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The role of EIP-AGRI Operational Groups as a driver towards innovation in viticulture

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Abstract

European policies play a crucial role in helping farms and stakeholders in the agri-food sectors to proactively engage in digital and environmental transitions. Among them, the European Partnership for Innovation in Agriculture (EIP-AGRI), which was established in 2014, has proven significant in promoting sustainable production models and value chains in Europe. Operational Groups (OGs) within the Partnership provide "interactive innovation" platforms in which research institutions work with farmers, advisors, businesses, NGOs and other interest groups to co-create innovative solutions for agriculture and forestry as well as rural communities; the rationale is that when farmers and foresters are engaged in the process, the solutions are more likely to be based on their concrete reality and thus relevant. While the benefits of the participatory, multi-actor and bottom-up approach of OGs have been widely acknowledged, little is known about the drivers and barriers influencing the process. This contribution explores their role in the wine sector, applying a mixed methods approach to analyse the perceptions of OG stakeholders from different Italian regions. Interviewees have been asked to what extent they believe the EIP-AGRI OGs serve as drivers of innovation and provide a network able to foster knowledge exchange, and what they perceive to be their barriers to innovation. By addressing this knowledge gap, this study will provide some insights and good practices to improve EIP-AGRI policies at regional, national and European levels.

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Introduction

European policies play a crucial role in helping farms and related stakeholders to engage proactively in the "twin transition" that fosters environmentally sustainable practices through the adoption of digital innovation (JRC, 2022). In the sphere of food production and agriculture, the EU Common Agricultural Policy (CAP) seeks to foster more sustainable production models and value chains. To this end, in 2012 it launched the European Innovation Partnership for Agricultural Productivity and Sustainability (EIP-AGRI)[1] to encourage the spread of Agricultural Knowledge and Innovation Systems (AKIS), a multi-actor collaborative way of producing and sharing knowledge to promote innovation and the use of new technologies (EU SCAR, 2012). In addition, since the 2014-2020 programming period, the EIP-AGRI has also been supporting the creation of Operational Groups (OGs), which are innovation-oriented projects to foster regional cooperation strategies to address specific agricultural issues. By pairing research institutions with farmers, foresters, businesses, advisors, NGOs and other environmental and interest groups, OGs draw upon the complementary knowledge of different stakeholders to co-create practical solutions and drive competitive, sustainable, and inclusive growth of the agricultural and forestry sectors as well as of rural communities[2] (Arzeni *et al*., 2023; Giarè & Vagnozzi, 2021; Parzonko *et al*., 2022)especially to innovation brokers working there. The aim of the study was to determine the role of the innovation broker in the formation of EIP-AGRI operational groups. Mechanisms of innovation support in the agricultural sector were presented, paying particular attention to the tasks of the National Network for Innovation in Agriculture and Rural Areas (NRN. Therefore, the OGs complement the collaborative systemic approach promoted by the AKIS to encourage technological solutions for place-based sustainability (Collini & Hausemer, 2023).

OGs serve as intermediaries of innovation by fostering demand articulation for the innovation needed, promoting and assisting the institutional change, working on knowledge and network brokering, capacity building and providing a structured management process for innovations in terms of coordination and negotiation (Piñeiro *et al*., 2021; Kilelu *et al*., 2013). They are designed to be challenge-driven, and to provide conducive environments for obtaining better and quicker outcomes than those offered by top-down

1. EU CAP NETWORK, Innovation & knowledge exchange: https://eu-cap-network.ec.europa.eu/support/innovation-knowledge-exchange-eip-agri_en (last retrieved 24/07/2024).

2. EU CAP NETWORK, Operational Groups: https://eu-cap-network.ec.europa.eu/operational-groups_en (last retrieved 27/03/2024).

approaches (Collini & Hausemer, 2023). However, it has been observed that the place-based nature of this tool has led to uneven development of projects across European regions. Generally, funding opportunities to prepare and implement OG projects among the European member states are provided by the current CAP programming period (2023-2027) via national CAP Strategic Plans[3]. They are supported by a dedicated EIP-AGRI Network to ensure that the "interactive innovation model" is used to find solutions to the needs of farmers and foresters, that the relevant stakeholders are brought together and that a co-decision and co-creation approach is central throughout the project (EU Regulation 2021/2115, Art. 127, 2021).

In Italy, the Italian Regional governments have established different modalities for setting up OGs, as well as different regulations for actors to participate and cooperate in OGs. This came about during the 2014-2022 period, with measure 16 of the Italian national Rural Development Programme (RDP). For example, some regions required that only farms take on the coordination of OGs, while others assigned a higher score in their project evaluation if the lead partner was a farm, and still others did not impose any constraints. Similarly, the required minimum number of farms within the individual project, the duration and the maximum budget differed from one Region to another. In addition, not only have innovation needs been addressed differently across the regions, but also the participatory approach has not been uniformly embraced, which had an impact on the results and on the innovation outputs themselves (Giaré & Vagnozzi, 2021). Indeed, according to Molina *et al*. (2021), when focusing on the innovation process, it is important to consider how the different social actors participate in the co-creation activities and to what extent, as well as the factors influencing their participation, such as motivation, commitment, interaction, communication, networking, and trust, in order to create a solid working structure, reinforced by tailored policies and engaged stakeholders acting as knowledge and innovation brokers. An innovation broker is an intermediary whose primary role is to create suitable connections within innovation systems and facilitate interactions among multiple stakeholders involved in the innovation process (Klerkx *et al*., 2009). According to Howells (2006, p. 720), an innovation broker is defined as "an organization or body that acts as an agent or broker in any aspect of the innovation process between two or more parties".

Strong national involvement in the innovation processes of the entire agricultural sector resulted in a plethora of regional OGs, whose information is collected on a specific web platform entitled

3. EU CAP NETWORK, Operational Groups in EU Member states: https://eu-cap-network.ec.europa.eu/operational-groups-eu-member-states_en (last retrieved 27/03/2024).

