanent grassland, sector 86 different products were identified (Figure 2). This agricultural sector is mainly focused on <u>animal products</u> (37%), mainly covering milk (58% of Animal Products), meat (36% of Animal Products) and pork (6% of animal products), but also <u>livestock</u> (32%), covering cattle (42% of Livestock), swine (42% of Livestock) and sheep and <u>processed Animal Products</u> (14%) such as milk products (mainly cheese) and meat products, being also associated to <u>poultry</u> (5%), covering chickens and turkeys.



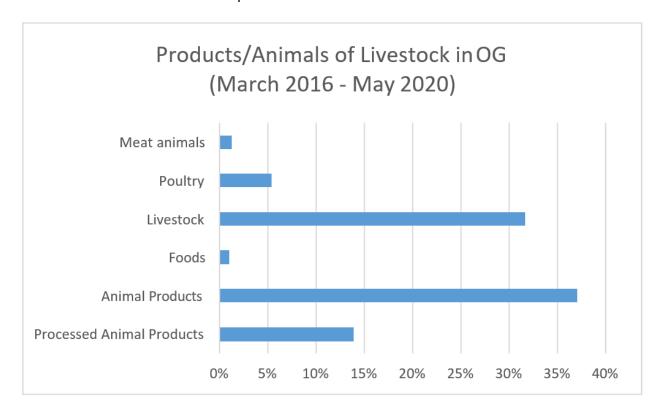


Fig 2 Main Products/Animals of livestock OGs

3.2.3 Operational groups by products forestry sector

In total, 20 different products of forestry were found (Figure 3), which are mainly related <u>to forest products</u> (42%), mainly covering Wood and Cork; <u>Plantae</u> (51%), mainly related with fast-growing tree-species such as <u>Pinus</u> and <u>Eucalyptus</u> and <u>processed products</u> (9%), mainly associated to wood products such as charcoal, wood chip.

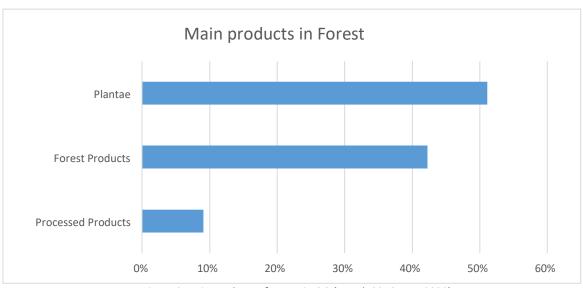


Figure 3 Main Products of Forest in OG (March 2016-May 2020)

3.3 Operational groups activities by agricultural sectors





Main activities associated with the agricultural sectors are linked to the profitability of the sector and how this is impacted by management, economy or production (Figure 4). Farming systems providing a holistic approach of the farm is also relevant in all the evaluated sectors excepting the forestry sector, which has a specific activity named "forestry management". There are also agricultural activities associated with resource management but with less representativeness. Production activities are mostly related to arable crops and cross-cutting agriculture. The number of activities associated with arable crops, permanent crops, livestock and permanent grassland, cross-cutting agriculture and forestry were 98, 80, 123, 110 and 35, respectively.

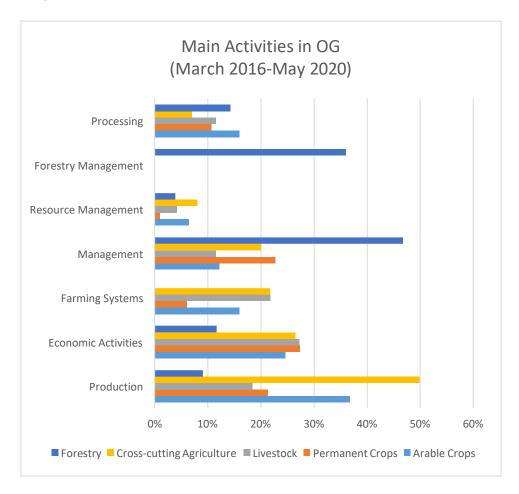


Fig 4 Main Activities in Arable Crops (light blue), Permanent Crops (red), Livestock (grey), Cross-cutting Agriculture (orange) and Forestry (dark blue).

