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How are Agricultural Research Projects conceiving innovation? An assessment of the European Union Multi-Actor Projects

Samuel Brea Martinez-Collado
University of Arkansas, Fayetteville

How are Agricultural Research Projects conceiving innovation? An assessment of the European Union Multi-Actor Projects.

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by

Samuel Brea Martinez-Collado
European University of Madrid
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Alvaro Durand-Morat, Ph.D.   Pieter Spanoghe, Ph.D.
Thesis Director   Co-promoter

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Jefferson Miller, Ph.D.
Committee Member

Abstract

Horizon research programs are the European Union's lighthouse for innovation and research concerning the agri-food chain, the management of natural resources, and the bioeconomy. Their innovation strategy approach is one that pursues the practical application of the research via the collaboration of all actors involved. Such strategy is the reflection of a Multi-Actor Approach as their procedure to enhance innovation. This paper presents the main trends and directions 101 Multi-Actor Projects (MAPs) are following on said approach towards innovation. The analysis is based on the use of well-defined "pathways" and "measures" proposed in the Guidelines for Evaluation of Innovation in Rural Development Programmes from the European Commission. Project coordinators from the 101 sampled MAPs were contacted to validate the initial assessment. Furthermore, analyses of the allocated budget, project type, and several other relevant project-specific variables were conducted to provide further insights on the innovation of MAPs. Results indicate an approximately equal distribution between projects working on identifying and developing new ideas ("Pathway 1") and projects working on the implementation of existing knowledge ("Pathway 2"). Trends towards the development of new products, practices, and processes, as well as the horizontal and vertical co-operation among supply chain actors, were also identified. The results suggest that Horizon should consider strengthening investment in projects targeting Pathway 2 for livestock & permanent grassland and the permanents crops sectors, as well as conducting more actions towards the diversification of farming activities.

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Introduction.

The European Union (EU) is facing several societal challenges, including "ensuring food and nutritional security, sustainably exploiting the potential of the oceans, promoting dynamic territorial development, boosting investment, employment and economic growth in the European Union" (European Commission 2017a). To address these challenges, in 2013 the EU implemented the research and innovation program Horizon 2020, which evolved into the program Horizon Europe in January 2021 (Council of the European Union 2020). Horizon sets a common research strategy and budget amongst the 27 EU member states. Three percent of the European Commission budget is allocated for general Research and Development. Cooperation and open and free knowledge exchange are the core values of the program, which aims to deliver scientific, technological, economic, environmental, and societal innovations as a method to address the societal challenges (Council of the European Union 2020). With the purpose of implementing a Multi-Actor Approach (MAA), the Horizon 2020 program has so far funded more than 120 MAPs, with over 500 million euros in the last three years (EIP-Agri 2020).

The Horizon programs are integrated into the EU Bioeconomy Strategy, the EU Common Agricultural Policy (CAP), the EU Integrated Maritime Policy and the EU Common Fisheries Policy. This makes Horizon the lighthouse for innovation and research concerning the agri-food chain, the management of natural resources, and the bioeconomy (European Commission 2017a). To better integrate the Horizon programs into the European rural development ecosystem, the European Innovation Partnership 'Agricultural Productivity and Sustainability' (EIP-Agri) was created. Working together with the Horizon program, its mission is to support the implementation of a MAA to research by facilitating networking among all stakeholders

involved in, or potentially affected by, the research outputs and innovations (European Parliament 2013; EU SCAR AKIS 2019; Campling et al. 2021). A MAA is a demand-driven approach to research in which the heterogeneous but interconnected needs of the actors are considered from the outset. Cooperation is the instrument that allows to identify and broadcast the solution to shared problems from and towards a network of interconnected agents.

The MAA is a core rationale for the implementation of multi-actor projects (MAPs), which must "reflect a balanced choice of key actors with complementary types of knowledge (scientific and empirical), with the goal of facilitating the implementation of the project results" (EU SCAR AKIS 2019). In other words, MAPs are expected to facilitate the transformation of basic research into applicable innovations, to make "results easily understandable and accessible", and to use the "dissemination channels most consulted by end-users of the project results" (EU SCAR AKIS 2019). Rosa et al. (2021) concluded that projects using the MAA have demonstrated potential to deliver social innovation, translating the integration of multiple actors in the research process into applied progress. Furthermore, participatory processes on research in the European context have shown to be advantageous for refurbishing end-user trust in research (Klerkx et al. 2017). Feo et al. (2019) concluded that a MAA is likely to accelerate innovation for all Horizon research structures, like Thematic Networks[1], Operational Groups[2], Focus Groups[3], and MAPs.

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[1] Thematic Networks: Research structure collecting existing scientific close to being put into practice, but not yet sufficiently ready for farmers and foresters to implement. The Networks will translate this knowledge into easily understandable end-user material (EIP-Agri 2019).
[2] Operational Groups: "Partnerships involving a wide variety of stakeholders but most importantly, interested actors such as farmers, researchers, advisors and businesses involved in the agriculture and food sector"(European Network for Rural Development 2017a).
[3] Focus Groups: "collect and summarise knowledge on best practices in a specific field, listing problems as well as opportunities" (EIP-AGRI 2017).

The objective of this research is to assess the main patterns MAPs are following on their quest for innovation. This will be valuable from a policy point of view, since it may help to identify gaps in research support that could be undermining progress towards tackling the societal challenges faced by the EU and beyond. The results of this study can help policymakers and society at large by providing a description of the current research support landscape. This could serve as a benchmark in the evaluation of Horizon programmes and in making future adjustments to optimise the use of collective resources.

Measuring Innovation: Pathways and Measures

Considering the lack of a broadly used framework to evaluate innovation (Svagzdiene and Kuklyte 2016; Carnahan, Agarwal, and Campbell 2010; Ahuja 2000), this research uses the Guidelines for Evaluation of Innovation in Rural Development Programmes (EC guidelines) from the European Commission (2017b) to evaluate the approaches to innovation being used in MAPs. The EC guidelines, developed for the Commission by the European Network for Rural Development (ENRD) and the European Helpdesk for Rural Innovation, were originally meant to evaluate the performance of Member State-level Rural Development Programs (RDP). Still, for the purpose of this research they are considered appropriate because, "…other stakeholders may also use the guidelines as a reference document … for questions arising regarding the evaluation of innovation … and EIP operational groups as background information when designing projects and understanding their innovation potential" (European Commission 2017b) The EC guidelines propose using two instruments to measure innovation, which they refer to as i) *pathways* to innovation and ii) the *measures* for rural development.

The pathways represent the way different actions can contribute to the innovation process. As portrayed in Figure 1, the interconnected pathways are ultimately intended to fulfil the EU RDP objectives, while the measures and sub-measures are expected to contribute to the identification of specific innovation needs. MAPs have flexibility to select and combine measures depending on their specific needs (European Commission 2017b). Of all the measures for Rural Development, the EC guidelines specify that Measure 1 (M1), Measure 2 (M2), Measure 16 (M16), and Measure 19 (M19) (Table 1) as the ones directly contributing to the EU objectives for innovation on rural development.
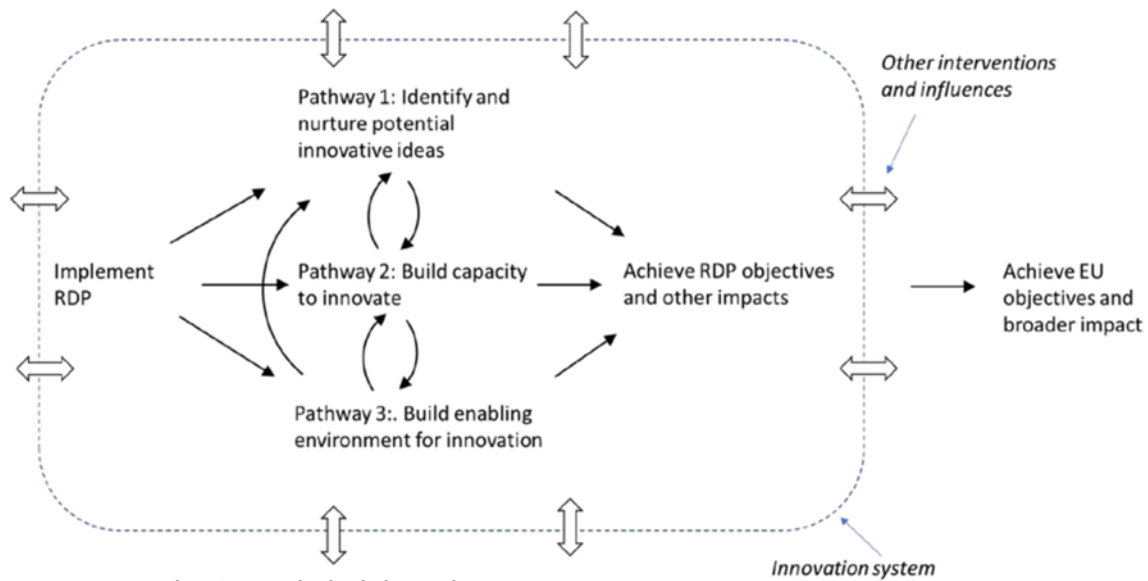
Source: EU Evaluation Helpdesk (2017)

Figure 1. The role of pathways in Rural Development Programs (RDP)'s quest for innovation.

Methodology.

A total of 120 MAPs have been approved for funding since 2007 (EUREKA 2020). This research focuses on the 101 Horizon MAPs analyzed as part of the EUREKA project (Annex 1) due to replicability and accessibility reasons. As described above, the EC Guidelines are the basis used in this study to evaluate innovation in MAPs.

Data collection, pathways and measures

To identify the pathways and measures/sub-measures targeted by each project, the Community Research and Development Information Service (CORDIS) website was consulted for each MAP investigated. Each MAP was classified by their corresponding pathway and sub-measures of innovation. As a criterion for the classification of the pathways, their definition is compared with the MAP's objective found in CORDIS.

The pathways are defined by the EC Guidelines (European Commission 2017b) as follows:

- Pathway 1 (develop potential innovative ideas): The development of new ideas leading to new views, approaches, products, practices, services, production processes/technology, new ways of organising or new forms of cooperation and learning.

- Pathway 2 (build capacity to innovate): The capacity of individuals and of the knowledge and innovation system itself to experiment, self-organise and make use of new ideas and approaches.

- Pathway 3 (enable environment for innovation): The institutional and policy environment for emerging innovative processes. The outputs are recommendations or materials contributing to the policy environment and discussions.

The guidelines portray the pathways as an exclusive classification (only one pathway per MAP). Each MAP is allocated to a pathway following the information available in CORDIS. MAPs that could fit into more than one pathway were assigned to the pathway that most closely fits their main objective. MAPs that are exploratory in nature and, thus, do not have a defined objective but rather plan to build one based on their findings, were classified into Pathway 1, as the format is more closely associated to the generation of new ideas.

Each MAP was classified in terms of measures and sub-measures that are not mutually exclusive. The definitions of the sub-measures refer to all the possible actions contemplated by the EC guidelines (Table 1). In this case, a sub-measure was allocated to each MAP when the author of this study judged the measure definition to sufficiently match the description of the planned actions of the MAP in CORDIS.

Table 1. Definition of measures and sub-measures to evaluate innovation according to the Guidelines for Evaluation of Innovation in Rural Development Programmes.

Measures		Sub-measures	
M1.	Measure one covers vocational training and skill acquisition, demonstration activities and information actions. In addition, it may also cover farm and forest management exchanges and visits.	1.1	Vocational training and skills acquisition actions
		1.2	Demonstration activities and information actions
		1.3	Long-term farm and forest management exchange as well as farm and forest visits
M2.	Includes advice to individual farmers, young farmers and other land managers, as well as training of advisors or innovation support service providers. This covers several elements, such as the advice measures at farm level aiming *inter alia* at innovation at innovation Chapter 1.1, by offering the opportunity to transfer knowledge. In addition, in the context of the European Innovation Partnership (EIP), advisors/innovation support services acquire a "coaching" role in the interactive innovation processes in the context of Operational Groups (OGs).	2.1	Support to help benefit from the use of advisory services
		2.2	Support for the setting up of farm management, farm relief and farm advisory services as well as forestry advisory services
		2.3	Support for training of advisors

Table 2. Continued.