"INNOVARURALE"[4]. Up to February 2024, the OG-related measures have involved 20 agri-food sectors (including multisectoral projects covering two or more chains) within 717 projects, for about 258,7 million euros in total investment. The viticulture and wine sector have been prominent, only second in terms of funding received (over 36 million euros)[5]. Agricultural production is estimated to be one of the main causes of greenhouse gas emissions. In particular, the production of greenhouse gasses during the agricultural phase of winemaking process accounts for 17% to 40% of the emissions of the whole national wine supply chain (Bosco *et al.*, 2011; Rugani *et al.*, 2013; Tezza *et al.*, 2019). Indeed, the viticulture and wine sector must make short and long-term changes to address the challenges related to sustainability, climate change and a more competitive and diversified market (Costa *et al.*, 2022). Therefore, promoting both a green and digital transition is crucial for helping this sector.

From the digital point of view, beyond the aspects related to the organisation of production, the major innovation-related challenges of the wine sector concern the definition of suitable business models, the need to provide an efficient offer in response to the changing needs of international markets, and the readiness to the use of the latest information and communication technologies to enhance the competitiveness of the businesses involved (Dressler & Paunovic, 2021). The adoption of innovations by wine companies is influenced by their resources, positioning, and size, and by other factors as well: the value of knowledge exchange and a synergistic approach to innovation as a strategy for improving the innovation ecosystem should also be acknowledged (Dressler, 2022). Similarly, the evolution to develop innovation ecosystems is also affected by territorial factors, for example the presence or absence of relational networks among actors and institutions and related knowledge sharing may promote or deter change (Chaminade & Randelli, 2020). It is important to observe OGs not only on the EU and national level, but also on the regional level, in order to understand the mechanisms of knowledge transfer and innovation co-creation that they foster, and to identify the most effective strategies for promoting the twin transition towards environmentally sustainable practices through the adoption of digital innovation.

Starting from the analysis of OGs in the viticulture and wine sector, this research article explores the role of OGs as intermediaries of innovation

4. INNOVARURALE, Operational Groups Database: www.innovarurale.it/en/pei-agri/gruppi-operativi/bancadati-go (last retrieved 27/07/2024).

5. INNOVARURALE, Statistics from the Operational Groups Database in Italy - costs per thematic area: www.innovarurale.it/it/pei-agri/gruppi-operativi/bancadati-go-pei/statistiche (last retrieved 27/07/2024).

and as creators of knowledge networks within different Italian regions. The objective of this article is twofold: to provide an understanding of the role played by the RDP OGs in the innovation processes, and to identify OG strengths and weaknesses in co-design and innovation transferring strategies supported by the EIP-AGRI.

1. Innovation in the viticulture and wine sector: what are the needs and main challenges?

In response to the evolution of agriculture and its interconnectedness with other productive sectors in rural contexts, there is a need for information and learning networks that engage not only farmers, but also a wider range of stakeholders, inside and outside the agricultural sphere. Given the intricate and diverse local settings of today's agricultural concerns, along with the multitude of functions that agriculture must perform, stakeholders need more inclusive and participatory approaches to managing the creation, integration, and dissemination of information (Šūmane *et al.*, 2018).

The innovation process can offer beneficial solutions for the actors involved, and thus help to address sustainability trade-offs. Initiatives such as the OGs from the EIP-AGRI espouse a bottom-up approach to innovation that helps create win-win solutions as stakeholders compare, share, and reflect on their knowledge and innovation efforts (Brunori, 2023).

An added benefit of adopting innovations to foster a green and digital transition in agriculture is that innovation ecosystems at different levels may profit from the socio-technical and ecological processes, with changes that go far beyond the technological, material, and organisational dimensions to engage socio-cultural, economic, institutional, and policy-related dynamics (Kivimaa *et al.*, 2019).

Italy is one of the biggest players in the wine sector worldwide, and produces more wine than any other European country (ISMEA, 2022). Thus there is great interest in developing knowledge and innovation in the Italian wine sector. Innovations may have significant effects on different stages of the value chain. Farmers are facing unprecedented challenges from climate change and associated fluctuating weather patterns, shorter growing seasons, heat waves and droughts. In addition, they also deal with labour shortages and increased production costs (Soar *et al.*, 2008; Tardaguila *et al.*, 2021).

In the viticulture and wine sector, various reforms of the EU Common Agricultural Policy have led to differentiated sectoral regulations regarding income support for farmers and ways to enhance their competitiveness (Pomarici *et al.*, 2021). Moreover, the financial support of the first and second pillars is complemented by sectoral interventions confirmed in the new CAP

programme (ISMEA, 2019). There is an ever stronger emphasis in European policies to encourage member states to boost innovation that enhances sustainability. Specifically, in the Strategic Plan Regulation concerning the wine sector, member states are invited to pursue the common objective of facing climate change by improving the sustainability of their production systems. To this end, "tangible and intangible investments in innovation consisting of the development of innovative products […] processes, and technologies for the production of wine products […], as well as other investments adding value at any stage of the supply chain, including for knowledge exchange […]" are suggested (Waye *et al.*, 2023).

As a result, the new CAP framework may provide potential changes in the viticulture and wine sector policy, with consequent impacts on the European and international wine markets. The complex regulatory modifications do not address changes in the amount of funds to be distributed, but instead, focus on raising the sector's sustainability levels, which could better align the EU wine supply with market demand and make it competitive with non-EU producers (Pomarici & Sardone, 2022).

2. Materials and methods

With the goal of clarifying the role played by the Rural Development Plan's OGs in innovation processes, and to identify the strengths and weaknesses of OGs in co-design and innovation transferring strategies supported by the EIP-AGRI, this research collected data and interviewed members of a number of OGs in different Italian regions:

- as a first step, the authors carried out desk research using the OG database on the INNOVARURALE portal, extracting and analysing data about the OGs implemented in the viticulture and wine field;
- as a second step, authors collected quantitative data through a questionnaire submitted to OGs coordinators to identify whether or to what extent RDP measure 16 contributed to the innovation intermediation by OGs;
- as a third step, the authors collected qualitative data, by interviewing OG members to gather insights about their involvement and participation in OG projects.

