

EIP-AGRI innovation drivers on the path to climate change mitigation and adaptation: Multi-Actor approach mapping

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Abstract Multi-Actor projects (MAPs) are a type of action funded by the EU Horizon 2020 and Horizon Europe programmes to foster agricultural innovation in response to the challenges of climate change and rural depopulation. This study describes the regional deployment and synergies of 120 MAPs coordinated by different European countries. The analysis includes the mapping of coordination and partners, and the interactions within the H2020 landscape. The results show that Western European countries, especially Spain, France and the UK, are the main origin countries for both project coordinators and participants of MAPs, while Eastern and North European countries, as well as Ireland, present a lower share. Greece, Denmark and Sweden stand out as the countries with more significant participation relative to their population. The number of connections between projects reveals the networking and knowledge co-creation and sharing within the innovation programmes with larger countries, as well as Belgium and the Netherlands, as main EU innovation hubs performing the higher number of interactions, while Eastern countries such as Croatia and Slovakia have low figures. Therefore, the present study provides insights into the regional distribution and synergies of MAPs and suggests areas for improvement in terms of geographical balance and collaboration.

Keywords: Rural development, EUREKA, Innovation drivers, AKIS, Green Deal

Introduction

Climate change brings significant challenges and opportunities for the agricultural sector in Europe, as it affects crop yields, water availability, biodiversity, and soil quality. Certain agricultural and farming practices have contributed to greenhouse gases emissions, nitrogen pollution and water availability as intensive agriculture with high inputs of external fertilizers, soil tillage and intensive livestock systems (IPCC 2007; European Environment Agency et al. 2018; Hernández-Morcillo et al. 2018; Morrissy et al. 2021).

In order to cope with the climate change challenges and potential opportunities, the European Commission has

developed an innovation framework to support the transition to a more sustainable and resilient food system, based on the principles of circular economy, bioeconomy, and digitalization. Thus, the European Green Deal leads the way to a green transition, with the ultimate goal of reaching climate neutrality by 2050 (EC 2019).

As part of this strategy, innovation has become a major actor on the European scene as main tool to manage the climate change and rural depopulation challenges jeopardizing environmental sustainability and food security (IPCC 2022). To achieve this vision, the European Commission and therefore the Green Deal rely on the Agricultural Knowledge and Innovation Systems (AKIS), as the networks of actors and institutions that use and produce knowledge for agriculture related fields. Thereupon, AKIS aim to improve the flows of knowledge among farmers, advisers, researchers, educators, businesses and policy makers, using a multi-actor and interactive approach that fosters innovation, digitalisation and knowledge exchange for a more competitive, smart and sustainable agriculture.

Under the EIP-AGRI, innovation has been driven through funding schemes as the Rural Development Programmes of the CAP and EU Horizon 2020 and Europe programmes, supporting different types of actions depending on the objectives and expected impacts of the projects being Multi-Actor projects (MAPs) one of the main types within the different types of actions as i) Coordination and Support Actions (CSA), ii) Research and Innovation Actions (RIA) and Innovation Actions (IA). As one of these actions, the H2020 EUREKA project aimed at facilitating and promoting the longer-term and wider use by farmers, foresters and other rural businesses of the practical knowledge and innovative solutions that are generated by Horizon 2020 multi-actor projects (EUREKA 2020).

Thus, this study aims at describing the H2020 MAPs regional deployment and synergies attained. To this end, 120 MAPs were analysed including i) the mapping of coordination and partners, and ii) interactions within the H2020 landscape.

1. Methodology

The geographic perspective was the initial basis for establishing the connections between the 120 Multi-Actor Projects (MAPs) of the Horizon 2020 Research and Innovation Programme listed on the European Innovation Partnership for Agricultural Productivity and Sustainability (EIP-AGRI) /CORDIS database. Based on this, the analysis of the existing international collaborations of the projects was carried out within the frame of the EUREKA project aiming to inform the countries and subsequently the Rural Development Programmes (RDPs) about such information (Mosquera-Losada et al. 2020). Geographic data were obtained from the EIP-AGRI and CORDIS official websites (EC 2022; EIP-AGRI 2022). Mapping the 120 MAPs and 43 FGs 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.

The 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 yEd 3.20 tool (yWorks 2011).

Maps were created by using Geographic Information System (GIS) mapping to better understand the networking (QGIS.org 2021). 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 - Figure 1).

