



Supporting the role of small farms in the European regional food systems: What role for the science-policy interface?

Sandra Šūmane^{a,*}, Dionisio Ortiz Miranda^b, Teresa Pinto-Correia^c, Marta Czekaj^d,
Dominic Duckett^e, Francesca Galli^f, Mikelis Grivins^a, Christina Noble^e, Talis Tisenkopfs^a,
Irina Tomaⁱ, Theodore Tsiligiridis^j

^a Baltic Studies Centre, Kokneses prospekts 26-2, Rīga, LV1014, Latvia

^b Department of Economics and Social Sciences, Universitat Politècnica de València, Camino de Vera S/n 46023, Valencia, Spain

^c Instituto de Ciências Agrárias e Ambientais Mediterrâneas (ICAAM), Universidade de Évora, Núcleo da Mitra, Apartado 94, 7006-554, Évora, Portugal

^d University of Agriculture in Krakow, The Faculty of Agriculture and Economics, Al. Mickiewicza 21, 31-120, Krakow, Poland

^e The James Hutton Institute, Craigiebuckler, Aberdeen, AB15 8QH, Scotland, UK

^f Department of Agriculture, Food and Environment, University of Pisa, Via Del Borghetto 80, 56124, Pisa, Italy

ⁱ Highclere Consulting SRL, Cam. 7, et. 1, Complexul SCM "TRICONPREST", Str. Dr. Victor Babeş, Nr. 36, Braşov, 500073, Romania

^j Agricultural University of Athens, Dept. of Economics and Rural Development, InfoLab, 75 Iera Odos, 11855, Athens, Greece

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ABSTRACT

Small farms dominate the European agricultural landscape, but they are much less represented in agricultural decision-making structures than larger farms. The weak political representation of small farms diminishes the degree to which their needs are addressed in public agricultural policies and support measures. This under-representation has been constraining small farms' contribution to food and nutrition security and sustainability. This paper explores the science – policy interface as boundary networks between researchers and policy-makers, to generate policies that are better-informed and better tailored to small farms' situations. It gathers researchers' experiences, from the Horizon 2020 project SALSA, through a range of project-generated activities and knowledge, of their engagement in the policy process. From the case studies analyzed, three types of SPI emerge: expert advice, networking platform and collaborative governance. Cooperation between researchers and policy-makers, that is often embedded in broader stakeholders' networks, generate three kinds of contributions: better-informed policy process; increased social capital and empowerment of participants; and improved participant knowledge and skills.

1. Introduction

Small farms, whether we consider either their physical extent or their economic size,¹ comprise two thirds of all European farms (Eurostat, 2018a). However, proportionally, these farms cultivate only 6.1% of the utilized agricultural area (Eurostat, 2018a) and have limited access to other production resources such as finances, knowledge, and equipment, all factors that undermine their productive capacity (Labarthe and Laurent, 2013; Leimane et al., 2014). While there is increasing attention given towards small farms among agricultural policy-makers and

researchers, European small farms have long been and still largely remain on “the dark side of the moon”. The existing albeit limited research about small farms' situation and role in food systems are indicative of their distinctive contribution to food and nutrition security (FNS) (Ricciardi et al., 2018; Davidova et al., 2013; HLPE, 2013; Min-cyte, 2011; Rivera et al., this issue). Meanwhile, small farms continue to disappear with the ongoing concentration trend in agriculture (Eurostat, 2018b).

The poor visibility of small farms is also linked to their limited political voice and weak representation in agricultural policy making (van

* Corresponding author.

E-mail addresses: sandra.sumane@gmail.com (S. Šūmane), dortiz@esp.upv.es (D. Ortiz Miranda), mtpc@uevora.pt (T. Pinto-Correia), martaczekaj@poczta.onet.pl (M. Czekaj), dominic.duckett@hutton.ac.uk (D. Duckett), francesca.galli@unipi.it (F. Galli), mikelis.grivins@gmail.com (M. Grivins), Christina.Noble@hutton.ac.uk (C. Noble), talis.tisenkopfs@lu.lv (T. Tisenkopfs), office@highclere-consulting.com (I. Toma), tsili@aau.gr (T. Tsiligiridis).