2.1. *Desk research in the Innovarurale OG database*

An initial introduction to OG projects in the viticulture and wine field took place in February 2024. The Innovarurale portal was searched by

selecting 'viticulture' as one of the production sectors, while leaving empty all the other fields, including the project start and the end date. The results yielded a total of 96 OGs implemented in the viticulture and wine field all over Italy, with grants of over 36 million euros since 2016. Background information on each OG project was extracted, specifically, the keywords, the funding region, the year of start and end, as well as the duration and the total budget allocated. With these results, we created our own database and added information on the actors involved and the lead partner, as well as the project's objectives, topic, and focus area. In order to provide a situational overview by region, the authors adopted descriptive statistics to identify the concentration of OGs in the viticulture and wine sector, and to analyse the average budget granted for each OG, as well as the themes and the targeted focus areas.

2.2. *Gathering quantitative data*

To identify the contribution of RDP measure 16 on OGs in terms of innovation intermediation, a questionnaire was submitted by email to the lead partners. The information requested was based on the dimensions provided by Piñeiro *et al*. (2021) and on the functions defined by Kilelu *et al*. (2013). Table 1 lists the topics addressed in the survey, to provide data for quantitative analysis of how OGs in Italian viticulture and wine production support the technological transfer of innovations, investigating the dimensions concerning the articulation of the demand, the institutional support, the network brokering, the capacity building, the management of innovation processes, and the knowledge brokering.

Out of the 96 OG coordinators who received the surveys, 24 responded, a response rate of 25%. The authors aggregated answers by region, to highlight regional differences or similarities in the perception of OGs as innovation intermediaries. For each respondent, the item values for each dimension listed in Table 1 were summed. Due to the limited number of observations, the median was chosen as the index of central tendency to attenuate the effect of possible outliers. The median values for each dimension were then normalised to allow for cross-regional comparison. Coordinators were also asked dichotomous questions to find out the number of OGs they had already been part of, and the number of partners for each OG. In addition, they were asked to indicate their satisfaction or lack thereof with the results achieved by their OG, and whether they believed the OG strategy was a success of the EIP-AGRI policy.

Table 1 - Description of the functions that OGs may provide as intermediaries of the innovations proposed by Piñeiro et al. (2021)

Dimensions of OG Functions	Description
Demand Articulation	Assisting the process of determining innovative possibilities and problems as seen by the many stakeholders through needs assessment, visioning, and diagnostic exercises. A few examples of the needs are access to information, technologies, funding, and institutional gaps.
Institutional support	Promoting and assisting institutional change by fostering new business models and encouraging interactions with new actors.
Network brokering	Identifying and connecting many actors.
Capacity building	Fostering and bolstering novel organizational structures.
Innovation process management	Coordinating communication, promoting negotiation, and fostering learning amongst several actors.
Knowledge brokering	Determining the knowledge and technology requirements, mobilizing, and sharing the information and technology from many sources.

2.3. *Gathering qualitative data*

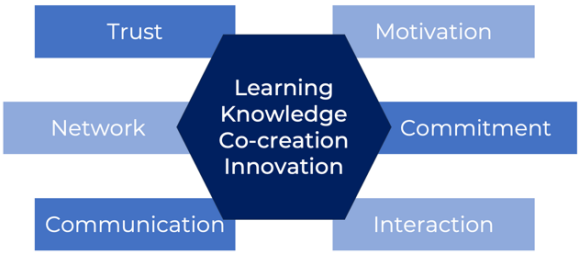
The quantitative investigation was also paired with qualitative interviews, structured according to the qualitative approach developed by Molina *et al.* (2021): OG members were asked to explore the relational dynamics among stakeholders, and the role of farms within the OG partnerships. In addition, 9 key informants, as coordinators or intermediary partners in one or more OG, were interviewed to identify the factors influencing the interactive process of innovation. The 9 key informants took part in a total of 15 OGs in the viticulture and wine sector, and a total of 25 OGs considering all production sectors.

Participants were asked to answer a few open-ended questions to reveal how the different OGs were organised, the role of each partner, their motivations, the overall partnership approach and the relations that they had developed.

Interviews were conducted online, recorded and machine transcribed. Two researchers conducted thematic analysis on the results (Gibbs, 2018; Saldaña,

2021), adopting the dimensions from the framework of Molina *et al.* (2021) (Figure 1).

Figure 1 - Factors that influence the participatory innovation process. Source: Our own elaboration based on Molina et al. (2021)



This qualitative methodology made it possible to extract relevant information from the interviews, summarize it according to specific labels for the emerging topics and categorise it under the main themes.

To do so, researchers first familiarised themselves with the content of all the interviews. Second, they separately conducted the qualitative analysis. Third, they agreed on the results emerging from the analysis conducted separately. Lastly, they provided an overview of the results according to the main codes, categories and related themes.

3. Results

The descriptive analysis of the data showed the main trends regarding the innovation pattern and the orientation of the different Italian Regions. Since 2016, Emilia-Romagna (25 projects) has been the region with the highest number of OGs in the wine sector, followed by Veneto and Tuscany. The wine sector projects covered 19 of the 36 topics included in the set-up of OGs. The highest number of investments addressed precision agriculture, disease and pest control, protection of biodiversity and farm management. In particular, Emilia-Romagna focused on biodiversity, Tuscany and Piedmont on precision agriculture and Veneto on disease and pest control, while other regions have a more uniform distribution of topics.

The thematic area of precision agriculture has the greatest amount of funding followed by disease and pest management, and farm management. Under the topic of farm management, the projects cover a variety of issues

such as agronomic management of soil, water, and vineyards by means of monitoring systems and Decision Support Systems (DSS) for pest and disease control, grape monitoring in the cellar and during shelf-life.

Analysing the 96 projects revealed by the Innovarurale portal query, we found that the average budget per project is €368,894.53; the region with the lowest average budget per project is Calabria (below €100,000), while in regions such as Piedmont, Lombardy, Sicily, and Apulia the average funding per project exceeds €450,000.