3.3.1 Operational groups activities by agricultural sectors: arable crops

In total, 98 different activities were detected in Arable Crops related to production (50%), economic activities (25%) and management (20%). <u>Production</u> was mainly covering crop production (91% of Production) while the <u>economic activities</u> (25% of activities in Arable Crops) were covering Agriculture (20% of Economic Activities), including Farming Systems (Arable farming, Alternative Agriculture, Sustainable Agriculture and Precision Agriculture- and Agricultural practices), Horticulture (12% of Economic Activities) and Product development plus Commercialization (8% of Economic Activities). Finally, <u>management</u> covered resource management – mainly land management (vineyards and orchards), Soil management and waste





management - (40% of Management), risk management (5% of Management), and water management (5% of management).

3.3.2 Operational groups activities by agricultural sectors: permanent crops

Permanent crops were linked to 80 different activities related to economic activities (27% of activities within permanent crops), management (23%), production (21%) and plant protection (3%). With regard to the Economic Activities, they were associated to Horticulture – viticulture and fruit growing- (56% of Economic Activities), Agriculture (34% of Economic Activities), covering Farming Systems – Organic Agriculture and Precision Agriculture- and Agricultural practices; and Product development – Commercialization- (10% of Economic Activities). Management was associated with Land management –mainly vineyards and orchards- (61% of Management), Soil management (10% of Management), resource conservation (4% of Management) and water management (4% of Management). Production was mainly covering crop production (72% of Production), while plant protection.

3.3.3 Operational groups activities by agricultural sectors: livestock and permanent grassland

Livestock and permanent grassland detailed 123 activities associated with economic activities (27% in livestock & permanent grassland, production (18%), feeding (16%), management (12%). Economic activities are covering Agriculture (80% of Economic Activities), covering Farming Systems — Organic Agriculture and Precision Agriculture—, and Product development — Commercialization— (4% of Economic Activities). The production activities are mainly associated with animal production (83% of Production) — milk and meat. Feeding was associated to animal feeding (35% of Feeding) — meaning fattening — and suckling (5% of Feeding), Management activities are, covering resource management (36% of Management), Grassland management (21% of Management) and Livestock management (21% of Management).

3.3.4 Operational groups activities by agricultural sectors: forestry

Only 35 different activities were detected in Forestry and were associated to economic activities (12% of activities in forestry), production (9%), management (47%) and processing (14%). Economic activities covered agriculture, associated with Farming Systems – Agroforestry and Intensive farming-. Management covered forest management (36% of Forestry), mainly forestation and finally, Processing was mainly linked to carbonation and fabrication.

3.3.5 Operational groups activities by agricultural sectors: cross-cutting agriculture

The cross-cutting agriculture operational group agriculture was represented by 110 different activities which can be grouped as economic activities (26 % of the activities associated to cross-cutting agriculture), production (50%) and management (20%). With regard to the economic activities, they were mainly associated to Farming Systems – Precision Agriculture Sustainable Agriculture, Organic Agriculture and Conservation Agriculture-, Horticulture (8% of Cross-cutting Agriculture) and Product development – Commercialization- (3% of Economic Activities). Attending to production covered covering crop production (32% of Production) – cultivation and planting. Finally, with regard to management, it was split in Resource management (40% of activities in Cross-cutting Agriculture) and Water management (32% of Cross-cutting Agriculture).

3.4 Operational groups topics by agricultural sectors





Main topics linked to the different agricultural sectors of the operational groups are associated to sustainability (highlighting arable crops with a 35%) and productivity (with high relevance for forestry) as shown in Figure 5. While topics related with deficiency, climate change and soil properties are treated in all the evaluated sectors, but some of them only associated to livestock (i.e. animal health and animal welfare) or environment impact (arable crops and cross-cutting agriculture) and others exclude forestry (resilience) or forestry and arable crops (profitability). In total, 20 and 21 different topics were detected in arable and permanent crops, respectively, being 22, 29 and 9 associated to livestock, cross-cutting agriculture and forestry, respectively.

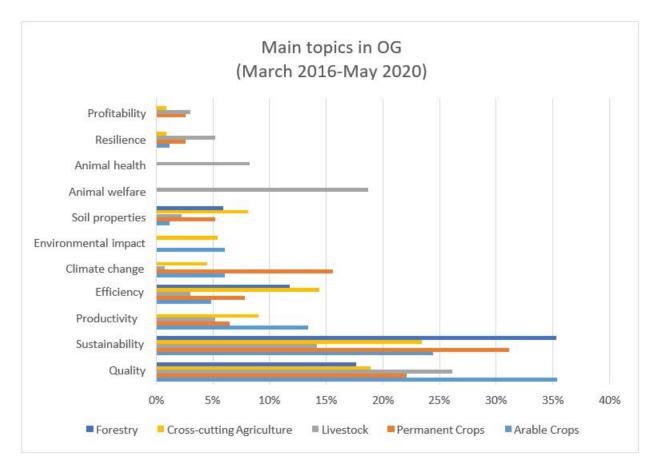


Fig 5 Main topics in Arable Crops (light blue), Permanent Crops (red), Livestock (grey), Cross-cutting Agriculture (orange) and Forestry (dark blue).