Measures		Sub-measures	
M16.	Supports cooperation between a wide range of actors that contribute to achieve the objectives of rural development policy (agriculture and forestry sectors, food chain, producer groups, cooperatives, inter-branch organisations and others). Furthermore, the creation of clusters and networks and the establishment and operation of OGs of the EIP-AGRI.	16.1	Support for the establishment and operation of operational groups of the EIP for agricultural productivity and sustainability
		16.2	Support for pilot projects, and for the development of new products, practices, processes and technologies
		16.3	Cooperation among small operators in organising joint work processes and sharing facilities and resources, and for developing and marketing tourism
		16.4	Support for horizontal and vertical cooperation among supply chain actors for the establishment and development of short supply chains and local markets
		16.5	Support for joint action undertaken with a view to mitigating or adapting to climate change and for joint approaches to environmental projects and ongoing environmental practices
		16.6	Support for cooperation among supply chain actors for sustainable provision of biomass for use in food and energy production and industrial processes
		16.7	Support for non-CLLD[4] strategies
		16.8	Support for drawing up of forest management plans or equivalent instruments
		16.9	Support for diversification of farming activities into activities concerning health care, social integration, community-supported agriculture, and education about the environment and food
		16.1	Others
M19.	Supports the local rural development through the application of the LEADER[5] principles. One of these principles focuses on promoting innovations through activities of the local action groups and the beneficiaries of CLLD strategies.	19.1	Preparatory support
		19.2	Implementation of operations under local development strategies
		19.3	Cooperation activities
		19.4	Running costs and animation
Verbatim definitions from Guidelines for Evaluation of Innovation in Rural Development Programmes (European Commission 2017b)			

[4]Community-Led Local Development (CLLD): preparatory support, implementation of operations under the CLLD strategy, preparation and implementation of cooperation activities of the local action group…, running costs and animation, referred to in Article 35(1) of Regulation (EU) No 1303/2013 (European Commission 2014).
[5] LEADER: These funds are used to support thousands of generally small projects for adding value to local food products, diversification, improving rural services, environmental improvements, small-scale infrastructure, village renewal and training (European Commission 2014).

As a validation of the researcher's allocation of the sub-measures, project coordinators of all the MAPS were contacted via email and asked to give their impressions about the classification of their project. In addition to the initial assessment made in this study, coordinators were provided with the definitions of all the measures and sub-measures. If they disagreed with the assigned classification, they were asked to provide a new one. The collected answers were then integrated into the original classification to make refinements for the final version. Similar validation methods have proven to be robust (Martinson, Thrush, and Lauren Crain 2013) (Maul 2017) and there are precedents of its application to agricultural research (Carey et al. 2003)(Boryan et al. 2011).

Project classification

Each MAP was categorized by (1) agricultural sectors, (2) research category, (3) research action, and (4) Region to help explore new trends and build meaningful project profiles (Figure 2). Agricultural-sector classification follows Mosquera-Losada et al. (2020) in using six broad categories: arable crops, permanent crops, cross-cutting agriculture, forestry, livestock & permanent grassland, and rural development. Research category was assigned according to the European Commission's (2016) strategic approach to EU agricultural research & innovation, which identifies three research categories: human and social capital[6], rural innovation[7], and sustainable primary production[8]. Research action categories were chosen following Horizon

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[6] Human and Social Capital: Human capital (i.e. individual skills that enable actors to perform or initiate economic activities) and social capital, i.e. the links, incentives, shared values and norms that underpin the capacity of actors to trust each other and cooperate, are essential to successful rural innovation (European Commission 2016)
[7] Rural Innovation: modernising rural territories and policies: New openings for rural growth, enhancing the human and social capital in rural areas
[8] Sustainable Primary Production: Creating value from land - sustainable primary production: Resource management (notably soil, water, biodiversity), Healthier plants and animals, and Integrated ecological approaches in farm (European Commission 2016)

2020 (2016), and include Research and innovation actions (RIA)[9], Innovation actions (IA)[10], and

Coordination and support actions (CSA)[11]. Finally, every MAP is classified by region following

the principal investigator's country of residency. Regions were clustered into the four macro

regions assigned by the UN, namely Nordic-Baltic, Danube/Balkan, Mediterranean, and

Atlantic/ North Sea. Finally, this research analyses the budget allocation (listed on the CORDIS

website) by pathway and measure as a way to better understand the distribution of funding.
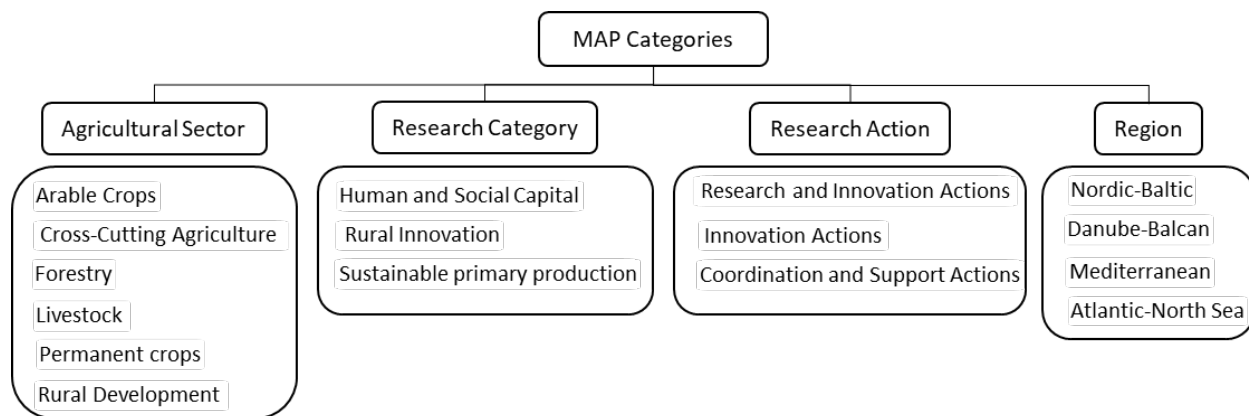
Figure 2. Classification of multi-actor projects (MAPs) by agricultural sector, research categories, research actions, and regions.

Data processing

Statistical analysis consists primarily of assessing the frequency distribution of pathways,

measures and sub-measures among the set of 101 MAPs. While each MAP is classified into

exactly one pathway, a project may address more than one measure or sub-measure. The

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[9]RIA: R&D to establish new knowledge or explore the feasibility of a new or improved technology, product, process, service or solution (including basic and applied research, technology development and integration, testing and validation on a small- scale (Horizon 2020, 2020).

[10]IA (innovation actions): Innovation activities directly aiming at producing plans and arrangements or designs for new, altered or improved products, processes or services (including prototyping, testing, demonstrating, piloting, large-scale product validation and market replication) (Horizon 2020 2020).

[11] CSA: Accompanying measures such as standardization, dissemination, awareness-raising and communication, networking, coordination or support services, policy dialogues and mutual learning exercises and studies (Horizon 2020 2020).

approach followed here is to first classify MAPs according to the measure used, regardless of

the number of sub-measures employed, and then subsequently to analyze the achievement of

sub-measures separately.

For all categories the statistical difference across pathways is assessed using the Kruskal-

Wallis equality-of-populations rank test (Wu and Guan 2017) using Stata version 15.

The frequency analysis of pathways was filtered by the four categories (agricultural

sectors, research category, research action, and region) described above. Measures and sub-

measures were not analyzed by these four categories because they describe the actions that

MAPs perform, which are largely independent of these factors and are more related to a

project's research approach.

Results and Discussion

MAP validation

For most of the MAPs analysed, the allocation to one of the three innovation pathways (see *Methods*) was straightforward. However, for 17 of the 101 projects, there was intricacy on the allocation. Out of the 17, for 8 MAPs it was difficult to identify a clear objective, so as prescribed by the methodology this subset was allocated to the Pathway 1, developing innovative ideas. For the remaining 9 more than one objective was detected, a second review allocated the MAPs to the Pathway that was considered primary.

Forty-one complete replies from principal investigators (out of a sample of 101) were received with, corresponding to a response rate of 40.6 %. Table 2 compares the original allocation of projects by measure conducted by the author to those of the MAP coordinators. This categorisation was further validated by independent assignment of sub-measures for each project, Annexes 4 and 5.

Table 3. Comparison between the research's (R) initial count of measures achieved and those of the MAPs principal investigators (PIs). Sample size of the 41 MAPs from which responses were received.

	(R) Count	(PIs) Count	Variation in the achievement
Measure 1 (Communication)	34	39	12.2%
Measure 2 (Advisory Services)	10	9	2.4%
Measure 16 (Support for cooperation)	36	35	2.4%
Measure 19 (Implementation of LEADER)	10	14	9.8%

Pathways

Looking at the distribution of MAPs by pathway, it was found that 41% of projects belong to Pathway 1 (Develop innovative ideas) and 36% to Pathway 2 (Build capacity to innovate) and 24% to Pathway 3 (Enabling environment for innovation). Such distribution represents a

successful achievement of the European research strategy, which is not exclusively focused on developing new innovative ideas but there is a large number of projects dedicated to building the capacity to innovate.

<u>Agricultural Sector</u>

Figure 3 shows the distribution of the pathways amongst each agricultural sector, to bring perspective on the sample, the total number of MAPs per sector is added. The distribution of pathways varies significantly ($p < 0.05$) across agricultural sectors. For example, for forestry 60% of the MAPs are focused on extension activities and only 20% on primary research, which indicates that the focus is on disseminating existing knowledge (Pathway 2) rather than developing new one (Pathway 1). These findings for forestry are in line with those of Lawrence et al. (2020) and Fieldsend et al. (2020) who highlighted trends pointing towards a raising demand more sustainable and modern forest management techniques.

A majority of the MAPs focusing on "livestock & permanent grassland" (78%) and "permanent crops" (71%) fall under Pathway 1, developing new ideas. This is indicative of the priority given to furthering basic research as these sectors face new challenges and opportunities (e.g., reducing environmental impact and water footprint) (Rathod, Chander, and Bardhan 2018). Among MAPs focused on arable crops and rural development the distribution of pathways is more balanced (Figure 3), which could be associated with the well-established research record (Pathway 1) in these areas and the need to facilitate the dissemination of those basic findings via capacity building (Pathway 2) and the development of an enabling policy environment (Pathway 3).
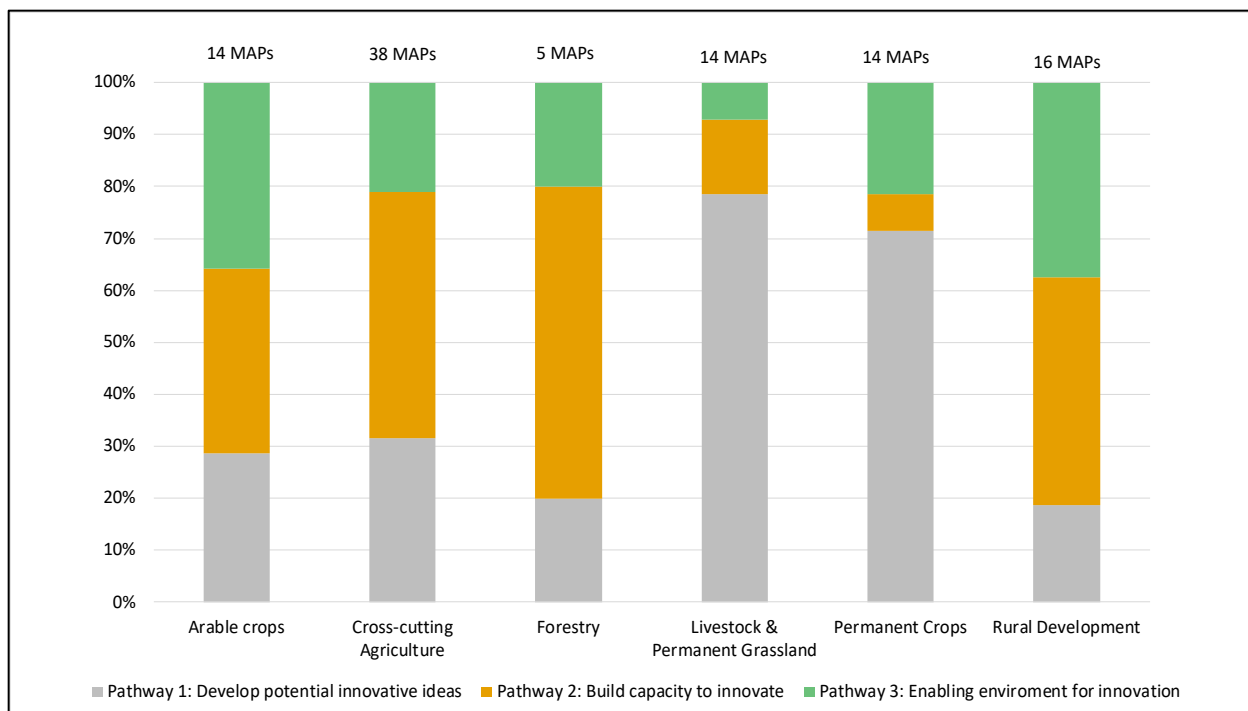
Figure 3. Distribution (%) of pathways for the different agricultural sectors. The frequency of MAPs per agricultural sector is added on top of each sector to bring further context.