This reflects the different policies and funding regimes adopted by the regions, which diverge from one another regarding cooperation and innovation measures (Giarè & Vagnozzi, 2021). Similarly, leadership varies among the regions. In some, agricultural enterprises, cooperatives, business associations, and producers lead the projects, while in other regions research institutions have taken the leadership role.

3.1. *OG functions as intermediaries of innovations*

Analysis of the surveys conducted among the OG coordinators revealed that 96% are satisfied with the results achieved by at least one OG of which they are a member and 88% consider this RDP measure of the EIP-AGRI policy to be a success.

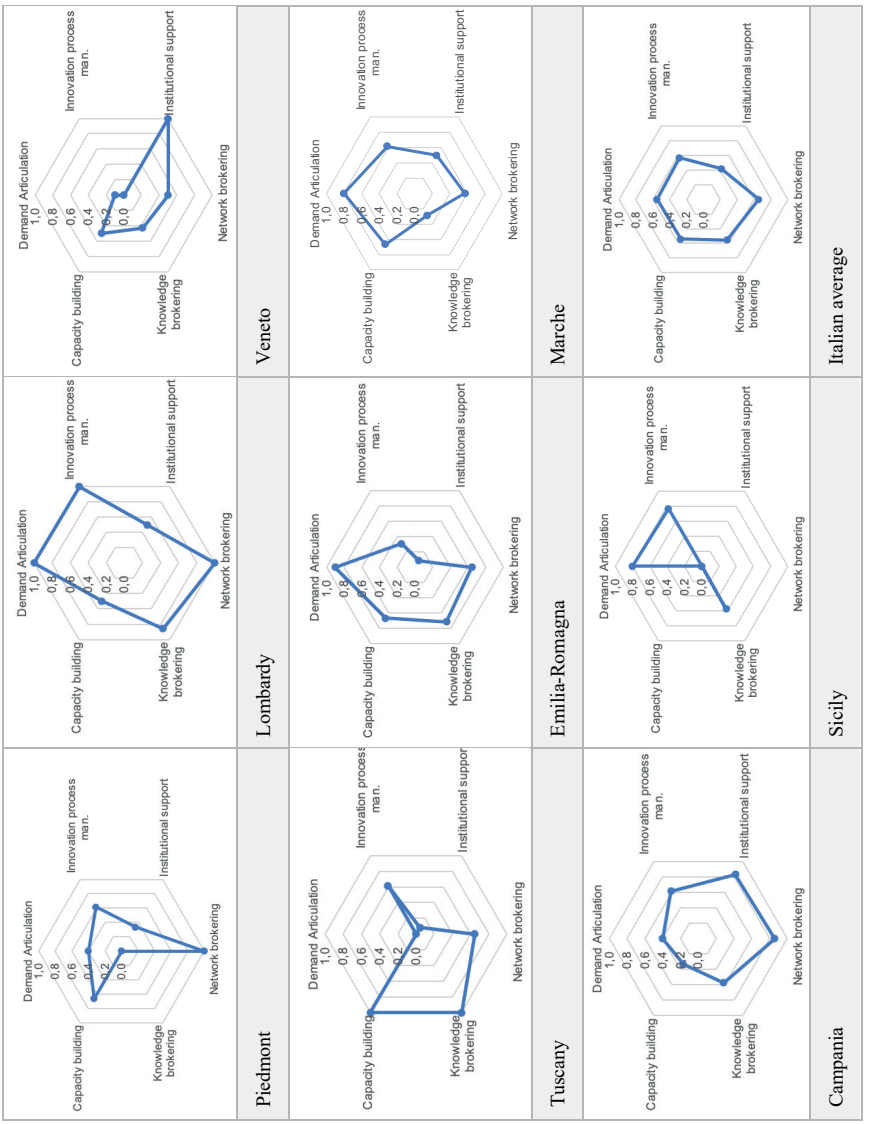
As shown in Figure 1, the respondents from Lombardy, Emilia-Romagna, Sicily, and Marche consider OGs to be significant in *Demand Articulation* and therefore in facilitating the process of understanding the needs of the various actors, identifying and studying new solutions and opportunities, and integrating the different approaches of the actors involved.

Regarding *Innovation Process Management*, the respondents from Lombardy, Sicily and to a lower degree Piedmont, Campania and Marche recognised the value of OGs in facilitating collaboration between different actors to develop projects in support of innovation, favouring information exchange among partners about specific actions, and promoting their control and assessment mechanisms.

Respondents from Tuscany, Marche and Emilia-Romagna also expressed a positive opinion about the *Capacity Building* function of OGs in promoting new forms of organisation to support projects and objectives within the same groups.

Concerning *Networking Brokering*, respondents from Lombardy, Piedmont, and Campania and to a slightly lesser extent Emilia-Romagna, Tuscany, and Marche deemed that OGs are important for spreading and promoting cooperation between internal and external actors through platforms, workshops, or other projects with common aims.

Figure 2 - Overview graphs of the perception of the role of OGs as innovation intermediaries by region



The respondents from Lombardy and Tuscany especially recognised the *Knowledge Brokering* function of OGs and their potential to spread knowledge and information about new technologies as practical solutions.

Finally, respondents in Veneto and Campania judged that OGs are useful in supporting the institutional function. They indicated that OGs have been helpful in assisting partners in the consolidation of their economic activity and acquiring funding for the team's professional training, facilitating institutional and economic support in the proposal of legislation useful for problems identified by the group, and increasing policy maker awareness about suitable solutions.

3.2. *Factors influencing the participatory innovation process in the OGs*

This section presents the results of the qualitative analysis of the interviews carried out with different OG members. Results are based on the framework provided by Molina *et al.* (2021), who describe the factors influencing stakeholder participation in co-creation activities (motivation, commitment, interaction, communication, networking, and trust), and impacting the innovation process and outputs.

Nine interviews were conducted with OG members from different regions of Italy (Northern, Central-northern, Southern Italy, and one of the islands), 6 of whom are OG projects coordinators. This provided the research with a systemic perspective on the engagement and participation of different partners.