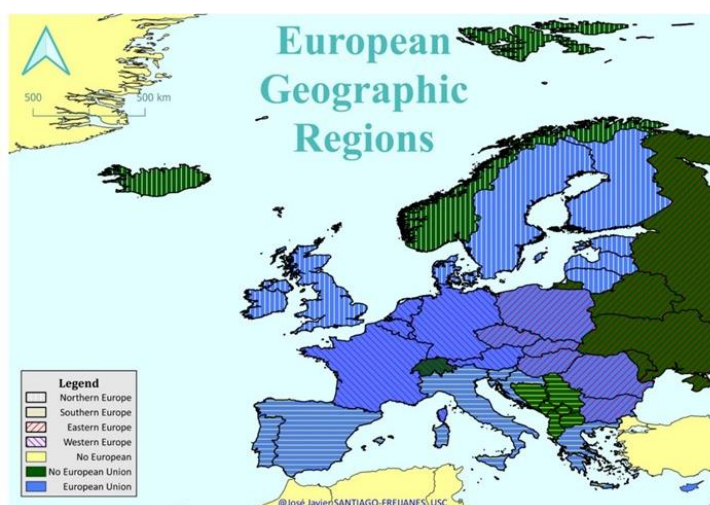


Figure 1. Countries identified within European geographic regions to perform the analysis.

2. Results

Resulting from the desktop study conducted, the following results and related figures allows to describe, from a geographical perspective, the situation at the final stage of the H2020 research and innovation Programme in Europe by referring to the grade of collaboration and contacts for the different MA projects as CSA, RIA and IA projects. As for obtaining a regional categorization, results consider the country of origin of the coordination teams and partners.

Thus, it was found that majority of coordination teams come from Western Europe countries as Spain, France and UK. On the other hand, Eastern and North European countries, in addition to Ireland, present the lowest share. Greece, Denmark and Sweden stand out as the countries with more significant participation. Regarding partners, larger countries provide higher number and share, being Spain, France, Italy, Germany and UK the ones with more participants. Belgium and the Netherlands stand out with high number despite their lower population. Again, Eastern countries are the less represented including Latvia, the Czech Republic or Slovenia.

Figure 2 evince the grade of collaboration at the country level. As for the coordination teams and project partners numbers, large countries seem to establish more connections, being the Netherlands and Belgium two exceptions to highlight as main hubs of networking within larger countries such as Spain, the UK, Italy and France, followed by Germany and Denmark. Most of the countries in the EU seem to perform collaboration at an acceptable rate, being notable examples Ireland, Greece, Sweden, Slovenia, Finland Austria and the Czech Republic. Conversely, countries as Croatia, Slovakia, Cyprus, Lithuania and Malta reflect poor networking. Regarding networking with non-EU countries, Serbia, Switzerland and Norway highlight as poles of collaboration. Out of Europe we could consider mainly China and Brazil as networking axis but also Turkey, Israel, Chile, Canada or the United States. In brief, the EU MA projects networking reaches a total of 40 countries globally, increasing up to 50 if also considering non-EU countries.