Research Category

Figure 4 shows the distribution of MAPs and pathways according to research category (human and social capital, rural innovation, and sustainable primary production). The distribution of pathways varies significantly ($p < 0.01$) across research categories. Over 60% of the MAPs focus on sustainable primary production, among which 57% fall under Pathway 1. Pathway 2 is the most common for MAPS focused on human and social capital, and rural innovation. In addition, 40% of the MAPs focusing on sustainable primary production belong to the agricultural sector categories "livestock & permanent grassland" and "permanent crops". Such relation builds a trend on projects that work on sustainable primary production (mainly on livestock & permanent grassland and permanent crops) and focus on developing new ideas. Research projects on social and human capital tend to focus on the second pathway (66%), which aligns

well with the underlying aims of the MAA to connect actors and build the social capacity to innovate. Still, the low count of social and human capital research projects is a meaningful and could support the need for more funded social science research programming. Rural innovation has the largest share of projects under Pathway 3 (44%), depicting a research sector focused on building the appropriate environment for innovation and tackling the social challenges that need to take place.
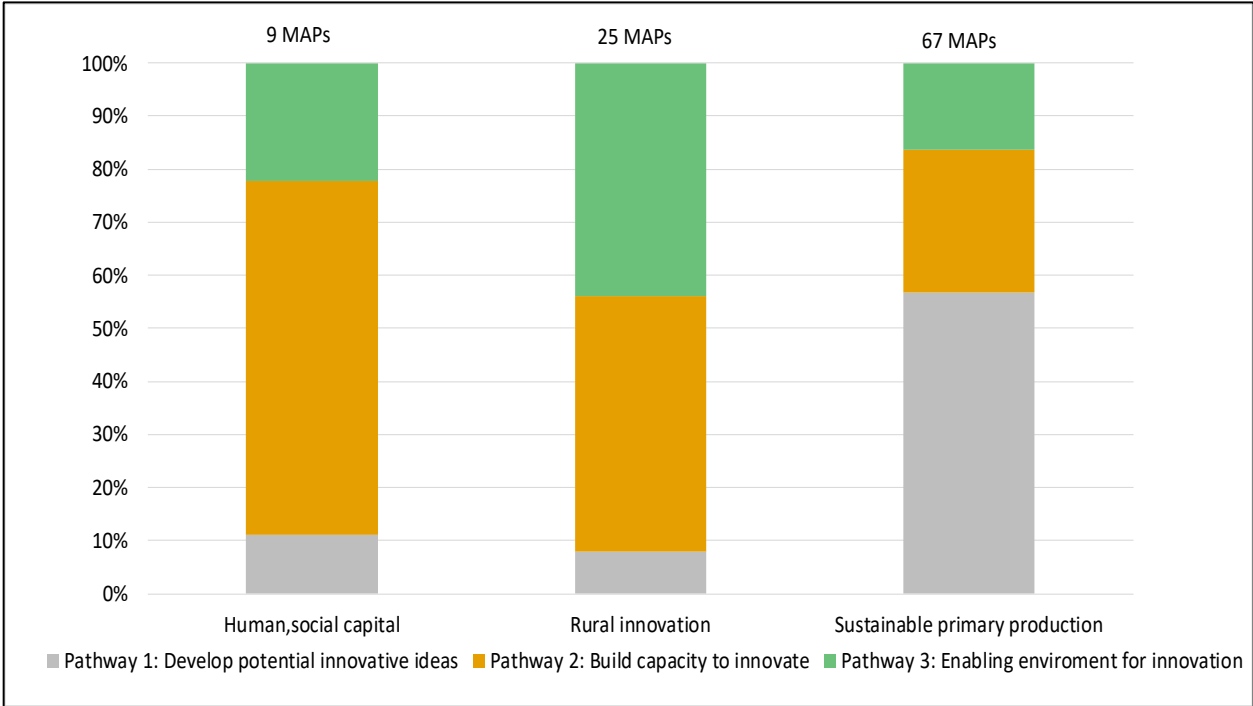
Figure 4. Distribution of pathways to innovation of Multi-Actor Projects by Research Category. The frequency of MAPs per research category is added on top of each column to bring further context.

Research Action

Before assessing the distribution of pathways by research action type, it is worth noting that 83% of the MAPs focus on research and innovation actions (RIA) (Figure 5 and Annex 2). There is no statistical difference (p < 0.53) in the distribution of pathways across research action categories. Nevertheless, we can see a more balanced distribution for the RIA type MAPs

compared to those focused on Innovation actions (IA) or Coordinated and support actions (CSA) (Figure 5). Both IA and CSA have a strong weight of Pathway 2. This is to be expected for CSA MAPs, as they share the goal of fostering cooperation and knowledge exchange as a way towards innovation.
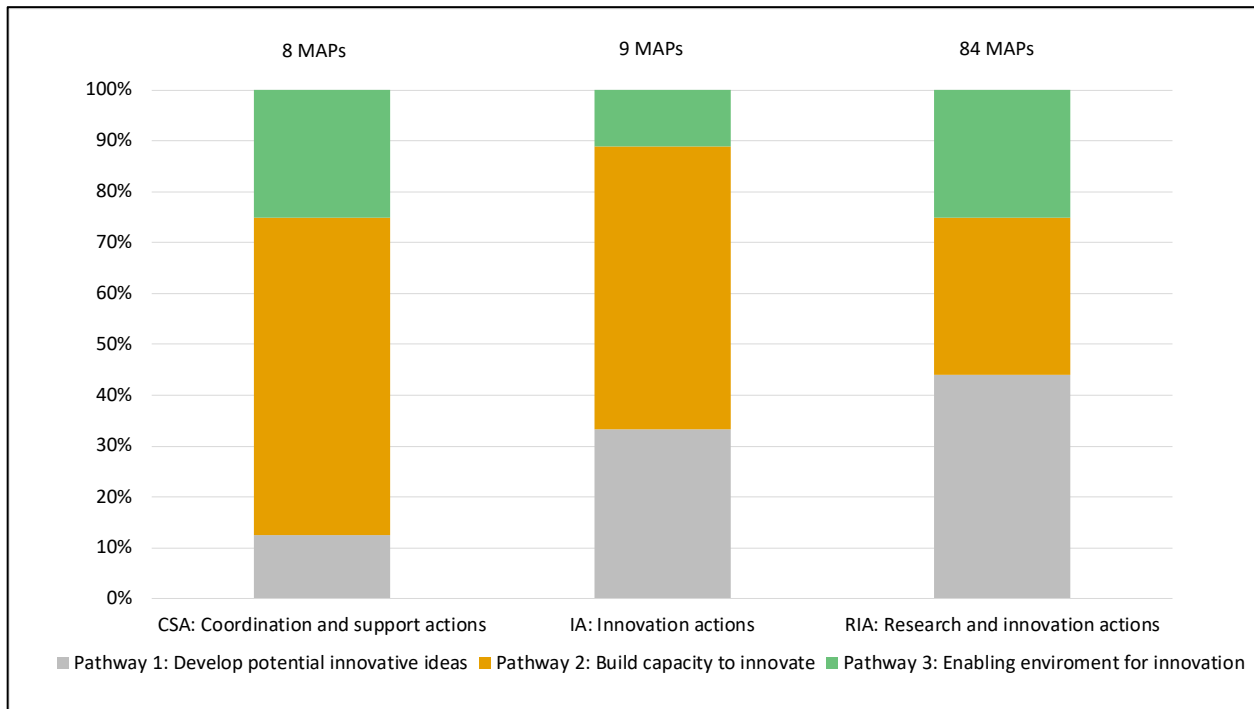
Figure 5. Distribution of pathways to innovation of Multi-Actor Projects by Research Action. The count of MAPs per research action is added on top of each column to bring further context.

Region

The final categorization is by region, which may indicate slightly different trends for innovation (pathways) across the European regions (Figure 6), but which is not statistically significant ($p < 0.21$) at the commonly used significance levels. As discussed by (Mosquera-Losada et al. 2020) the Atlantic and Mediterranean regions coordinate the most MAPs because of their larger populations and size of agricultural sectors . MAPs in the Atlantic region have the most balanced distribution of pathways, while the Mediterranean and Danube regions show a higher

frequency of Pathway 1, which may be related to the fact that agriculture represents a larger share of the overall economy in these regions (Eurostat 2018). In addition, Balkan and Mediterranean regions suffer from historically lower agricultural productivity(Tait 2001), so a focus on developing new ideas might appear as solution to the problem. Finally, the Nordic/Baltic regions present a high (53%) weight of the 2nd pathway, showing their efforts for enhancing cooperation and implementation of knowledge.
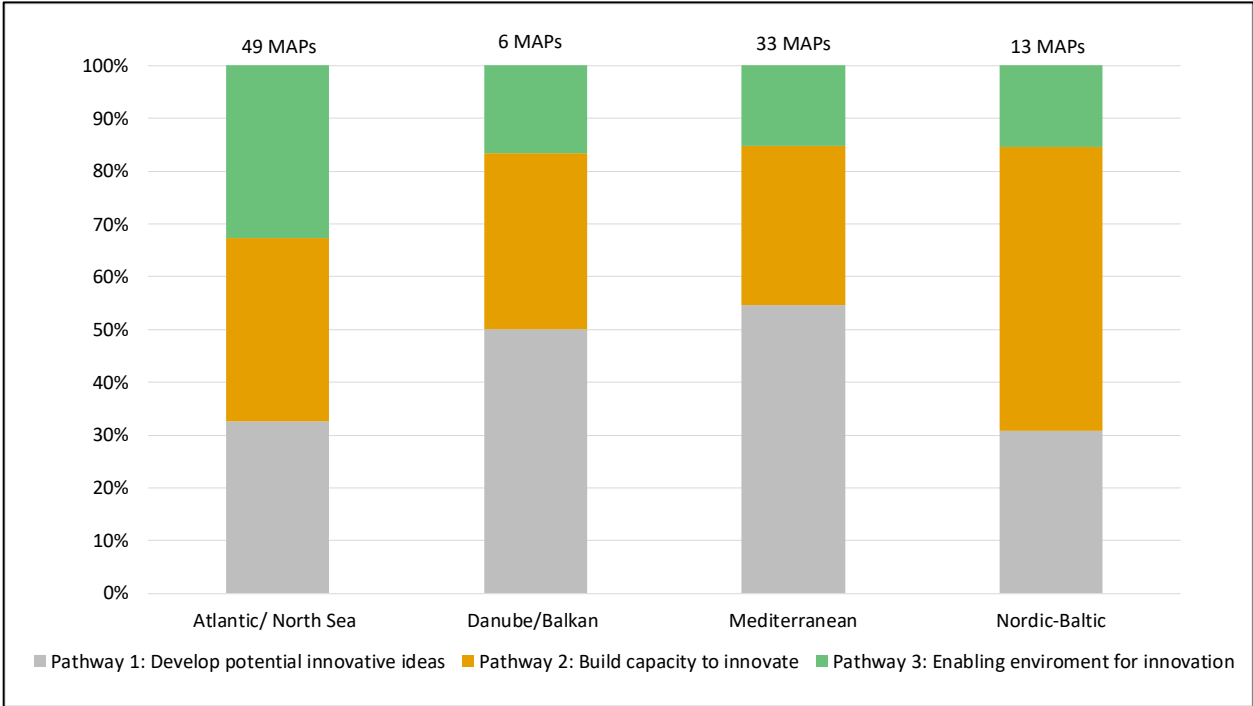
Figure 6. Distribution of pathways to innovation of Multi-Actor Projects by Region. The count of MAPs per region is added on top of each column to bring further context.