Table 2 presents the characteristics of the OGs considered by the research.

The following sections describe the factors influencing the innovation process, according to the dimensions identified by Molina *et al.* (2021).

3.2.1. Motivation to engage and participate in OG projects

The main motivation for partners to engage in OG project initiatives arises from the need to increase knowledge on topics that are still poorly addressed legally and scientifically (OG1, OG2) and to foster innovative agricultural practices by going beyond what is known so far and experimenting new methods, tools and processes (OG8). Often, the project idea itself comes from a bottom-up shared need from businesses, which increases the probability that the project will be successful (OG6, OG7, OG8, OG9).

Moreover, partners recognise the concreteness of the OG projects, and the tangibility of the innovative solutions for practitioners in the viticulture and wine sector. Indeed, small and medium-sized enterprises (SMEs) in

Table 2 - Characteristics of the OGs involved in the study

Resp. ID.	Type of organisation	Role of organisation	N° of OGs in viticulture and wine sector in which they participated	N° of OGs in other sector in which they participated	Other partners	OG Region	Solution category
OG1	Protection and valorisation consortia	Coordinator	2	0	Research body University Institutional body Association Wineries	Lombardy	Climate change, Pest and disease control, Landscape and land management, Agricultural practices
OG2	Research body	Coordinator	1	0	Research body University Wineries	Sicily	Agricultural competitiveness and diversification, Fertilisation and nutrient management, Soil management, Biodiversity management, Agricultural practices, Agricultural production systems
OG3	Tech company	Coordinator	1	0	Research body University Trade Association Wineries	Campania	Agricultural practices/ Agricultural machinery and equipment; Climate change; Plant pest control/disease; Soil quality control
OG4	RDI consulting company	Scientific partner	1	5	Research body (coordinator) University Consulting companies (RDI) Wineries	Emilia Romagna	Plant pest control/disease; Farming systems; Soil quality control

OG5	Winery	Coordinator	2	0	Research body University Consulting companies Trade association Wineries	Veneto	Agricultural practices; Agricultural machinery and equipment
OG6	Research body	Coordinator	3	1	Research body (coordinator) Consulting company (ICT) Wineries	Tuscany	Agricultural machinery and equipment Agricultural practices Agricultural production systems
OG7	Research body	Coordinator	3	0	Research body (coordinator) University Consulting companies Trade association Wineries	Piedmont	Agricultural and forestry competitiveness and diversification Fertilisation and nutrient management Agricultural production systems
OG8	RDI consultancy company	Technical-environmental partner	1	3 (1 of which in Sicily)	Research body University Trade association Wineries	Marche	Climate and climate change Soil management Agricultural Practices Natural resource use Organic regenerative agriculture
OG9	Consulting company	Innovation broker	1	1	Research bodies University R&D Consulting-Tech company Wineries	Apulia	Agricultural and forestry Competitiveness and diversification Supply chain, marketing and consumption Biodiversity management

particular see the concrete value of these projects, because they give them access to technological advancements normally not within their reach, due to infrastructural limitations, lack of knowledge and limited financial resources, in comparison with bigger companies, which find it easier to engage in such investments and collaborations with tech companies and research institutions (OG3, OG9). Therefore, it is very important to create consortia that can manage and sustain this kind of project (OG8).

OG partners feel motivated to have a role in the process of innovation development: here, research institutes and universities serve to transfer knowledge, providing research and scientific data for the development of specific solutions (OG3), while capitalising on their participation through publications and similar scientific products (OG5). Like research institutes (OG5), tech companies also engage in the process of innovation co-creation by helping to prototype new products and services, and benefit from their collaboration with the opportunity to launch these products and services on the market (OG3, OG5). One organisation (OG8) said the main motivation to engage in an OG was the opportunity to disseminate regenerative agriculture practices as a form of innovation, while others were motivated by the opportunity to make such innovations accessible to SMEs (OG8, OG9).

Regarding barriers to participation, several OG partners expressed scepticism about projects funded and managed by regional governments (OG3, OG4). Particularly, engaging farms and SMEs in a consortium to apply for a specific call might result difficult for different reasons. First, they perceive that public initiatives often fail to drive positive changes for farmers (OG4). Second, strict bureaucratic obligations demand too much time and expertise (OG4, OG5, OG9). Third, they cannot rely on financial resources from a Region-managed project, because the project budget is delivered after the submission of the activities report, and it might be reduced compared to the agreed amount, should one of the partners fail to complete their part of the project (OG3, OG8, OG9). Moreover, in some cases the Region delays delivery of the final balance of the funds, and thus farms cannot participate in future projects, due to the lack of guarantees in the funding reception within an adequate timespan (OG9).

3.2.2. Commitment towards project objectives

Generally, members are highly committed when there is a common perception of the shared benefits from the innovative output (OG5) and when the consortium is based on existing and previous collaborations (OG8). Small farms showed high commitment, proactivity and enthusiasm, as OGs make the application of innovative solutions in their farms accessible (OG9).

Instead, competition among similar partners, especially research bodies, can slow the project run (OG3, OG9). Moreover, when research bodies are committed to more than one project at a time, their level of engagement decreases, thus producing delays in the delivery of the project outputs, with negative impacts on the farms (OG9).

Commitment can be promoted or harmed by partner actions or attitudes. Defining feasible goals (OG7) and a common vision, as well as the roles and responsibilities for different tasks is crucial for ensuring successful project implementation (OG1, OG2, OG7, OG8). This should be done since the very establishment of the consortium and must be consistent with the actual effort that each partner could ensure (OG6). In general, there is heterogeneity in the efforts of the participants: while some partners show great initiative, others might demonstrate lower commitment or even prove to be a liability. Although project initiatives are based on unanimous cooperation (OG2), partners with a "pioneering" attitude towards the innovation could lack a sense of collaboration. Also, companies may be reluctant to release data collected over the years, and this can hinder the whole collective learning experience (OG1). Moreover, some negative consequences may occur when the specific interests of some partners lead to divergent views on the project. For example, in one case (OG8), the Region cut the budget because one of the topics declared in the application was neglected by partners who chose to prioritise other topics.