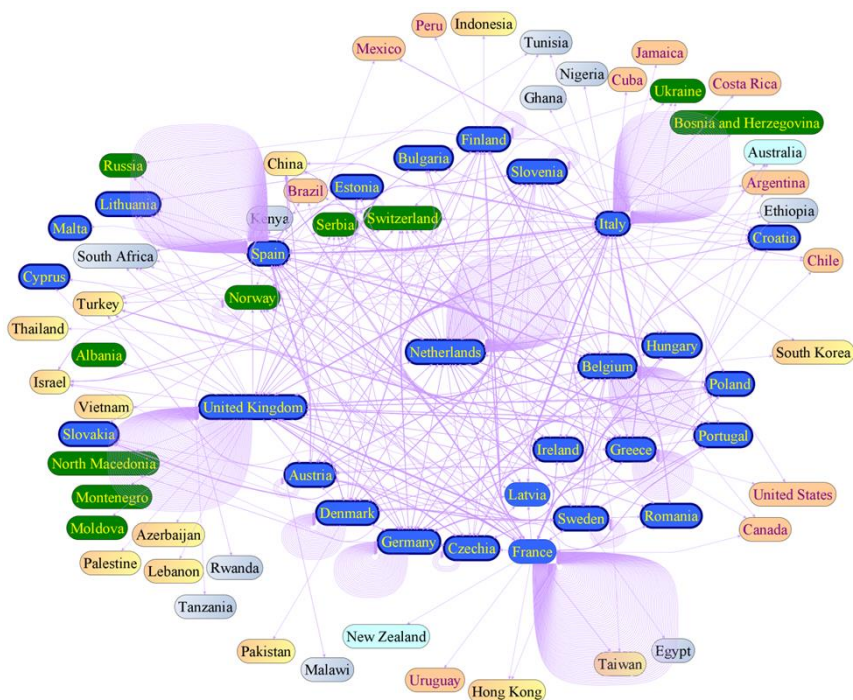


Figure 2. Contacts among MA projects coordination teams and projects consortiums. Blue represents EU countries, Green represents non-EU European countries, Yellow refers to Asian countries, Pink refers to America, light blue represents Africa and aquamarine light blue refers to Oceania.

Considering the number of contacts, it was found that for the 73 countries involved in this study, it can be established three different ranges: up to 8000 contacts, up to 1000 contacts and up to 60 contacts. Thus, the countries with more contacts are the ones referred before in this article with the largest share of coordinators and partners. In the range between 4000 and 8000 contacts per country appear countries with a developed innovation system, including Spain, Italy, Germany, France, The Netherlands, Belgium and the UK. As it could be expected, several countries from outside the EU were found to be the countries with the lower number of contacts, while Cyprus is the EU country with the lowest number of contacts among MA partners, even being it lower than the number reached by non-EU and non-European countries as Costa Rica, Taiwan, Kenya or South Korea. Also, a lower number of contacts within the EU network was found for Slovakia, Croatia or Bulgaria with no more than 300 to 500 contacts each. It is remarkable the high number of contacts reached by some non-EU countries as Switzerland, China and Serbia.

3. Discussion

The dominance of large European countries in terms of innovation performance and capacity in Europe indicates a regional imbalance. This is evident from the analysis of the four EU regions based on the United Nations' Geoscheme (UN 1999), which shows that Eastern countries present lower degree of innovation development. Moreover, Northern Europe also has a small share of innovation development compared to the other regions.

The distribution of MA project coordinators across European countries suggests that EIP-AGRI resources for innovation are predominantly allocated to large countries in Western and Southern (EC 2023). This may reflect a higher level of innovation development in these regions compared to Eastern countries, as indicated by the European innovation scoreboard (EC 2021). The lower degree of innovation in Eastern countries potentially influenced the lower competitive calls application for RIA, IA and CSA coordination. Moreover, the number of participants in MA followed a similar pattern, with larger countries having more participants and Eastern countries having less than other EU regions which could be attributed to the significant correlation between the population size and the MA contacts, rather than the country area (Mosquera-Losada et al. 2020).

The analysis of the number of MA contacts by country supports the aforementioned, and suggests that the size of the country (by population), the number of tertiary education institutions, and the level of investment are key factors for creating a network that involves a large number of countries. It may also be influenced by the number of teaching staff in tertiary education institutions per country, as countries with a high number of teaching staff tend to have more extensive networks (EC 2018).

One of the factors that influences the higher degree of international collaboration in research is the existence of formal agreements between countries or regions that facilitate the exchange of resources and knowledge. Thus, the European Union (EU) has established bilateral agreements on research with several third countries, as Switzerland and China, which enable them to participate

at the EU's research funding programmes, such as Horizon 2020 (EC 1999, 2014). This creates opportunities for researchers from both sides to cooperate and benefit from each other's expertise and infrastructure. As a result, it has been found in this study those third countries, such as China and Switzerland, achieved a higher level of connections than other EU members.

4. Conclusion

This study has analyzed the Horizon 2020 network by examining the relationships between the partners of 101 multi-actor projects in the EIP-AGRI domain. It was scrutinized a large dataset of about 70000 bilateral

connections to explore the structure and dynamics of this network. The MAP coordination teams were mainly located in large EU Southern and Western countries, which also had the most extensive collaborations with other countries worldwide. The most frequent interactions outside of Europe were with Asian countries, especially China, which reflects the strategic partnership between the EU and China in research and innovation.

These results provide insights into the EU and global dynamics and impact of the MAP projects and suggest potential areas for improvement and further cooperation, specially for the Eastern EU countries.

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