¹ According to economic size, small farms are those with a standard output up to 8000 euros. In physical terms, small farms operate up to 5 ha of land.

der Ploeg, 2017; Poulton et al., 2010). In existing agricultural and food policy and decision-making structures, bigger farms and food industries are well represented, in comparison to smaller enterprises. Despite some targeted public policy measures to support small farms, agricultural policies have largely followed the argument that economies of scale turn out to be beneficial both for food supply and use of natural resources, and have been overlooking small farms (Dürr, 2016). As a result, small farmers have benefitted less from public agricultural policies and support measures, and this has been constraining their contribution to FNS and sustainability (Dürr, 2016; Vēveris, 2014; Rabinowicz, 2014).

Science and technology are at the core of change in food systems. They are also central to policy change providing knowledge that policy makers draw upon as decision support evidence (Vanloqueren and Baret, 2009). In order to overcome the lack of recognition of small farms' realities, roles and needs in European agriculture (Ricciardi et al., 2018; Pinto-Correia et al., 2017), researchers have a key role to play in exploring novel analytical tools and consequently producing new knowledge, while at the same time provoking a dialogue with both practice and policy.

In this paper, we explore researchers' and policy makers' interactions to generate better-informed and better tailored public policies more supportive of small farmers in the European context. The paper is based on researchers' experiences from EU Horizon 2020 research project SALSA which studies the role of small farms in FNS. We analyze experiences of researchers' engagement in the policy process through a range of activities and knowledge generated within the SALSA project. While SALSA research has been filling some knowledge gaps regarding small farms' situation and their role in FNS (Rivera et al., *this issue*; Guiomar et al., *this issue*; Pinto-Correia et al., *this issue*), it has also generated or contributed to a range of initiatives at the science-policy interface (SPI), i.e. spaces for interactions, exchanges and co-construction of knowledge between researchers and other actors in the policy process at different scales, with the aim of enriching decision-making (van den Hove, 2007; Pinto-Correia et al., 2015). To understand how SPI can better support small farms in regional food systems, we explore how SPI for small farms emerges, how interactions between scientists and policy makers are organized, and consider their goals and outcomes. We study these questions from the researchers' perspective.

SPI has been receiving increasing research attention and is broadly explored in the domains of environmental studies and that of health. Both contexts provide SPI insights that, at least partly, can be applied to the food and agricultural development domains, although there are few studies on science-policy interactions in agriculture per se (see Kropp and Wagner, 2010; Dinesh et al., 2018). Those few tend to focus on the topic of environmental management in agriculture, for instance adaptation to climate change (Adelle, 2015), and mitigation of agricultural water pollution (McGonigle et al., 2012). We apply the SPI framework to analyze science and policy interactions in the agriculture and food sectors, with a focus on small-scale farming, which is an underexplored area in SPI studies. Therefore, we provide insights and knowledge on developing not only better-informed, but also more inclusive and equitable food and agricultural policies.

The remainder of the paper is organized as follows. In the next section, we present the SPI framework to explore science and policy interactions in agriculture and the food sector, with a focus on small-scale farming. The methodological section outlines data collection and analysis methods and introduces the SALSA SPI initiatives. The analytical part addresses development and outcomes of SPI in various public agricultural and rural policy settings across Europe. We conclude with a discussion on the performance of SPI and the participation of social scientists in the policy process.

2. Science-policy interface in sustainable food system governance

Transition towards more sustainable food systems is at the core of the discussions on improving FNS. Successful transition demands essential changes both in food practices all along food-chains and in the ways food systems are governed (De Schutter et al., 2020). Long standing food policies have been principally agricultural policies, and these have stimulated intensification and concentration of food production in large, industrial farms. This mode of food production has secured benefits including a level of quality assurance, high availability, and greater affordability of food, but it has also generated a range of environmental, social, and economic pressures in food systems putting at risk their ability to ensure FNS (Rasmussen et al., 2018; Rockström et al., 2017).