Budget

The total budget per pathway is highly correlated (0.91) with the number of MAPs in each pathway (Figure 7). This is to be expected given that average MAP budget is not statistically different across pathways. Pathway 2 has a higher average budget, adding to Moeliodihardjos et al. (2012) findings that suggest that capacity building for innovation requires substantial

funding in order to succeed. Research on Pathway 3 requires the second highest average budget and finally Pathway 1 requires the lowest one. These findings support the ones from (Crowley, Scott, and Fishbein 2018), who showed how the increasing willingness of policy making institutions to base their actions on scientific output is raising the funding to research focused on delivering policy advice (Pathway 3).

Figure 7. Average and total budget per pathway. Blue bars refer to the left axis (total budget of the 101 MAPs). Golden dots refer to the right axis(average budget allocated per MAP). To bring further context, frequency of MAPs is added per each pathway.

Measures

The count of the measures conducted by the 101 MAPs (Figure 8) gives a general overview on the actions the sampled MAPs have followed to achieve their goals. It is important to acknowledge that the counts are non-comparable between different measures and should be analysed individually.

87 out of the 101 MAPs (Annex 5) conduct actions included in M1 (Communication).

Horizon grants are required to have an extension component to help disseminating the outputs of the research, so 87 out 101 could be considered as a low degree of achievement. Several reasons may explain why 14 MAPs do not address M1, including early-stage MAPs not having a clearly defined communication strategy, or simply a lack of communication actions. To help overcome some of the challenges in communication, Potokar, Tomažin, and Škrlep (2021) propose a common European-level data management strategy, which they argue would increase the availability and communication of the scientific outputs of the MAPs.

Moving to M2 (Advisory Services), 19 MAPs (17.8%) (Annex 5) include developing some kind of advisory service. This relatively low percentage may result from the fact that the MAA promotes a more horizontal structure of knowledge transfer, which reduces the need for traditional advisory services. Far from being a negative scenario, this suggests that the MAPs are moving away from the traditional hierarchical structure that has kept practitioners and end-users of scientific knowledge from playing a more participatory role in innovation (Feo et al. 2020), (Dockès, Tisenkopfs, and Bock 2011).

Measure 16 (Support for cooperation) represents the support for cooperation actions conducted by the MAPs, a concept central to the MAA. According to this assessment, 84 of the 101 MAPs (Annex 5) conduct sub-measures included in M16, which reflects the importance placed on cooperation and networking as a way of finding common solutions. On the other hand, some projects, like LIAISON and NEFERTITI work either on the very specific development of knowledge or the development of policy advice do not take direct actions to support cooperation, but instead act as listeners of the actors' needs.

The fourth and final relevant measure considered in this study is M19 (Implementation of LEADER). By nature of the MAA, the general focus is to interconnect different actors for general problems. The relatively high proportion of MAPs that achieve M19 (39.60%) suggests a recognition of the need for local actions as part of a solution of larger scale problem.

A final measure-related analysis of the data on MAPs analysed here is of the budget allocated to projects grouped by the measure(s) they implement. Figure 9 shows that MAPs addressing M1 (Communication) and M16 (Support for Cooperation) have the largest share of the budget (35% and 37%, respectively), while MAPs addressing M2 (Advisory Services) receive only 8%, clearly correlated to the number of MAPs conducting actions included in each of the measures. The comparison of the average budgets per measure brings relevant insights on the situation of the MAPs, even if no statistical significance could be found. Projects conducting sub-measures included in M19 (Implementation of LEADER), on average count with almost one million euros more than the M1 counterparts. Circumstance that seems reasonable if it is considered that for M19 some interaction with local communities needs to be conducted whereas for M1 a simple social media campaign is sufficient.
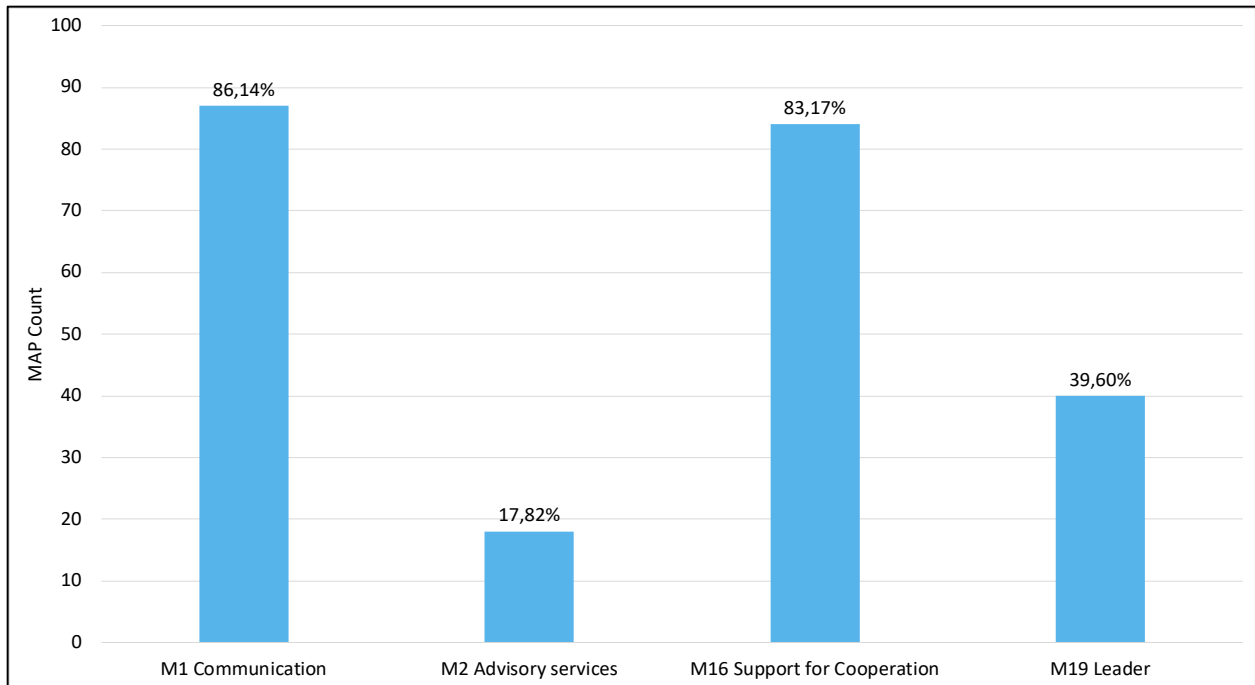
Figure 8. Count of the measures conducted by the 101 MAPs, represented by the blue bars. The labels show the percentage of MAPs conducting actions corresponding to each measure out of the 101 MAPs (Annex 5).
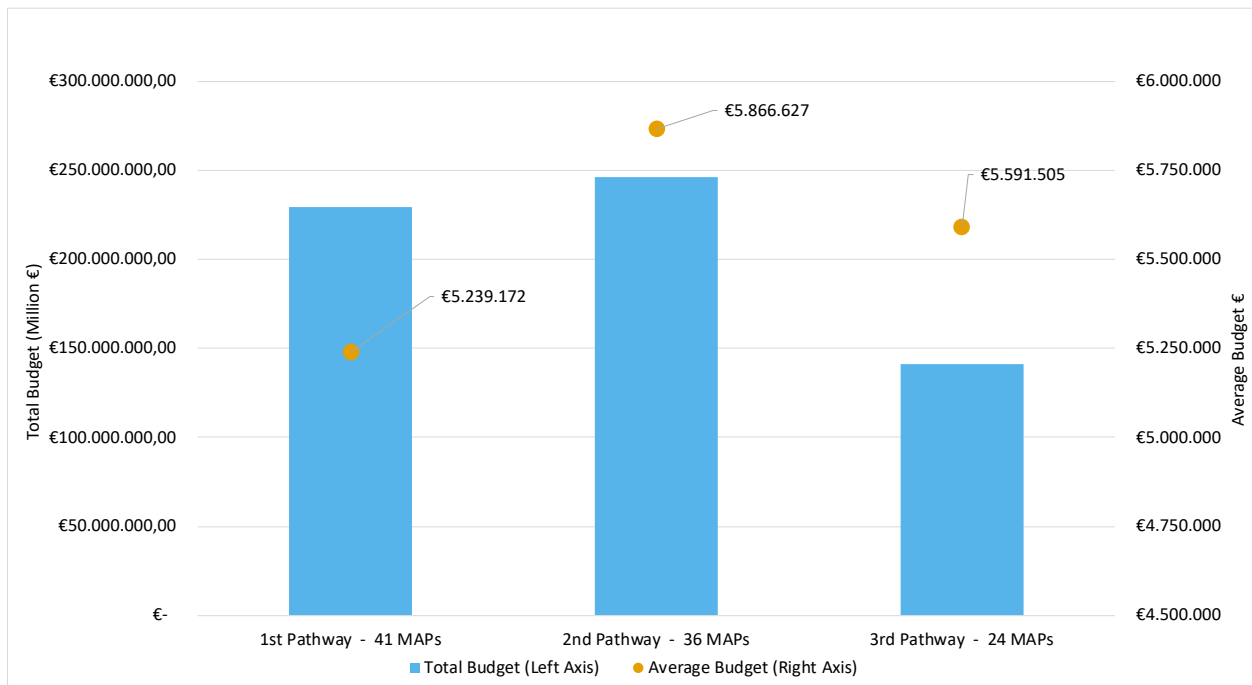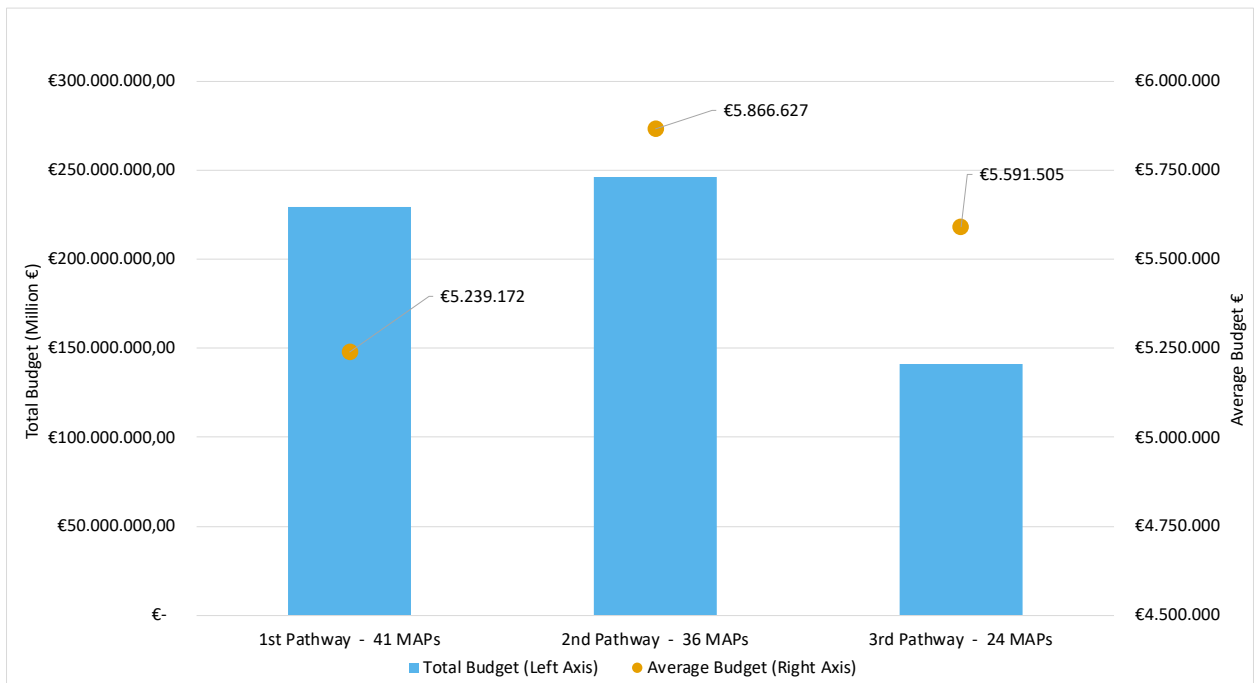

Figure 9. Average and total budget of the 101 MAPs per measure. Blue bars refer to the left axis (total budget of the 101 MAPs). Golden dots refer to the right axis (Geometric mean budget allocated to the MAPs per each measure).