Some of those interviewed stressed the importance of the commitment of the project manager. For some respondents, the coordinator should oversee the different roles throughout the project, making sure that all partners accomplish their bureaucratic duties (OG3) and ensure transparency about their contributions in the financial reporting (OG4), since it is the coordinator who bears the economic and legal responsibility to the funding agency and the project partners (OG2). Others stressed that an experienced and committed project manager in the consortium might ensure positive results for the project (OG8).

The coordinator is responsible for ensuring partner commitment towards the project goals and the specific task assigned (OG1, OG2). One partner suggested that this role could be covered by the innovation brokers (OG9), acting as an intermediary among partners, the OG and the regional officers, and responsible for the communication and dissemination of the project results (OG9).

The commitment and motivation of farmers and SMEs could be boosted when coordinators/innovation brokers support their project activities, provide them with clear indications at each step, and show the tangible benefits from the solutions. In such cases, the farmers would likely offer to engage in extra activities and experiments, and speak well of the project to their

acquaintances, which can have positive economic implications on the project (OG3, OG9).

There is no doubt that face to face and even online meetings encourage the commitment of participants. Field visits and brief technical meetings in person not only help the implementation of the project (OG9) and serve for practical purposes of installing and maintaining technological tools, testing, and data collection from the experiments (OG7) but they also help create personal connections among stakeholders (OG4, OG7). Online calls advance project implementation and coordination (OG4), but can also foster team building with partners from different provinces in the same region or different regions altogether (OG3, OG9). Also in this context, coordinators must acknowledge partner commitments and keep the meeting and communication schedule feasible for everyone (OG6).

Moreover, availability of additional funding resources allows to tackle challenges that are similar in OGs operating in different regions or areas of the same region, and support further experimentation at different levels, with a common ground for the analysis and comparation of results (OG4, OG9).

Several respondents also indicated that regional officers are usually committed to solving OG bureaucratic issues, checking the overall project procedures and functions (OG3, OG6, OG8), and providing networking opportunities at the regional level, by connecting different projects to share practices and solutions (OG3). In one case, disorganisation and lack of punctuality was highlighted (OG9).

3.2.3. Interaction throughout the project

To provide efficient space for interaction and set up a strong partnership it is helpful to establish consortia based on pre-existing collaborations (OG7, OG8), and to choose partners who can face budget anticipation (OG8).

In this context, mainly the coordinator or, in one case, the innovation broker (OG9) is perceived as having a decision-making role, not only because this person has “a broad view of the project topic” (OG2) but also to avoid assigning this role to some participants who may work on specific tasks and therefore be less responsive when it comes to making decisions for project management and coordination (OG3).

It is essential from the very outset of the project idea to organize “key meetings to explain the nature of the funding call and give guidance on participation” (OG2, OG7), whether the project involves partners from the same region or collaborators from different territories, chosen for strategic reasons (OG1).

Diplomacy is important (OG2) to make sure that everyone's voice is heard when speaking about the project progress and outlining solutions in line with principles and aspirations of each (OG2, OG5). However, when organisational or relational problems occur, the coordinator/innovation broker must safeguard the integrity of the consortium and find feasible solutions, perhaps by re-assigning tasks among the partners (OG3, OG9).

In addition, coordinators oversee the overall management process of the project. Previous experience in project management might be a bonus, but acting strategically in setting up the partnership and knowing partners' commitments is of extreme importance for running the project smoothly (OG6, OG7).

Coordinators and innovation brokers play a key role in the cohesion and effectiveness of operational groups. Coordinators intervene with their decision-making power, especially in situations of conflict (OG2). Innovation brokers also are known for their contribution to partnership cohesion. In one case, the innovation broker supported the creation of the consortium by identifying partners from different areas of the region that were connected to producer organisations; this made it possible to establish of a consortium that officially counted on 3 farms but that actually connected a huge network of farms, where the innovations could be experimented throughout the project (OG9). Instead, the poor engagement of coordinators and innovation brokers negatively affects the development and diffusion of innovation, the engagement of partners and other key stakeholders (e.g., consumers or opinion leaders) and the consistency of feedback received about the innovation output (OG2, OG9).

Interactions in the project involving project management agencies and scientific partners also influence the success of the initiative. Some respondents felt that the former do not help the operational groups, because of their project-oriented nature (OG6, OG7).

According to some (OG2), the scientific partner also contributes to the process, to "dictate the intensity of the [different] […] actions", together with the innovation broker, "who should create connections between businesses potentially interested in the topic […] and research centres" (OG2).

There can be many barriers to innovation co-creation. First and foremost, the short duration of the project (OG1, OG2, OG4, OG7) could yield data of little significance (OG1, OG2, OG4), unrepresentative of the entity of the efforts made (OG1). Secondly, regional projects often are bureaucracy heavy, "full of formalities" (OG2) and restrictive budgeting and reporting rules, with up-front demands for specific information on activities before it is possible to provide this information (OG6), thus creating delays in the project timeline (OG2, OG9).

Interactions might be difficult also when the partners have different educational backgrounds, values, willingness to share information (OG7) or vision for the type of innovations and activities to be implemented (OG2, OG8) and when businesses have internal disagreements (e.g.: entrepreneur vs. employees/workers) on the experiments to be conducted (OG8).

Moreover, in the wider local context in which the OG operates, there could be "jealousy" and "egocentric" attitudes due to established power-interest relationships, sometimes "political" and often related to a "fear of change" (OG3). This could result in the lack of recognition of the OG results (OG3) by other local actors. In some other cases, instead, regional policy makers have shown a collaborative approach regardless of their political affiliations (OG8).