3.4.1 Operational groups topics by agricultural sectors: arable and permanent crops

Quality (35% of arable crops) was the main topic associated with arable crops covering food safety, organoleptic properties (sweetness and bitterness) and contamination. The quality topic was followed by sustainability (24%), productivity (13%), climate change (6%), environmental impact (6%) and efficiency (5%). Concerning OG, permanent crops sustainability (31% of permanent crops) was the most important topic followed by quality (22%), covering food quality, pollution, organoleptic properties, processing quality and keeping quality, climate change (16%), efficiency (8%), covering use efficiency, and specifically water use efficiency, productivity (6%) and soil properties (5%), covering soil fertility.





3.4.2 Operational groups topics by agricultural sectors: livestock

Livestock operational groups were characterized by 22 different topics related to quality (26%), animal welfare (19%), sustainability (14%), animal health (8%), productivity (5%) and resilience (5%).

3.4.3 Operational groups topics by agricultural sectors: Forestry

Forestry operational groups main topics were integrated within the concepts of sustainability (35%) quality (18%), efficiency (12%), productivity (9%), soil properties (8%) covering soil fertility, climate change (5%), environmental impact (5%)

3.4.4 Operational groups topics by agricultural sectors: cross-cutting agriculture

Cross-cutting agriculture main topics were related with sustainability (23%), quality (19%) covering water quality, pollution and organoleptic properties, efficiency (14%), productivity (9%), soil properties (8%) covering soil fertility, climate change (5%) and environmental impact (5%).

3.5 Operational groups resources and methods by sectors

Figure 6 shows the resources and method classification by sector (forestry, cross-cutting agriculture, livestock, permanent crops and arable crops). Natural and biological resources as well as innovations are the main aspects tackled by operational groups within the resources and methods classification of AGROVOC. Especially relevant is the link of forestry with natural resources. All AGROVOC categories have all evaluated sectors with the exception of breeding methods (only linked to livestock and cross-cutting agriculture), monitoring techniques only associated to permanent crops, propagation materials related to cross-cutting agriculture, permanent crops and arable crops and genetic resources not tackled with forestry. Arable and permanent crops were linked to 40 and 41 different resources and methods, respectively, while livestock, cross-cutting agriculture and forestry were associated with 41, 53 and 16.



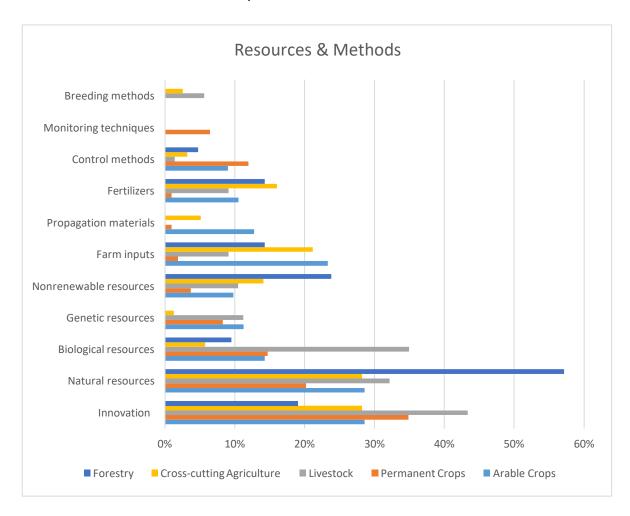


Fig 6 Main Resources & Methods in Arable Crops (light blue), Permanent Crops (red), Livestock (grey), Cross-cutting Agriculture (orange) and Forestry (dark blue).

3.5.1 Operational groups resources and methods by agricultural sectors: arable and permanent crops

Arable crops were mostly related with innovation (29%) and natural resources (29%) covering biological resources (14%, mainly *genetic resources – varieties –* and *biodiversity*) and non-renewable resources (10%). Farm inputs represented the 23% of the resources and methods categories of arable crops covering propagation materials (13%, mainly seeds) and fertilizers (11%) followed by farm inputs (23%) and control methods (9% mainly pest control).