With the turn towards a more comprehensive approach to food systems (Ericksen, 2008) and in the search of developing more sustainable food production modes, small-scale agriculture is recognized for its potential to improve food systems' sustainability and FNS (Brunori et al., *this issue*; Ricciardi et al., 2018; HLPE, 2013). Some targeted public policy measures have been introduced in the EU within the Common Agricultural Policy to support small farms, for instance the Small Farmers' Scheme for direct payments, Small Farmer Thematic Subprograms and support to small-scale food processing and marketing. However, with small farms decreasing in numbers at an alarming rate across Europe and with growing evidence highlighting the inadequacy of support mechanisms, the efficacy of existing measures and of current agricultural policy to address small farms' needs and boost their potential is cast into serious doubt, undermining FNS and other sustainable agriculture and rural development goals (Eurostat, 2018b; Pe'er et al., 2017; van der Ploeg, 2017; Toma et al., *this issue*).

De Schutter et al. (2020) argue that for sustainable food system governance in Europe, there is a need for more coherence across different policy domains and governance levels, long-term adaptive approaches, and the introduction of new democratic mechanisms into decision-making. Food systems governance involves a range of "processes and actor constellations that shape decision-making and activities related to the production, distribution and consumption of food" (van Bers et al., 2016: p.10). In these constellations, SPI takes a prominent role. Historically, research has contributed to policies, and joint science-policy efforts have emerged to ensure progress towards better-informed and more just public policies that can support sustainable food systems governance. In the European context, the European Commission has adopted a multi-actor approach in many of the research initiatives it has funded to stimulate innovative developments by science-society-policy interactions. Social scientists have a critical role in designing societally acceptable decisions for sustainable natural resource management (Cvitanovic et al., 2015). They can contribute to the policy process by improving the understanding of decision processes and path dependencies at nested scales, they can assist in anticipating future developments in people's actions, and they can act as facilitators for science-policy interactions in practice (van den Hove, 2007).

However, researchers' and decision-makers' collaboration is not straightforward. Uptake of scientific knowledge in the policy process can be undermined by a range of factors, such as perceived poor credibility, irrelevance and lack of legitimacy of scientific knowledge (Cash et al., 2002), different values, norms and "languages" of researchers and policy-makers (Mair et al., 2019), the dominant discourses, different agendas of policy makers (Eistrup et al., 2019; Pinto-Correia et al., 2019) and their negotiations and power struggles (Darnhofer, 2020). These challenges delineate science and policy as separated life-worlds demarcated by socially constructed or negotiated boundaries (Cash et al., 2002; Pinto-Correia et al., 2019). These boundaries maintain their identities, independence, and internal coherence but they need to be made explicit and be transgressed to make effective communication and collaboration possible.

We consider SPI as boundary networks that operate at the

intersection of these two life-worlds. Similarly to boundary organizations (Guston, 2001), boundary networks involve actors both from science and policy domains who interact around boundary objects (Star and Griesemer, 1989; Tisenkopfs et al., 2015), and co-produce new knowledge and social order inscribed in outputs and outcomes of these interactions (Callon, 1991). However, boundary networks may lack formal structures and hierarchy, and they tend to be more open and flexible than formal organizations. When considering SPI in food systems governance we need to account for its complex, multi-level and multi-actor nature with a diversity of processes and actors intermingled. For a better understanding of the role of researchers in such multi-stakeholder policy processes, we have to look beyond the science-policy interface and consider relational configurations, or boundary arrangements, at multiple research-stakeholder interfaces (Schut et al., 2013). Following this approach, we regard SPI for small farms as potentially embedded in multi-actor networks where researchers and decision-makers are among other stakeholders that participate in the policy process and with whom they interact.

The way interactions and communication between science and policy are organized has an impact on the development and outcomes of those interactions. Boundary networks have a good potential to enable participatory, collaborative knowledge exchange and generation for decision-making purposes that are more effective than unilinear communication of scientific findings (Cash et al., 2002; Cvitanovic et al., 2015). In practice, the implementation of SPI is shown to be a complex process that remains challenging. Opening or entering such spaces for science-policy interactions might be even more challenging when the issue at stake is not yet on a policy agenda, or when an alternative, incompatible discourse to the dominant one is proposed. The constraints on small farms to be heard in the policy arena is strongly linked to the difficulties of effecting change and diversifying the long-term, dominant policy goals of growth and efficiency backed by entrenched decision-making structures, including lobbies.