Overall, respondents would engage in future collaboration, although the terms and conditions are not clear for the follow-up activities (OG7). They are willing to pair old and new partners to engage in new funding opportunities. Trade associations might have a role in creating new connections to broaden the networks since, due to time constraints and other overlapping commitments, few efforts have been made to convert potential contacts into concrete partnerships for future collaborations (OG3). Many projects have produced a great impact on the local area, and the organisation of workshops attracted the interest of potential new entrepreneurial generations who are "perhaps culturally […] sensitive to environmental and […] sustainability issues, and who naturally see […] innovative solutions as a possible economic outlet" (OG2). Nevertheless, it is difficult to involve other farmers in projects adopting innovative and sustainable agricultural practices. It takes time to change people's minds, but some respondents said that these OGs activities have recently begun producing some impact in this direction (OG8).

Future collaborations could involve other OGs, to allow knowledge exchange […] and the development and adoption of innovation (OG1, OG2). However, identifying someone who could develop this collaborative activity is essential (OG6): this could be done by coordinators (OG1) or regional governments, which should act to connect different project coordinators (OG1, OG2) through dedicated services like instant messaging platforms and training days (OG2, OG3, OG4).

3.2.4. Communication

Communication within the operating group and also the sharing of information and results outside the partnership is of key importance. Within the OG, coordinators and partners responsible for project communications (OG9) seek to provide effective, transparent and balanced communication

among partners by circulating meeting information and providing an overview of further steps to ensure the attention and commitment from all partners (OG1). Especially for partners from different areas, internal communication can be ensured by online meetings (OG7) and, periodically, by technical face to face meetings (OG9).

However, the excess of meetings, emails and messages can impact negatively on the consortium, especially if members deem them superfluous or not of equal interest to all the partners (OG2). In this context, coordinators might consider an alternative communication language, according to the frequency and level expected by each of them (OG3). Moreover, issues may arise due to the willingness of some partners to pursue their own interests, giving priority to aspects of the project that the other partners do not perceive as a shared need (OG8).

Coordinators should also oversee the sharing of information and results from the projects outside the OG partnership, for example through workshops, newsletters, articles in the national press, etc. (OG2, OG7, OG9), by participating in conferences that would favour further knowledge exchange (OG7) throughout the entire viticulture and wine sector (OG4) and by involving producer organisations and their networks within the consortia (OG9). For example, OGs have organized thematic dissemination meetings to share the project results and even storytelling seminars hosted by farms to present their innovative solutions (OG9). Generally, effective sharing of information and results could strengthen the existing network and help establish new relationships, especially if OG partners succeed in communicating a shared vision and showing coherence and common values, although one respondent indicated that this does not always happen (OG8).

Here, local agricultural agencies involved in the OG projects (OG7) or regional governments can play in important role by publicizing OG projects and their positive results for the viticulture and wine sector and providing new opportunities for the OG members to increase their knowledge and build relationships inside and outside the OG through AKIS programme activities (OG3). This could result in new collaborations and an enhanced reputation beyond the regional context. Word of mouth and informal communications are also important during the dissemination events to foster networking. Here, presenting good practice examples from farms participating in the OGs could stimulate other farmers (OG3) to invest in the developed solutions.

3.2.5. Ensuring a strong and collaborative network

The establishment of relationships of trust among participants is essential for running experiments and ensuring on-site applications of the solution

developed. Training activities might foster understanding of roles among participants and relevance of the solution for business activities (OG3), although the age of the manager and the business size might impact the responsiveness towards the technological product. Indeed, senior managers of SMEs have proven to be more oriented towards implementing the technologies developed than have the younger managers who run bigger farms (OG3).

In general, when partners face highly urgent problems together, for example, floods or other natural disasters, or parasite damage to fields, they tend to have a strong collaborative and "problem-solving" attitude. Instead, when bureaucracy hampers the activities, partners are less open to collaborating (OG3, OG8, OG9).

To broaden the consortium beyond the official partners, one OG invited representatives of producer organisations with a high number of farms, from other parts of the region. This allowed more companies to benefit from the experiments and enhanced sharing of the project results (OG9).

Often external relations with other OGs in the viticulture and wine sector are established by coordinators and innovation brokers themselves. This is easy when they manage more than one OG or create contacts with OGs working on similar innovations domains, to gain an overall understanding of the OG results produced regionally (OG4). This action is very important because to date no particular attention has been devoted to creating opportunities for networking at an extra-regional level, beyond the "Innovarurale" online database for retrieving information about viticulture and wine OG projects, and some national initiatives organised by the Ministry of Agriculture with some selected OGs to promote exchange among OGs from different regions (OG3, OG8). Collaborative relationships with regional officers and policymakers potentially impact policy implementation and project success (OG3, OG8) with increased awareness of and knowledge about the innovations (e.g. Agriculture 4.0) implemented by the OGs, resulting in following more punctual and pertinent measures and call for funding (OG3).

3.2.6. Building and encouraging trust

Trust lies at the core of successful project implementation. The perception that the different partners are working with equal engagement in the project reinforces a sense of cohesion. Opportunities for bonding among participants happen when partners carry on activities together and engage in periodic meetings (OG3, OG4).

Coordinators and other intermediaries (OG7), such as innovation brokers (OG9), should ensure a space of trust in order to address innovation barriers.

They should help partners overcome administrative obstacles (OG2, OG3, OG4, OG7) and carefully choose business partners to involve in the project, with the awareness that the involvement of many business partners is certainly a positive aspect for the project, but that a small group also has its advantages, allowing for better and faster identification of solutions to address issues that arise in the project (OG2, OG4, OG9). However, "roles and actions also depend a lot on people" (GO2). Indeed, besides the proactive partners engaged in project objectives and sharing of results (OG2, OG7), there could be other companies that are "silent," even during meetings (OG1). In general, partnerships built with acquaintances or previous collaborators would certainly