Innovation (35%) was the main resources and methods category of AGROVOC followed by natural resources (20%) covering biological resources (15% or biological resources) mainly genetic resources – varieties – and biodiversity) and nonrenewable resources (4% of biological resources)) and Control methods (12%, mainly pest control) and monitoring techniques (6%).



3.5.2 Operational groups resources and methods by agricultural sectors: livestock and permanent grassland

Permanent grasslands were mostly associated to the innovation category (43%) of the AGROVOC within the resources and methods sectors followed by natural resources (32%), covering biological resources (35%, mainly genetic resources – animal breed- and biodiversity) and non-renewable resources (10% of biological resources), farm inputs (9%) covering fertilizers 89%) and breeding methods (6%).

3.5.3 Operational groups resources and methods by agricultural sectors: cross-cutting agriculture

Cross-cutting agriculture was mainly associated to the categories of innovation (28%), m natural resources (28%), covering non-renewable resources (14%, including water and land resources) and biological resources (6%, mainly biodiversity) and finally to farm inputs (21%), covering fertilizers (16%, mainly organic fertilizers), and propagation materials (5%, mainly seeds and planting stocks).

3.5.4 Operational groups resources and methods by agricultural sectors: forestry

Natural resources (57%) was the most relevant category for forestry, covering nonrenewable resources (24%, including water and land resources) and biological resources (10%) and renewable resources (10%, bioenergy) followed by Innovation (19%) and farm inputs (14%) covering fertilizers (14%, mainly organic fertilizers)

3.6 Operational groups pests and diseases by sectors

Insecta was the category most treated in most of the types of agricultural sectors within the pest and disease AGROVOC section with the exception of arable crops more related pests. Most of the sectors are represented in the different AGROVOC sections with the exception of forestry and livestock for weeds, and infectious diseases, and livestock for plant diseases (Figure 7). Invasive species category is only treated by the cross-cutting agriculture AGROVOC section.

The number of different concepts dealing with pest and diseases AGROVOC sections were 20, 17, 15, 9 and 6 for arable crops, permanent crops, livestock and permanent grassland, crosscutting agriculture and forestry, respectively.

3.6.1 Operational groups pest and diseases by agricultural sectors: arable and permanent crops

Pests (35%) including weeds (23%) and pest insect (6%), is the most relevant concept for arable crops followed by insect (26%) covering coleopteran, Elateridae, Formicidae and diseases (19%), covering plant diseases (26%) – rots, blight – and infectious diseases (10%)

Insecta (70%) including Diptera, Lobesia botrana and Lepidoptera followed by the diseases (20%) covering plant diseases (15%) -fungal diseases, fruit creaking and spots and finally by pests (10%), mainly weeds (5%).





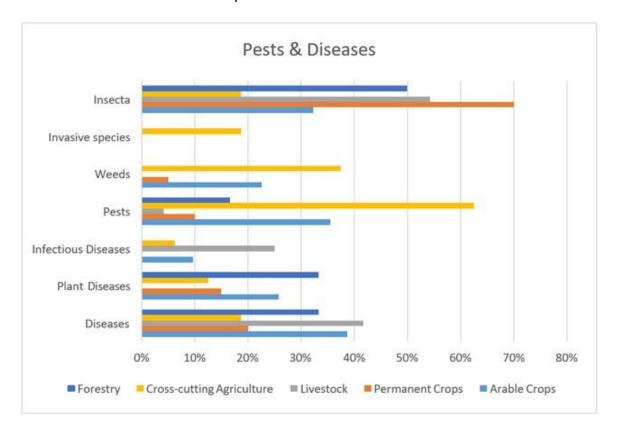


Fig 7 Pests & Diseases in Arable Crops (light blue), Permanent Crops (red), Livestock (grey), Cross-cutting Agriculture (orange) and Forestry (dark blue).

3.6.2 Operational groups pest and diseases by agricultural sectors: livestock and permanent grassland

Most of the livestock and permanent grassland pest and diseases topic is related with insect (54%) covering parasites and Apidae, followed by diseases (42%) covering infectious - bacterial diseases-, organic and systemic diseases and finally pests (4%).

3.6.3 Operational groups pest and diseases by agricultural sectors: cross-cutting agriculture

Pests (63%) is the most important issue treated in the cross-cutting agriculture sector followed by both Insecta (19%) as well diseases (19%) covering plant diseases (13%) —cabs and spots- and infectious diseases (6%).

3.6.4 Operational groups pest and diseases by agricultural sectors: forestry

Insecta (50%) is the most relevant topic associated to the AGROVOC section of pests and diseases, followed by diseases (33%) covering plant diseases (13%) –blight and canker- and pests (50%).