3. Methodology

We base our analysis on 15 cases of SPI related to the SALSA project (see Annex 1). The identified examples include (Adelle, 2015) targeted policy-oriented initiatives which have been planned within the project's work plan and which involve scheduled activities of SALSA researchers with stakeholders, such as work with SALSA communities of practice (CoP), macro-regional policy workshops, and dissemination activities linked to raising SALSA policy impact; and (Brunori et al.) other experiences at SPI that go beyond the project's scope, but in which knowledge gained from SALSA research has been a good support to contribute to policy. For this exploratory study of SPI for small farms, the cases were selected to capture SPI for small farms in their diversity as they were experienced by SALSA researchers. Therefore, the sample includes SPI from different domains of policy, policy-making levels and with various multi-actor relational configurations.

We have gathered this evidence from SALSA research teams in the project's participating countries in Europe with the help of written, structured, open questionnaires. The questionnaire was designed to address three key aspects of SPI: situation in the policy process (goal of SPI and its link to policy process), SPI process or boundary work (SPI participants, interactions and researchers' contributions) and outcomes of SPI (policy outcomes, SPI organizational dynamics, researcher's self-development and other relevant outcomes) (See Annex 2). The questionnaire was sent out to individual researchers and followed by a discussion if more details were needed. In total, 15 questionnaires were collected, i.e., one per case.

We applied directed qualitative content analysis to categorize, summarize and interpret the collected information (Hsieh and Shannon, 2005). The three key aspects of SPI, i.e. SPI position in the policy process, SPI process or boundary work, and outcomes, were used as initial codes (Table 1). They were complemented by new categories and

Table 1

Key components of SPI for small farms.

Key dimension of SPI	Descriptors
SPI situation in the policy context	Policy domain, policy level, SPI's purpose in the policy process
Boundary work	Participants, i.e., range and type of stakeholders involved; Boundary objects of participants' shared interest around which their interactions are organized; Boundary arrangements: relational configurations among stakeholders and researchers' role
Outcomes	Policy, research and societal impacts and outputs

detailed by subcategories emerging from the information gathered.

To analyze boundary work in SPI, we adapt Schut et al. (2013) to classify boundary arrangements between researchers and other stakeholders, including policy-makers (see Table 2). We explore how different boundary arrangements are linked to specific policy purposes of SPI for small farms and bring about different outcomes. Regarding the latter, we consider the impacts generated both on policy, research, and society (Jolibert and Wesselink, 2012). The coded information was structured, summarized and explored according to the established categories.

4. SPI relating to small farms' role in agri-food systems

In this chapter, we analyze how SPI related to small farms are situated in the policy contexts, what are their internal dynamics and what outcomes they can bring about.

Table 2

Types of boundary arrangements between researchers and stakeholders.

Boundary arrangement	Description
Independent research	Research is independent of stakeholder or political interests. Research is not concerned with how research findings are mobilized and used by stakeholders in policy processes.
Research steers stakeholder	Research actively seeks to persuade stakeholders to select a specific solution for the problem or a certain way of organizing the policy process.
Informative relationship	Research and stakeholders inform one another in a supply-oriented fashion, in a unidirectional or bidirectional way.
Advisory relationship	Researchers and stakeholders operate in their own separate domains, but research provides advice to stakeholders, and stakeholder can advise research on the relevance of research questions.
Exchange relationship	Research acknowledges that stakeholders have specific needs and questions, and proactively seeks to reconcile demand and supply. Research and stakeholders interact on research demands and exchange information
Co-learning relationship	Researchers and stakeholders engage in a joint learning relationship to produce stakeholder-relevant research.
Capacity building relationship	Research and stakeholders seek to complement each other. Research builds capacity and seeks to strengthen the position of the stakeholder in the policy process. Stakeholders can also empower research by providing research a platform to mobilize research findings.
Selective use of research	Research is used opportunistically, selectively, and strategically by stakeholders to defend their interests and pursue their goals. Research has little influence on how findings are interpreted, mobilized, and used by the stakeholders in the policy debate
Stakeholder steers research	Stakeholders influence and determine research agenda setting, how the research is conducted and/or used. The degree to which research can participate in, or contribute to, the policy process is controlled by the stakeholder