Sub-measures:

Sub-measures of M1 (Communication)

At the sub-measure level, the results show that of the 87 MAPs addressing M1, 62 achieve Sub-measure 1.2 (demonstration and information actions). Most of the standard communication actions such as websites, workshops, and press releases aimed at disseminating research outputs belong to this sub-measure. Sub-measures 1.1 (demonstration activities and information actions) and 1.3 (long-term farm and forest management exchange as well as farm and forest visits) include very specific actions, so smaller counts (9 and 30 projects, respectively) are to be expected. MAPs addressing Sub-measure 1.1 primarily include projects working on moving technological developments from the laboratory to the field through vocational training and demonstration activities. Similarly, Sub-measure 1.3 promotes long-term farm and forest management exchange as well as farm and forest visits as a way of expanding the implementation and adoption of new technologies. Research from García-Alfonso et al. (2020) and Nouatin and Baco (2011) show promising results for long-term farm and forest management exchange in terms of achieving innovation. Based on this, and on the low count of Sub-measure 1.3, EIP-Agri and Horizon funding should promote a larger implementation of sub-measure 1.3.
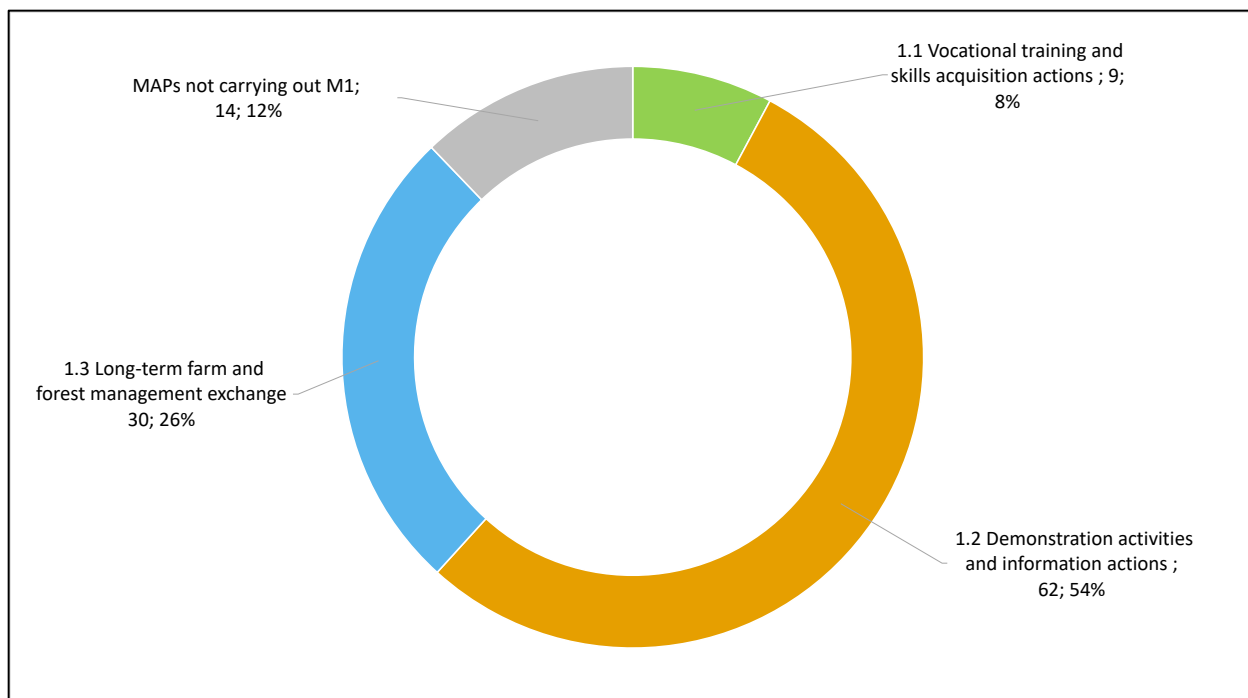
Figure 10. Distribution of the Sub-measures of M1, Communication among the 101 sampled MAPs. Under the label of each sub-measure, first the total count of MAPs achieving that sub-measure and secondly the percentage this count represents over the total sample is added.

Sub-measures of M2 (Advisory Services)

The distribution of the three sub-measures of M2, Advisory services, is similar across the MAPs

(Figure 11). Reducing the traditional relevance of Sub-measure 2.2 (support the setting up of

farm management, farm relief and farm advisory services) contributes to reduce hierarchies.

The balanced distribution of the M2 sub-measures further supports the previously mentioned

argument that a low count of M2 may well reflect a trend against the hierarchizing of research.

On the other hand, dedication of a project to Sub-measure 2.1, (support to help benefit from

the use of advisory services) and Sub-measure 2.3, (support for training of advisors,)

demonstrates an intention to transform research under AKIS principles (European Network for

Rural Development 2015).
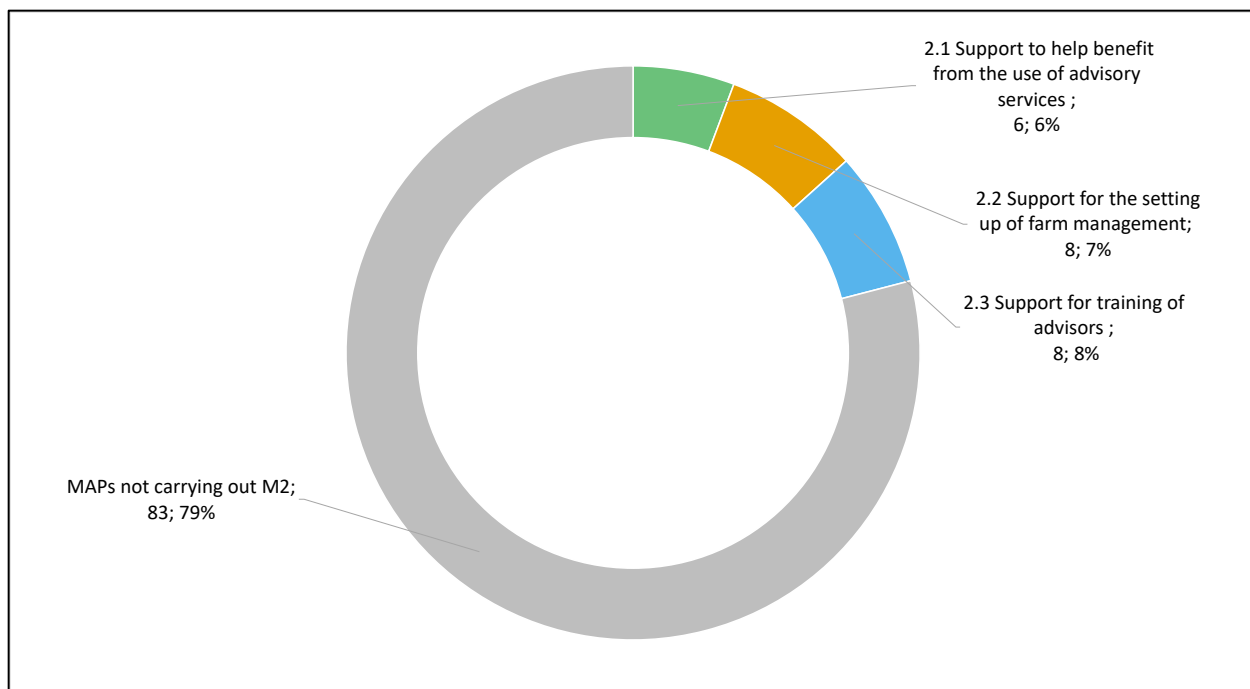
Figure 11. Distribution of the sub-measures of M2, Advisory Services, for the 101 sampled MAPs. Under the label of each sub-measure, first the total count of MAPs achieving that sub-measure and secondly the percentage this count represents over the total sample is added.

Sub-measures of M16 (Support for Cooperation)

For Measure 16 it was found that Sub-measures 16.2 (support for pilot projects and for the development of new products, practices, processes and technologies) and 16.4 (support for horizontal and vertical co-operation among supply chain actors for the establishment and development of short supply chains) are the most commonly used. Both these sub-measures represent a clear intention of MAPs of promoting the economic development and integration of rural actors. Forssell and Lankoski (2015), Renting, Marsden, and Banks (2003), and Parajuli, Thoma, and Matlock (2019) have praised such sub-measures as the best way for economic development of rural areas. The high count of Sub-measures 16.2 and 16.4 implies that MAPs are aiming, at least, to actively address and positively contributing towards the social challenges of "promoting dynamic territorial development, boosting investment, employment and

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economic growth in the European Union" (European Commission 2017a) These actions are also well-aligned with EIP-Agri's strategy to improve the economic situation of rural areas (European Network for Rural Development 2017b).

Sub-measures 16.5 (support for joint action undertaken with a view to mitigating or adapting to climate change) and 16.6 (support for cooperation among supply chain actors for sustainable provision of biomass) were conducted in 12% and 13% of MAPs, respectively, which reflects a trend towards environmental innovations that match the Councils of the European Union (2020) strategy to address societal challenges. When environmental research follows a MAA rather than a more traditional top-down approach, it helps reduce the externalities made by producing or consuming actors by considering the environmental impact and possible damage from the start (Swiergiel et al. 2019), (Ben Letaifa and Reynoso 2015). This trend and supporting evidence is promising for MAPs with environmental objectives.

Each of the remaining six sub-measures under M16 account for a relatively small share. Sub-measures 16.1 (support for the establishment and operation of operational groups of the EIP for agricultural productivity and sustainability) and 16.3 (co-operation among small operators in organising joint work processes and sharing facilities and resources, and for developing and marketing tourism), addressed in 4% and 5% of MAPs respectively, represent those projects that contribute towards dynamizing and improving the cooperation amongst actors.

MAPs play a crucial role in interconnecting EIP-Agri's network, either by helping to establish new operational groups or by organizing actors to share their facilities. Such action contributes toward the EIP-Agri's mission of connecting actors (EU SCAR AKIS 2019) and the EU

Council's (2020) research strategy. Six percent of the MAPs conduct activities related to Sub-measure 16.9 (support for diversification of farming activities into activities concerning health care, social integration, community- supported agriculture and education about the environment and food), which could be considered complementary to Sub-measures 16.2 and 16.4 as they share the goal of improving rural economies. The unique feature of 16.9 is that, rather than strengthening the agrarian supply chains, it instead aims to diversify the economic actions of the actors involved. The low prevalence of Sub-measure 16.9 may therefore suggest that MAPs focus to a larger extent on improving the economic situation of farmers than on supporting the farmers to contribute elsewhere in the rural economy. This could be justified by the Horizon research projects being integrated into the EU Bioeconomy Strategy, the EU CAP, the EU Integrated Maritime Policy and the EU Common Fisheries Policy, so other policy instruments are also covering such diversification. Still, it is a lost opportunity as the MAA represent an ideal approach for analysing and contributing towards the diversification of farming.