Table 3 - Drivers and barriers to participatory innovation process

Drivers to the participatory innovation process	The coordinator plays the role of connector, facilitator, motivator. This role can also be played by innovation brokers
	Pre-existing collaboration patterns in the consortium
	Partners grasp the concrete benefits from application of the innovation based on real needs
	The coordinator and the regional government work cooperatively
	The regional government is open to listen to partners about issues that arise during the project and acknowledge them, and to support a smooth work flow
	The OG can create present and future interconnections with other regional OGs
	Good dissemination of the project objectives and results, including through peer-to-peer interactions, positively impacts the commitment
	Frequent online and in-presence meetings enhance trust among the project members
	A transparent and useful subdivision of roles and activities
	Trustworthy intermediaries monitor the development of different activities
Barriers to the participatory innovation process	Pressing bureaucracy
	Delays in receiving funds
	Ineffective communication about the concrete results of the project
	Resistance to sharing data and information
	Different interests and divergent visions among partners
	Power-interest dynamics, sense of jealousy or competition diffused in rural contexts
	Poor dissemination of information and portals related to the OG activities and projects

set the ground for a relationship of trust (OG6, OG8, OG9). Instead, when partnerships have new members with whom there are very few personal interactions, having trustworthy intermediaries who ensure the accomplishment of different roles and activities might help to develop a good relationship among the partners (OG2, OG7, OG9).

Heterogeneity in membership (OG7), and clarity on roles are perceived to positively influence the project outcomes. When roles and tasks are allocated clearly, so that all members know their primary responsibilities, the project activities are more transparent and partners can help each other in achieving the project goals (OG1, OG2). Transparency on the specific tasks could be supported by the establishment of deadlines (OG7) and detailed rules, both internal to the partnership or external, for reporting and dissemination of the activities (OG1).

Based on the results of the qualitative data, Table 3 provides a synthesis of drivers and barriers to the OG innovation-oriented projects.

Conclusions

This study sought to understand the role played by OGs in the process of adopting innovation, and to identify the strengths and weaknesses of co-design and innovation transfer strategies supported by the European Innovation Partnership for Agricultural Productivity and Sustainability (EIP-AGRI).

The innovation process is multifaceted and can be influenced by a number of variables that are sometimes complex to identify and generalise. However, as highlighted by Costa *et al.* (2022), given the great challenge of the twin transition towards environmentally sustainable practices through the adoption of digital innovation, more effort is needed to improve the dissemination of innovations in the viticulture and wine sector, facilitating the culture of innovation and the orientation of operators towards a digital and sustainable production system.

The quanti-qualitative research presented in this contribution highlights some useful aspects for strengthening the instruments of OGs and fostering their dissemination. The research shows that OGs work better when they are based on innovation needs and interests shared by the participants. In line with the previous study of Piñeiro *et al.* (2021), OGs can be a tool for developing and applying concrete innovations from farmers' recognised need for knowledge or the willingness to move to more sustainable production systems.

According to the literature on the topic, the dynamics that foster the success of an OG are closely linked (Giarè & Vagnozzi, 2021; Molina *et al.*,

2021)the most important initiative of the European agriculture innovation policy is the European Innovation Partnership for Agricultural Productivity and Sustainability (EIP AGRI, and a common vision and shared objectives positively influence the management of the innovation process, favouring coordination and communication activities and the climate of trust among participants.

Here, the role of coordinators in project management is crucial: they keep participants reminded of the overall vision of the OG, manage transparent and balanced communication among the participants, support and listen to individual partners, deal with conflicts, facilitate project activities and work with the authorities on administrative and bureaucratic aspects. The expertise required to coordinate an OG is crucial, and regional agencies should take this into account when they define calls for proposals. For example, if the coordination role is restricted to farmers, the project may not have a coordinator with the expertise needed. Given the limited strength and availability of smaller farms, in the latter case, it would be useful to encourage the presence of innovation intermediaries who can assume the facilitation tasks and the absorption of administrative bureaucracy that is sometimes too burdensome for companies as early suggested by Parzonko *et al.* (2022). Other strategic decisions assigned to the Regions concern the timing and funds made available for projects, which should also be calibrated with the objectives set by the Region and the practical aspects concerning project implementation.

Communication, as pointed out by Molina *et al.* (2021), emerges as a decisive factor in the co-creation processes of innovations and knowledge transfer mechanisms. Communication skills are essential in interactions within and also outside the group, for example, in strengthening relations and contacts with other OGs nationally and internationally or with stakeholders facing similar issues.

Although the local government's institutional support in the design and setting up phase of the OG is acknowledged, the respondents indicated a lack of trust in managers of public funding, because of bureaucratic aspects and problems with excessively long waits for reimbursements.

Implications for practitioners

Although this contribution is more focused on management aspects of OGs than on analysis of specific innovations, important considerations emerge on managerial aspects that could involve practitioners.

Engaging actively in OGs offers practitioners an opportunity to access and share cutting-edge knowledge and innovative practices. This collaborative

environment not only helps to address existing gaps in the viticulture and wine sectors but also fosters a culture of continuous improvement and innovation. SMEs can benefit from active participation in consortia because it helps them overcome infrastructural and financial constraints and provides access to technological advancements that might otherwise be out of reach. Disseminating project results can significantly enhance the visibility and impact of the innovations developed, benefiting the entire sector, but primarily, farms could benefit internally from a diversified partnership for the training of their employees and the development of a stronger innovation culture through knowledge-spreading.

Implications for policymakers

Focusing on the operating mechanisms by which the EIP-AGRI supports innovation and knowledge exchange in agriculture, with particular attention to the viticulture and wine sector, this contribution offers significant insights for policymakers about the enabling factors and potential barriers to innovation development forward a twin transition.

Policymakers should support and enhance bottom-up initiatives that emerge from common stakeholder needs. What could increase effectiveness and adherence to OG projects is the simplification of bureaucratic processes and the reduction of administrative tasks. Clear and accessible guidelines for project management, budgeting and reporting could facilitate the effective participation and contribution of all partners. In addition, investing in the training of skilled project coordinators could be a contributing factor to improving the management of the project. Finally, local and national governments can play a pivotal role in supporting the dissemination of results and providing national and international networking opportunities among stakeholders to ensure that the innovations introduced by the OGs are widely disseminated and adopted, leading to sustainable growth and development of the viticulture and wine sector.

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