Source: Schut et al. (2013)

4.1. Situating SPI for small farms in the policy process

The identified SPI suggests a diversity of policy fields and policy levels within which small farms are addressed, and ways how SPI are embedded in the policy process. Regarding the policy fields, the SPI studied have intervened in agricultural, rural and regional development, food procurement and also environmental policies (See Table 3). While not exclusive, this list adequately characterizes key policy fields where small farms could be more systematically considered. One half of the SPI cases have small farms as their central boundary object and these SPI clearly aim to address small farms' problematic through, for instance, introduction of new measures for enhancement of small farms and small food businesses in national rural development programmes, and the identification of best policy tools and other support mechanisms for increasing the contribution of small farms to FNS in SALSA communities of practice and policy workshops. These SPI with the central focus on small farms were more often initiated by SALSA researchers. In the other half of the cases, small farms have been introduced in policy negotiations as a means to address specific policy problems, like, the improvement of public food procurement, or promoting innovative regional development through better use of small farms' potential.

The analyzed SPI cases were linked to various policy levels from local, regional to national and European scales (see Table 3). Many of the SPI cases are situated at regional and national levels which, depending on the country, correspond to the central decision-making level. There are also several SPI initiatives taking place at local (municipal or inter-municipal) level. It is more challenging to organize SPI at international level due to higher costs and organizational complexity, and only two SPI cases were identified at European level. Altogether this diversity points to the relevance of stakeholders and decision makers' engagement and possible, appropriate policy-solutions in response to small farms' needs at all policy levels. However, the policy level appeared to be linked to generally different policy interventions of SPI. National and regional level SPIs tend to contribute to policy formulation and were targeting specific policies or policy planning documents. SPI at local levels were negotiating practical

implementation of the identified policy tools.

Although SPI interactions happen at a specific policy level, most of the SPI cases analyzed were linked to policies at several levels. This reveals the inter-linked, multi-level character of policies in the EU. For instance, the Km0 Alentejo label in public procurement in Évora was developed and implemented at local level. At the same time, it is also linked to the regional level policy support tools dedicated to culture and tourism, and to the national and European level where the legislation regarding short supply chains, FNS and taxes is decided and applied. Most of SPI examples show that intervention activities and policy measures can be adopted at one single level, and in a bottom-up way, but SPI might need to work also in a multi-level way and in multiple policy domains.

We can distinguish three different ways in which SPI are embedded in the policy process, i.e. through provision of expert advice, networking platform, and fostering collaborative governance. Expert advice typically intersects with SPI where policy administrators seek targeted researcher expertise to address or solve a specific policy issue. Typically, this advice is linked to concrete policy instruments, such as regional development strategy, rural development programmes, public food procurement regulations, LEADER. These tools also characterize the range of existing or emerging policy tools that can be used for addressing small farms' needs and to whose goals small farms can contribute. Networking platform relates to SPI cases that have established and maintained connections between policy stakeholders, with networking, communication and information sharing purposes, that can have far-reaching impacts on policies. An exemplar is the networking among Polish researchers and national agricultural policy makers and stakeholders, which was activated during the SALSA macro-regional workshop and has subsequently evolved into a range of meetings and continuous communications where small farm conditions are discussed. Finally, fostering collaborative governance refers to SPI that focus on collaborative development and implementation of new governance arrangements for planning and managing of territories or assets. These governance arrangements can be already inscribed into policies, or SPI can propose new ones. We found evidence for this latter type of SPI

Table 3
Policy level, domain and embeddedness of SPI in the policy process.