Sub-measure 16.8 (support for drawing up of forest management plans or equivalent instruments) is a target of only 4/101 projects, which may at first imply an overall lack of research on forestry management. However, this relatively low share should not be understood as a lack of investment in forestry since other sub-measures focus on general activities which also include forestry, for example M1.3 on farm and forest management.
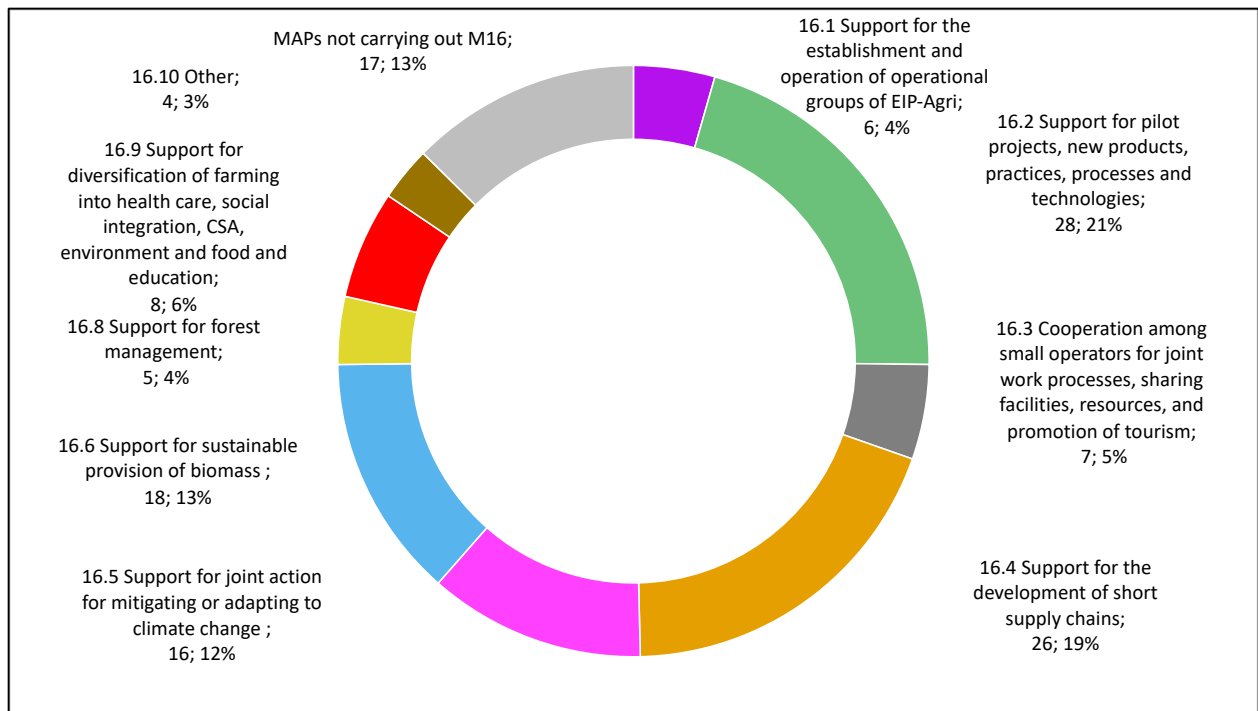
Figure 12. Distribution of the Sub-measures of M16, Support for Cooperation. Under the label of each sub-measure, first the total count of MAPs achieving that sub-measure and secondly the percentage this count represents over the total sample is added.

Sub-measure M19 (Implementation of LEADER)

Finally, the results for sub-measures of M19 (Implementation of LEADER), covered by 39.60% of MAPS, are presented and discussed. Sub-measure 19.2 (implementation of operations within the strategies for community-led local development) is the most common, with 18 MAPs targeting it. A common output of MAPs is the dynamization of a community-led local development, which involves networking with existing community-led initiatives and implement new operations within their topics that are adapted to the local needs. Actions under Sub-measures 19.1 (preparatory support) and 19.3 (cooperation activities) complement those of 19.2, especially when helping to develop and guide community-led local development from scratch, or in facilitating cooperation between related local action groups. Often, LEADER

projects find themselves underfunded (Martinescu 2021), (Shishkova 2020), explaining the

need for Sub-measure 19.4 (running costs and animation). Considering this generally poor

funding situation, the finding that just 7% of MAPs subscribe to Sub-measure 19.4 might be a

concern. Because the budget for LEADER programs depends on the Common Agricultural Policy,

these underfunding issues might be solved or improved by changes in future CAP policies and

initiatives.
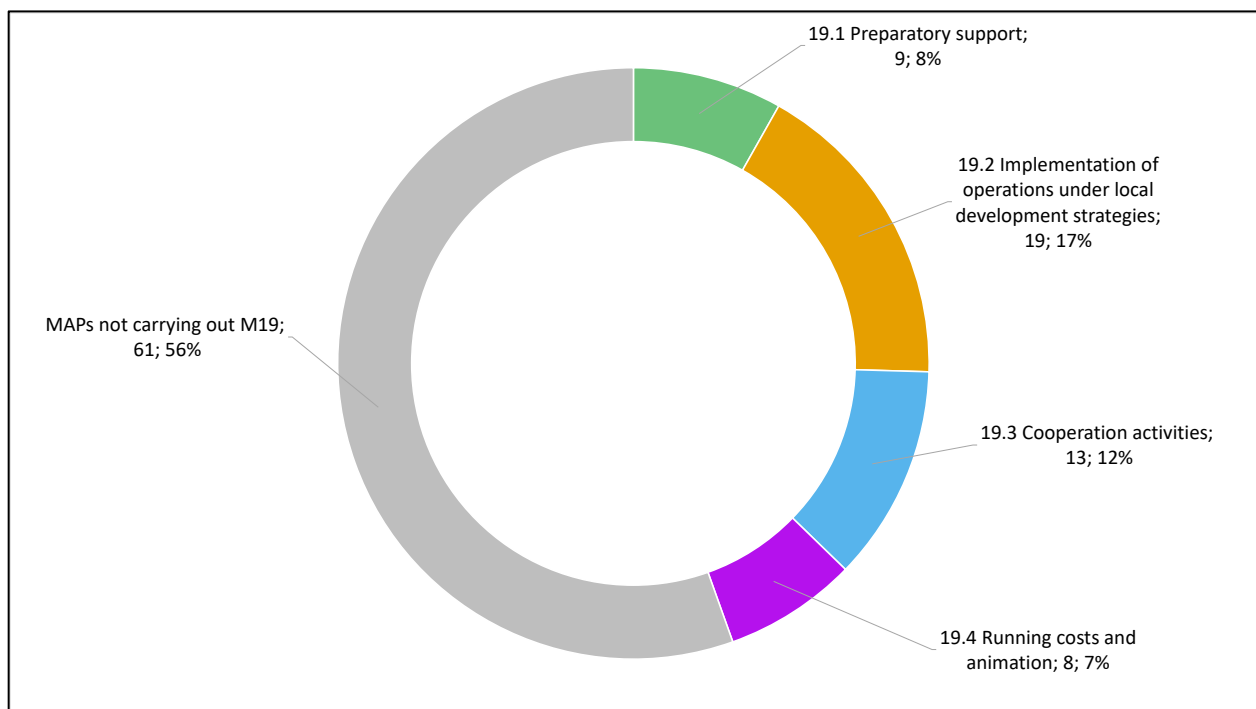
*Figure 13. Distribution of the Sub-measures of M19, Implementation of LEADER initiatives.
Under the label of each sub-measure, first the total count of MAPs achieving that sub-measure
and secondly the percentage this count represents over the total sample is added.*

Conclusions

The objective of this study is to assess the main trends and directions in agricultural research in the European Union. A total of 101 MAPs were analysed to understand their approaches to innovation using the pathways and measures/sub-measures defined in the EC guidelines as the main metrics.

The findings suggest that European MAPs are balanced similarly between projects working on developing innovative ideas (Pathway 1) and projects working on the implementation of existing knowledge (Pathway 2). Projects strictly focused on Pathway 3 (enabling environment for innovation) are less common. By analysing MAPs according to the (primary) pathway used and agricultural sector, a clear trend that emerged was that Pathway 1 was mainly used by projects focused on livestock & permanent grassland and permanent crops, while forestry projects mainly focus on Pathway 2. The lack of Pathway 1 projects for forestry can be explained by the long duration of trees to grow conflicting with the normal duration of research projects.

Across the three research categories (human and social capital, rural innovation, and sustainable primary production), projects that address sustainable primary production largely follow Pathway 1, whereas research projects on social and human capital tend to focus on Pathway 2. MAPs targeting innovation through Coordination and support actions (CSA) tend to focus on Pathway 2, while Pathway 1 is more common for MAPs focusing on Research and Innovation actions (RIA).

When analysed by region, as according to Wanzenböck, Scherngell, and Lata (2015), MAPs showed different tendencies on their approach to research. In the Atlantic region are

more equally spread across pathways, whereas Pathway 1 is the dominant approach for those from the Mediterranean and Danube regions. On the other hand, the Nordic/Baltic regions have a tendency for projects working on building capacity to innovate (Pathway 2). We find that there are no statistical differences in the average MAP budget across pathways.

Most of the MAPs fulfil to conduct communication activities, still this must be considered a failure as the requirement set by Horizon demand a mandatory communication strategy for all MAPs. A sign that a MAA has been adopted by projects is the meaningful presence of long-term farm and forest management exchange as well as farm and forest visits as part of the MAPs communication activities. Another noteworthy finding is the low prevalence of advisory services (M2), which coinciding with Sutherland et al. (2013) may be seen as an indicator of the dismantlement of traditional hierarchical research structures.

Support for pilot projects and the development of new products, practices, and processes and support for horizontal and vertical co-operation among supply chain actors are the most commonly conducted sub-measures of support for cooperation (M16), ahead of the sub-measures dedicated to supporting environmental actions as well as territorial cohesion. This represents a clear intention of MAPs to promote the economic development and integration of rural actors. Such intention is a contribution to the volatile and inconclusive debate between those who advocate for more environmental measures for the European CAP (Was and Kobus 2017),(Oglethorpe 2005)(Kirchner, Schönhart, and Schmid 2016) and the ones who stand for a more economically sustainable agriculture (Hanley et al. 2010),(Dallimer et al. 2008). In terms of contribution to LEADER programs (M19), the MAPs are dynamizing community-led local

development, driven by the high prevalence of sub-measure 19.2 (integrating local projects) and sub-measure 19.3 (support for the cooperation of local actors).

Considering their low prevalence of second pathway (building capacity to innovate) on the agricultural sectors of livestock & permanent grassland and the permanents crops one, moving forward, Horizon should further incentivise and support the creation of MAPs following Pathway 2 for those sectors. In terms of cooperation activities, MAPs must broaden the focus to conduct more actions towards the diversification of farming activities into activities concerning health care, social integration, community- supported agriculture and education about the environment and food (16.9). The trends followed by MAPs reflected an inclusive and productive adoption of the MAA, the implementation of the recommendations will bring further integration of all relevant agents

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Annexes

Annex 1 – (MAPs Pathway, Budget, and Categorization)

Table A1. 101 MAPs List, Categorization, Budget, and Pathway.

MAP	Agricultural Sector	Research Category	Type	Coordinator Region	Budget	Pathway
AGRICORE	Cross-cutting Agriculture	Rural innovation	RIA	Mediterranean	€3.937.248.75	3rd Pathway
AgriDemo-F2F	Cross-cutting Agriculture	Human, social capital	CSA	Atlantic/ North Sea	€1.985.363.75	3rd Pathway
AgriLink	Cross-cutting Agriculture	Human, social capital	RIA	Atlantic/ North Sea	€4.999.966.49	2nd Pathway
AgroCycle	Cross-cutting Agriculture	Sustainable primary production	RIA	Atlantic/ North Sea	€6.960.293.75	2nd Pathway
AGROinLOG	Cross-cutting Agriculture	Rural innovation	IA	Mediterranean	€5.935.714.89	2nd Pathway
ALTERFOR	Forestry	Rural innovation	RIA	Nordic-Baltic	€3.997.367.42	2nd Pathway
AVANT	Livestock & permanent Grassland	Sustainable primary production	IA	Nordic-Baltic	€5.999.905.02	1st Pathway
B-GOOD	Livestock & permanent Grassland	Sustainable primary production	RIA	Atlantic/ North Sea	€7.961.170.00	2nd Pathway
BOND	Cross-cutting Agriculture	Human, social capital	CSA	Atlantic/ North Sea	€2.890.691.25	2nd Pathway
BRESOV	Arable crops	Sustainable primary production	RIA	Mediterranean	€5.962.019.75	1st Pathway
Circular Agronomics	Cross-cutting Agriculture	Sustainable primary production	RIA	Mediterranean	€6.999.795.50	3rd Pathway
ClearFarm	Livestock & permanent Grassland	Sustainable primary production	IA	Mediterranean	€5.899.105.63	1st Pathway
COASTAL	Rural Development	Rural innovation	RIA	Atlantic/ North Sea	€4.999.943.75	3rd Pathway
CONSOLE	Cross-cutting Agriculture	Rural innovation	RIA	Mediterranean	€4.999.998.75	2nd Pathway
Contracts2.0	Rural Development	Rural innovation	RIA	Atlantic/ North Sea	€4.998.188.75	1st Pathway
DEFEND	Livestock & permanent Grassland	Sustainable primary production	RIA	Atlantic/ North Sea	€5.599.999.50	1st Pathway
DESIRA	Rural Development	Rural innovation	RIA	Mediterranean	€4.992.781.25	3rd Pathway

Table A1. Continued.