Policy level	Expert advice	Networking platform	Collaborative governance
European		SALSA macro-regional workshops (EU1)	
		Conferences of the Research Centre of Small Agricultural Holdings , Poland (PL1)	
National	Advisory group for the Rural Development Programme's measure on small farms and small food businesses* , Greece (GR1)	Networking of Polish stakeholders , Poland (PL2)	Result Based Agro-Environmental Payments for silvo-pastoral systems, Portugal (PT2)
	School food procurement, Latvia (LV2)	Discussion rounds of the National agricultural development policy for small farms , Latvia (LV1)	
		SALSA CoP for the National Agricultural Development Strategy , Greece (GR2)	
		Cross-party group on crofting , Scotland (UK1)	
Regional	LEADER local action groups, Spain (ESP1)		
	Development Strategy of the Malopolska region, Poland (PL3)		
Local			0 km Alentejo , Portugal (PT1)
			Rural district, Italy (IT1)
			Community of food of Garfagnana , Italy (IT2)
			MENSA consortium for school meal procurement, Italy (IT3)

*Cases in bold are those with the central focus on small farms.

Policy domains: Agriculture Food Rural and regional development Environment.

operating mostly at local level.

An overarching, albeit not always explicit, goal of all the SPIs from SALSA researchers' perspective has been raising awareness of and improving knowledge about small farms' situations, their needs and potential contribution to the objectives of policies and the policy-making community. In more operational terms, SPI have two focuses which designate the ways in which small farms' situations can be improved with the help of targeted policy instruments. One is the better market integration of small farms. Several of the SPI studied have tackled small farms' market integration by developing measures beneficial to small farms such as certification of local food (PT1), public food procurement for local school meals (IT3, LV2), public financial support for the processing and marketing activities of small food businesses (ESP1), strengthening local and short food chains with a focus on agro-food biodiversity, ecosystems, and food ethics (IT2). Another focus of the SPI is "legitimization" of small farms in public policies. This is pursued through tailoring public policies, i.e. key rural and regional planning documents, regulations and support measures with targeted measures to better address small farms' situations, needs and contribution to reaching policy objectives. This key goal demands acknowledging small farms as a target group, outlining their specificity including needs in the context of agro-food policies, and designing appropriate support. For instance, SPI for the Greek Rural development program developed bespoke measures for small farms and small businesses, such as support for investments in farm infrastructure, notably in both smart farming technologies, and for learning and networking. It is expected that these measures will improve small farms' productivity and sustainability and their adaptive capacity to climate change. We can observe differences between various policy levels in addressing these two themes. SPI at local level address small farms' market integration, and national and EU-level SPI more often takes a broader approach with better-tailored policies and support measures for small farms.

4.2. SPI in operation: interactions in multi-actor boundary networks

The type of SPI, i.e., Expert advice, Networking platform or Collaborative governance, is linked to the composition of SPI, stakeholder roles, and the structure of their interactions. While we focus on science-policy interactions, in most of the cases studied these interactions are embedded in broader multi-actor networks that involve a range of other stakeholders, including, farmers and their representatives, food businesses, trusts, advisors, NGOs and others. Each of these actors potentially can take the initiative of establishing and managing spaces for interactions with policy makers.

The 'Expert advice' types of SPI in the sample were exclusively initiated by policy-makers (Table 4). These SPI were also bilateral between policy-makers and researchers, and can be classified under the boundary arrangements where the stakeholder (policy makers) steers, or selectively uses research, and actively seeks research advice. They were interactions in which researchers engaged in response to concrete and targeted policy processes (e.g. the design or implementation of measures under the Rural Development Programs). These are the most asynchronous relationships, as the agenda and the process are predominantly controlled by the policy-makers. The researchers' role is limited to providing scientific expertise reactively.

Networking platforms and Collaborative governance building were

Table 4
Boundary work at 'Expert advice' type of SPI.