MAP	Agricultural Sector	Research Category	Type	Coordinator Region	Budget	Pathway
Diverfarming	Cross-cutting Agriculture	Sustainable primary production	RIA	Mediterranean	€9.999.277.50	2nd Pathway
DiverIMPACTS	Cross-cutting Agriculture	Sustainable primary production	RIA	Atlantic/ North Sea	€9.999.985.00	3rd Pathway
DIVERSIFOOD	Cross-cutting Agriculture	Sustainable primary production	RIA	Atlantic/ North Sea	€3.429.908.75	1st Pathway
DIVERSify	Arable crops	Sustainable primary production	RIA	Atlantic/ North Sea	€4.999.363.50	2nd Pathway
DYNAVERSITY	Cross-cutting Agriculture	Sustainable primary production	CSA	Atlantic/ North Sea	€1.922.901.25	2nd Pathway
ECOBREED	Permanent Crops	Sustainable primary production	RIA	Danube/Balkan	€5.759.458.50	2nd Pathway
ECOSTACK	Cross-cutting Agriculture	Sustainable primary production	RIA	Mediterranean	€9.963.866.00	1st Pathway
EFFECT	Cross-cutting Agriculture	Rural innovation	RIA	Nordic-Baltic	€4.999.365.00	1st Pathway
EMPHASIS	Permanent Crops	Sustainable primary production	RIA	Mediterranean	€6.526.038.51	1st Pathway
EXCALIBUR	Arable crops	Sustainable primary production	RIA	Mediterranean	€6.995.107.50	1st Pathway
FAIRshare	Cross-cutting Agriculture	Human, social capital	CSA	Atlantic/ North Sea	€6.998.652.50	2nd Pathway
FAirWAY	Arable crops	Sustainable primary production	RIA	Atlantic/ North Sea	€4.999.865.00	3rd Pathway
FARMERS PRIDE	Cross-cutting Agriculture	Sustainable primary production	CSA	Atlantic/ North Sea	€2.000.000.00	2nd Pathway
FATIMA	Arable crops	Sustainable primary production	RIA	Mediterranean	€7.966.697.00	2nd Pathway
FEED-A-GENE	Livestock & permanent Grassland	Sustainable primary production	RIA	Atlantic/ North Sea	€8.999.544.00	1st Pathway
FERTIMANURE	Livestock & permanent Grassland	Sustainable primary production	IA	Mediterranean	€7.784.512.25	1st Pathway

MAP	Agricultural Sector	Research Category	Type	Coordinator Region	Budget	Pathway
FF-IPM	Permanent Crops	Sustainable primary production	RIA	Mediterranean	€6.004.252.50	1st Pathway
FOX	Permanent Crops	Rural innovation	RIA	Atlantic/ North Sea	€7.065.223.75	3rd Pathway
GenTORE	Livestock & permanent Grassland	Sustainable primary production	RIA	Atlantic/ North Sea	€6.999.999.75	1st Pathway
GoodBerry	Permanent Crops	Sustainable primary production	RIA	Mediterranean	€4.868.332.50	1st Pathway
HOMED	Forestry	Sustainable primary production	RIA	Atlantic/ North Sea	€4.999.296.25	1st Pathway
InnoForESt	Forestry	Rural innovation	IA	Atlantic/ North Sea	€4.019.531.25	3rd Pathway
InnovAfrica	Cross-cutting Agriculture	Human, social capital	RIA	Nordic-Baltic	€4.794.632.50	3rd Pathway
IoF2020	Cross-cutting Agriculture	Rural innovation	IA	Atlantic/ North Sea	€29.999.528.02	2nd Pathway
IPM Decisions	Cross-cutting Agriculture	Sustainable primary production	RIA	Atlantic/ North Sea	€4.998.096.19	2nd Pathway
iSAGE	Livestock & permanent Grassland	Sustainable primary production	RIA	Mediterranean	€6.996.922.00	1st Pathway
iSQAPER	Arable crops	Sustainable primary production	RIA	Atlantic/ North Sea	€5.375.375.00	2nd Pathway
IWMPRAISE	Cross-cutting Agriculture	Sustainable primary production	RIA	Nordic-Baltic	€6.600.746.25	2nd Pathway
LANDMARK	Arable crops	Sustainable primary production	RIA	Atlantic/ North Sea	€4.999.663.00	3rd Pathway
LEGVALUE	Arable crops	Sustainable primary production	RIA	Atlantic/ North Sea	€5.000.000.00	3rd Pathway
LEX4BIO	Cross-cutting Agriculture	Sustainable primary production	RIA	Nordic-Baltic	€5.999.968.75	1st Pathway
LIAISON	Rural Development	Human, social capital	RIA	Atlantic/ North Sea	€4.999.143.75	2nd Pathway
LIVERUR	Rural Development	Rural innovation	RIA	Mediterranean	€4.107.005.00	2nd Pathway
LIVESEED	Permanent Crops	Sustainable primary production	RIA	Nordic-Baltic	€7.454.839.20	3rd Pathway

MAP	Agricultural Sector	Research Category	Type	Coordinator Region	Budget	Pathway
MAGIC	Cross-cutting Agriculture	Sustainable primary production	RIA	Mediterranean	€5.999.987.50	1st Pathway
MIND STEP	Cross-cutting Agriculture	Rural innovation	RIA	Atlantic/ North Sea	€4.000.000.00	3rd Pathway
MUSA	Permanent Crops	Sustainable primary production	RIA	Mediterranean	€3.987.403.75	1st Pathway
MycoKey	Arable crops	Sustainable primary production	RIA	Mediterranean	€4.953.160.00	2nd Pathway
MyToolBox	Cross-cutting Agriculture	Sustainable primary production	RIA	Danube/Balkan	€4.997.660.75	2nd Pathway
NEFERTITI	Cross-cutting Agriculture	Human, social capital	CSA	Atlantic/ North Sea	€6.999.991.25	2nd Pathway
NEURICE	Arable crops	Sustainable primary production	RIA	Mediterranean	€4.608.975.00	1st Pathway
nEUROSTRESSPEP	Cross-cutting Agriculture	Sustainable primary production	RIA	Atlantic/ North Sea	€6.995.052.50	1st Pathway
NEXTFOOD	Cross-cutting Agriculture	Human, social capital	RIA	Nordic-Baltic	€7.000.000.00	2nd Pathway
NoAW	Rural Development	Sustainable primary production	RIA	Atlantic/ North Sea	€6.887.570.00	1st Pathway
Nutri2Cycle	Cross-cutting Agriculture	Sustainable primary production	RIA	Atlantic/ North Sea	€6.850.050.50	1st Pathway
OPTIMA	Cross-cutting Agriculture	Sustainable primary production	RIA	Mediterranean	€3.425.600.00	1st Pathway
Organic-PLUS	Cross-cutting Agriculture	Sustainable primary production	RIA	Atlantic/ North Sea	€4.091.526.00	1st Pathway
PLAID	Cross-cutting Agriculture	Human, social capital	CSA	Atlantic/ North Sea	€1.960.017.50	1st Pathway
PoliRural	Rural Development	Rural innovation	RIA	Danube/Balkan	€5.999.875.00	3rd Pathway
POnTE	Forestry	Sustainable primary production	RIA	Mediterranean	€6.850.000.00	2nd Pathway
PoshBEE	Rural Development	Sustainable primary production	RIA	Atlantic/ North Sea	€8.999.998.75	1st Pathway

Table A1. Continued.

MAP	Agricultural Sector	Research Category	Type	Coordinator Region	Budget	Pathway
PPILOW	Livestock & permanent Grassland	Sustainable primary production	RIA	Atlantic/ North Sea	€9.999.580.00	2nd Pathway
PRE-HLB	Permanent Crops	Sustainable primary production	RIA	Mediterrane an	€6.639.762.50	1st Pathway
REFRESH	Rural Development	Rural innovation	RIA	Nordic-Baltic	€8.999.757.79	2nd Pathway
RELACS	Cross-cutting Agriculture	Rural innovation	RIA	Danube/Balk an	€999.675.00	1st Pathway
ReMIX	Arable crops	Sustainable primary production	RIA	Atlantic/ North Sea	€5.000.000.00	1st Pathway
ROADMAP	Livestock & permanent Grassland	Sustainable primary production	RIA	Danube/Balk an	€5.999.753.00	1st Pathway
ROBUST	Rural Development	Rural innovation	RIA	Atlantic/ North Sea	€5.999.934.00	3rd Pathway
RUBIZMO	Rural Development	Rural innovation	RIA	Nordic-Baltic	€3.928.852.04	2nd Pathway
RURALIZATION	Rural Development	Rural innovation	RIA	Atlantic/ North Sea	€5.995.904.00	3rd Pathway
RUSTWATCH	Permanent Crops	Sustainable primary production	RIA	Nordic-Baltic	€4.999.998.75	1st Pathway
SHEALTHY	Cross-cutting Agriculture	Rural innovation	RIA	Mediterrane an	€6.955.758.74	2nd Pathway
SHERPA	Rural Development	Rural innovation	CSA	Atlantic/ North Sea	€4.999.747.50	3rd Pathway
SiEUGreen	Rural Development	Rural innovation	IA	Nordic-Baltic	€6.999.999.38	2nd Pathway
SINCERE	Forestry	Rural innovation	IA	Nordic-Baltic	€3.991.234.38	2nd Pathway
SmartAgriHubs	Cross-cutting Agriculture	Rural innovation	IA	Atlantic/ North Sea	€19.999.458.62	2nd Pathway
SMARTCHAIN	Rural Development	Rural innovation	RIA	Atlantic/ North Sea	€5.998.373.75	2nd Pathway
SMARTER	Livestock & permanent Grassland	Sustainable primary production	RIA	Atlantic/ North Sea	€6.998.911.25	1st Pathway
SOILCARE	Arable crops	Sustainable primary production	RIA	Atlantic/ North Sea	€6.999.993.00	3rd Pathway
SOILDIVERAGRO	Arable crops	Sustainable primary production	RIA	Mediterrane an	€6.999.888.75	2nd Pathway

Table A1. Continued.

MAP	Agricultural Sector	Research Category	Type	Coordinator Region	Budget	Pathway
SolACE	Cross-cutting Agriculture	Sustainable primary production	RIA	Atlantic/ North Sea	€6.000.000.00	1st Pathway
STARGATE	Cross-cutting Agriculture	Sustainable primary production	RIA	Mediterrane an	€6.994.405.00	3rd Pathway
Strength2Food	Cross-cutting Agriculture	Rural innovation	RIA	Atlantic/ North Sea	€6.904.226.25	3rd Pathway
SUPER-G	Livestock & permanent Grassland	Sustainable primary production	RIA	Atlantic/ North Sea	€9.994.996.83	3rd Pathway
SuperPests	Cross-cutting Agriculture	Sustainable primary production	RIA	Mediterrane an	€2.991.525.00	2nd Pathway
TomGEM	Permanent Crops	Sustainable primary production	RIA	Atlantic/ North Sea	€4.993.506.25	1st Pathway
TomRes	Permanent Crops	Sustainable primary production	RIA	Mediterrane an	€5.996.175.00	1st Pathway
TRADITOM	Permanent Crops	Sustainable primary production	RIA	Mediterrane an	€4.372.015.25	1st Pathway
TREASURE	Livestock & permanent Grassland	Sustainable primary production	RIA	Danube/Balk an	€3.395.986.75	1st Pathway
TROPICSAFE	Permanent Crops	Sustainable primary production	RIA	Mediterrane an	€3.999.963.75	1st Pathway
TRUE	Arable crops	Sustainable primary production	RIA	Atlantic/ North Sea	€4.999.927.50	3rd Pathway
VIROPLANT	Livestock & permanent Grassland	Sustainable primary production	RIA	Mediterrane an	€3.331.580.00	1st Pathway
WATERPROTECT	Rural Development	Sustainable primary production	RIA	Atlantic/ North Sea	€4.997.006.50	2nd Pathway
XF-ACTORS	Permanent Crops	Sustainable primary production	RIA	Mediterrane an	€6.903.000.00	3rd Pathway

Sources: (Mosquera-Losada et al. 2020), CORDIS, and the authors

Annex 2 – (Categorization of the 101 MAPs by pathway)

Table A2. Pathway distribution of the MAPs by categories

	MAP Count	1st Pathway	2nd Pathway	3rd Pathway	% 1st Pathway	% 2nd Pathway	% 3rd Pathway
Agricultural Sector							
Arable crops	14	4	5	5	28.57%	35.71%	35.71%
Cross-cutting Agriculture	38	12	18	8	31.58%	47.37%	21.05%
Forestry	5	1	3	1	20.00%	60.00%	20.00%
Livestock & permanent Grassland	14	11	2	1	78.57%	14.29%	7.14%
Permanent Crops	14	10	1	3	71.43%	7.14%	21.43%
Rural Development	16	3	7	6	18.75%	43.75%	37.50%
Research Category							
Human, social capital	9	1	6	2	11.11%	66.67%	22.22%
Rural innovation	25	2	12	11	8.00%	48.00%	44.00%
Sustainable primary production	67	38	18	11	56.72%	26.87%	16.42%
Research Action							
CSA	8	1	5	2	12.50%	62.50%	25.00%
IA	9	3	5	1	33.33%	55.56%	11.11%
RIA	84	37	26	21	44.05%	30.95%	25.00%
Region							
Atlantic/ North Sea	49	16	17	16	32.65%	34.69%	32.65%
Danube/Balkan	6	3	2	1	50.00%	33.33%	16.67%
Mediterranean	33	18	10	5	54.55%	30.30%	15.15%
Nordic-Baltic	13	4	7	2	30.77%	53.85%	15.38%
Total 101 MAP distribution	101	41	36	24	40.59%	35.64%	23.76%

Annex 3 – (MAPs Total and average budget by Category)

Table A3. MAPS total and average Budget by Agricultural sector, Research Category, Research Action, Region, Pathway, and Measures.

	Total Budget	Mean Budget
Agricultural Sector		
Arable crops	€ 79.860.035.00	€ 5.618.114.09
Cross-cutting Agriculture	€ 243.580.935.45	€ 5.228.978.08
Forestry	€ 23.857.429.30	€ 4.659.413.26
Livestock & permanent Grassland	€ 95.961.965.98	€ 6.531.409.63
Permanent Crops	€ 79.569.970.21	€ 5.570.302.40
Rural Development	€ 93.904.081.21	€ 5.708.439.95
Research Category		
Human, social capital	€ 42.628.458.99	€ 4.260.265.25
Rural innovation	€ 174.825.018.03	€ 5.969.665.77
Sustainable primary production	€ 399.280.940.13	€ 5.580.818.98
Research Action		
CSA	€ 229.559.841.41	€ 5.239.171.79
IA	€ 246.133.693.96	€ 5.866.627.07
RIA	€ 141.040.881.78	€ 5.591.504.50
Region		
Atlantic/ North Sea	€ 318.867.466.15	€ 5.669.982.25
Danube/Balkan	€ 27.152.409.00	€ 3.899.792.23
Mediterranean	€ 194.947.875.52	€ 5.663.638.04
Nordic-Baltic	€ 75.766.666.48	€ 5.641.908.58
Pathway to innovation		
1st Pathway	€ 229.559.841.41	€ 5.239.171.79
2nd Pathway	€ 246.133.693.96	€ 5.866.627.07
3rd Pathway	€ 141.040.881.78	€ 5.591.504.50
Measure		
Measure 1 Communication	€ 510.214.927.55	€ 5.864.539
Measure 2 Advisory services	€ 111.142.113.36	€ 6.174.562
Measure 16 Cooperation	€ 526.585.065.77	€ 6.268.870
Measure19 Leader	€ 268.451.250.37	€ 6.711.281
Total 101 MAP	€ 616.734.417.15	

Annex 4 – (Results of the validation)

Table A4. Comparison between the research's (R) assessment and those of the MAPs' Coordinators (Cs) for the 41 MAPs for which there was a reply.

	(R)	(Cs)
MAPS that fully Agree with my assessment (Out of 41)		16
Clustered (YES) M1	34	39
Clustered (YES) M2	10	9
Clustered (YES) M16	36	35
Clustered (YES) M19	10	14
Sub-measures of M1 Communication		
M1.1 Vocational training and skills acquisition actions	4	6
M1.2 Demonstration activities and information actions	32	26
M1.3 Long-term farm and forest management	10	10
MAPs not carrying out M1	7	2
Total MAPs achieving M1	34	39
% of MAPs achieving M1	83%	95%
Sub-measures of M2, Advisory services		
M2.1 Support to help benefit from the use of advisory services	2	2
M2.2 Support for the setting up of farm management	2	4
M2.3 Support for training of advisors	9	5
MAPs not carrying out M2	31	32
Total MAPs achieving M2	10	9
% of MAPs achieving M2	24%	22%
Sub-measures of M16 Support for Cooperation		
16.1 Support for the establishment and operation of operational groups of EIP-Agri	0	3
16.2 Support for pilot projects, new products, practices, processes and technologies	12	14
16.3 Cooperation among small operators for joint work processes, sharing facilities, resources, and promotion of tourism	4	4
16.4 Support for the development of short supply chains	6	14
16.5 Support for joint action for mitigating or adapting to climate change	4	7
16.6 Support for sustainable provision of biomass	10	10
16.8 Support for forest management	2	3
16.9 Support for diversification of farming into health care, social integration, CSA, environment and food and education	2	4
MAPs not carrying out M16	5	6
Total MAPs achieving M16	36	35
% of MAPs achieving M16	88%	85%

Table A4. Continued.

	(R)	(Cs)
Sub-measures of M19, LEADER and CLLD		
Preparatory support	3	5
Implementation of operations under local development strategies	4	6
Cooperation activities	2	4
Running costs and animation	1	2
MAPs not carrying out M19	31	27
Total MAPs achieving M19	10	14
% of MAPs achieving M19	24%	34%

Annex 5 – (Result of the hybrid allocation of sub-measures)

Table A5. Hybrid frequency chart of the sub-measure allocation for the 101MAPs including the 41 inputs (when any) from the MAP coordinators.

Total measures achieved by the MAPs	Count
M1 Communication	87
M2 Advisory services	18
M16 Support for Cooperation	84
M19 Leader	40
Sub-measures of M1 Communication	
Vocational training and skills acquisition actions	9
Demonstration activities and information actions	62
Long-term farm and forest management	30
MAPs not carrying out M1	14
Total MAPs achieving M1	87
% of MAPs achieving M1	86%
Sub-measures of M2, Advisory services	
Support to help benefit from the use of advisory services	6
Support for the setting up of farm management	8
Support for training of advisors	8
MAPs not carrying out M2	83
Total MAPs achieving M2	18
% of MAPs achieving M2	17%
Sub-measures of M16 Support for Cooperation	
16.1 Support for the establishment and operation of operational groups of EIP-Agri	6
16.2 Support for pilot projects, new products, practices, processes and technologies	28
16.3 Cooperation among small operators for joint work processes, sharing facilities, resources, and promotion of tourism	7
16.4 Support for the development of short supply chains	26
16.5 Support for joint action for mitigating or adapting to climate change	16
16.6 Support for sustainable provision of biomass	18
16.8 Support for forest management	5
16.9 Support for diversification of farming into health care, social integration, CSA, environment and food and education	8
16.10 Other	4
MAPs not carrying out M16	17
Total MAPs achieving M16	84
% of MAPs achieving M16	83%
Sub-measures of M19, LEADER and CLLD	
Preparatory support	9

Table A5. Hybrid frequency chart of the sub-measure allocation for the 101MAPs including the 41 inputs (when any) from the MAP coordinators.

Total measures achieved by the MAPs	Count
Implementation of operations under local development strategies	19
Cooperation activities	13
Running costs and animation	8
MAPs not carrying out M19	61
Total MAPs achieving M19	40
% of MAPs achieving M19	39%

Table A6. List of the allocation of sub-measures for the 101 MAPs, including the 41 inputs from the MAP coordinators.

MAP NAME:	M1.1	M1.2	M1.3	M2.1	M2.2	M2.3	M16.1	M16.2	M16.3	M16.4	M16.5	M16.6	M16.7	M16.8	M16.9	M16.10	M19.1	M19.2	M19.3	M19.4
AGRICORE								X											X	
AgriDemo-F2F		X						X	X										X	
AgriLink		X						X												
AgroCycle		X						X												
AGROinLOG		X								X										
ALTERFOR		X	X							X	X			X						
AVANT		X									X									
B-GOOD		X										X								
BOND		X						X											X	
BRESOV		X		X				X	X		X				X					
Circular Agronomics		X						X									X	X	X	
ClearFarm	X							X							X					
COASTAL				X				X			X								X	
CONSOLE																				
Contracts2.0			X								X									
DEFEND		X																		
DESIRA		X						X		X								X	X	
Diverfarming		X												X						
DiverIMPACTS			X											X						X
DIVERSIFOOD	X	X				X		X		X	X									
DIVERSify		X						X												
DYNAVERSITY		X			X	X		X												
ECOBREED		X																		
ECOSTACK			X		X							X						X	X	
EFFECT		X																		
EMPHASIS	X	X						X									X			

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Table A6. List of the allocation of sub-measures for the 101 MAPs, including the 41 inputs from the MAP coordinators.

MAP NAME:	M1.1	M1.2	M1.3	M2.1	M2.2	M2.3	M16.1	M16.2	M16.3	M16.4	M16.5	M16.6	M16.7	M16.8	M16.9	M16.10	M19.1	M19.2	M19.3	M19.4
EXCALIBUR		X										X						X		
FAIRshare			X							X		X			X			X		
FAirWAY		X			X		X													X
FARMERS PRIDE		X				X					X							X		
FATIMA		X							X									X		
FEED-A-GENE		X				X					X									
FERTIMANURE	X	X									X									
FF-IPM			X	X																
FOX		X						X		X	X								X	
GenTORE		X				X														
GoodBerry		X									X									
HOMED								X												
InnoForESt			X																	
InnovAfrica			X							X					X		X			
IoF2020				X				X										X		
IPM Decisions			X									X								X
iSAGE		X	X		X		X			X	X	X						X	X	
iSQAPER			X								X									
IWMPRAISE		X	X									X					X			X
LANDMARK			X													X				
LEGVALUE			X									X								
LEX4BIO			X							X										X
LIAISON		X			X							X								
LIVERUR		X								X								X		
LIVESEED		X						X												
MAGIC					X															

Table A6. List of the allocation of sub-measures for the 101 MAPs, including the 41 inputs from the MAP coordinators.

MAP NAME:	M1.1	M1.2	M1.3	M2.1	M2.2	M2.3	M16.1	M16.2	M16.3	M16.4	M16.5	M16.6	M16.7	M16.8	M16.9	M16.10	M19.1	M19.2	M19.3	M19.4
MIND STEP		X								X								X	X	
MUSA		X								X					X			X		
MycoKey	X		X		X		X											X		
MyTool Box		X				X					X						X			
NEFERTITI	X										X									
NEURICE		X	X						X											
nEUROSTRESSPEP		X						X			X									
NEXTFOOD	X					X		X		X	X	X		X						
NoAW			X					X												
Nutri2Cycle			X			X		X										X	X	
OPTIMA		X																		
Organic-PLUS		X																		
PLAID		X			X							X								
PoliRural		X								X	X									X
POnTE		X	X					X												
PoshBEE	X	X						X			X							X		
PPILOW	X	X				X		X		X								X		
PRE-HLB															X					
REFRESH		X	X									X							X	
RELACS	X	X	X	X		X	X	X									X	X	X	
ReMIX	X	X	X									X								
ROADMAP																				
ROBUST	X							X	X	X	X									
RUBIZMO		X				X				X					X	X				
RURALIZATION			X							X		X							X	
RUSTWATCH			X							X								X		
SHEALTHY		X								X	X	X			X			X		

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Table A6. List of the allocation of sub-measures for the 101 MAPs, including the 41 inputs from the MAP coordinators.

MAP NAME:	M1.1	M1.2	M1.3	M2.1	M2.2	M2.3	M16.1	M16.2	M16.3	M16.4	M16.5	M16.6	M16.7	M16.8	M16.9	M16.10	M19.1	M19.2	M19.3	M19.4
SHERPA			X							X										
SiEUGreen			X									X								X
SINCERE		X		X		X	X											X		
SmartAgriHubs	X							X									X			
SMARTCHAIN										X		X								
SMARTER		X																		
SOILCARE					X				X	X									X	
SOILDIVERAGRO		X										X								
SolACE		X								X										
STARGATE		X						X									X			
Strength2Food		X						X	X	X					X				X	
SUPER-G								X			X									
SuperPests								X		X		X				X				
TomGEM		X	X												X					
TomRes		X										X								
TRADITOM		X								X		X								
TREASURE		X																		
TROPICSAFE		X	X											X				X		
TRUE		X																	X	
VIROPLANT		X	X							X										
WATERPROTECT																				
XF-ACTORS		X						X												