Case	Expert advice		
	Initiator	Composition	Boundary arrangement
GR1	Policy	Bilateral	Stakeholder steers research
LV2	Policy	Bilateral	Advisory relationship; Selective use of research
ESP1	Policy	Bilateral	Stakeholder steers research
PL3	Policy	Bilateral	Advisory relationship

more internally diverse (see Table 5 and Table 6), however, there are some emerging trends. These two types of SPI cases were always multilateral, i.e. with different stakeholders among the participants. While different stakeholders were among the initiators of Networking platforms, this was a typical SPI that researchers launched. This reflects the fact that researchers tend to look for more inclusive models of interaction and that, multi-stakeholder dialogue, in turn, is appealing to policy-makers. However, this does not mean that "research steers stakeholders" in Schut's et al. (2013) terms. Although researchers had their agendas in SPI and they proposed their vision and solutions, none of the cases appeared to show researchers actively seeking to persuade stakeholders to select a specific solution for the problem or a certain way of organizing the policy process. The boundary arrangements between stakeholders were diverse in Networking platform and ranged from less engaging informative relation to mutual capacity building.

Furthermore, while the SPI cases of Collaborative governance were initiated by different actors, characteristically it was the type where non-research and non-policy stakeholders had generally taken the initial lead. Moreover, according to our cases, these stakeholders seem to resort to researchers for very targeted and concrete policy measures, and not to set strategic policy direction. Networking platform and Collaborative governance types of SPI tend to be more balanced in terms of participants' control over the process, and more ambitious in scope as they also involve exchange, co-learning or capacity building relationships. In other words, they lead to more creative processes that can potentially produce more enduring long-term impact for both researchers and other stakeholders. Researchers' roles were more diversified in these two types of SPI and, in particular when stakeholders were engaged in co-learning, exchange and capacity building relationships. In these boundary arrangements, besides providing their scientific expertise, researchers were also facilitators, brokers and participants in joint learning and co-creation.

It should be also noted that these actor configurations most often represent time-limited interactions of limited formality. Most of the SPI cases were created for specific purposes with a prescribed duration, and there were few experiences of perpetual SPI focused on small farms. They often operate without formal rules, structure, and functions, and depend on stakeholders' self-mobilization in the process. The informal character of interactions characterizes policy process within forums where negotiations happen in both formal and informal formats. The only exceptions, i.e. the cases with long-term and more formal structures, were Conferences of the European Research Centre of Small Agricultural Holdings and the Cross-party group on crofting at the Scottish Parliament. In both cases there are strong formal organizations managing the SPI.

4.3. SPI outcomes: what are SPI impact zones?

What are the outcomes of these initiatives? All the analyzed SPI considered uptake or better addressing small farms' needs and roles in

Table 5
Boundary work at 'Networking platform' type of SPI.

Case	Networking platform		
	Initiator	Composition	Boundary arrangement
EU1	Research	Multilateral	Co-learning, Capacity building
	Research	Multilateral	Informative, Exchange relationship
GR2	Research	Multilateral	Co-learning, Capacity building relationship
LV1	Stakeholders/ Researchers	Multilateral	Exchange, Co-learning relationship
UK1	Policy	Multilateral	Informative, Advisory, Exchange relationship
PL2	Research	Multilateral	Informative, Exchange relationship

Table 6

Boundary work at ‘Collaborative governance’ type of SPI.

Case	Collaborative governance		
	Initiator	Composition	Boundary arrangement
PT1	Research	Multilateral	Exchange, Co-learning, Capacity building relationship
PT2	Stakeholders	Multilateral	Capacity building relationship
IT1	Policy	Multilateral	Capacity building relationship
IT2	Stakeholders	Multilateral	Exchange, Co-learning, Capacity building relationship
IT3	Stakeholders	Multilateral	Advisory, Exchange, Capacity building relationship

food systems in respective policy domains. In most of the cases analyzed it is premature to judge their impacts on small farms, as some SPI activities have recently taken place, and other are still ongoing. An exception is the Km0 Alentejo initiative (PT1) where specific outcomes in terms of small farms connection to the market, enhanced sales of their products and diversification of income have been reached. However, these impacts currently only concern a small number of farms, and an assessment of more long-term, widespread effects needs more time. Therefore, we discuss SPI outcomes principally in relation to the policy process itself, and we can distinguish three types of outcomes – policy, societal and research – in this regard.

Most of the SPI cases have produced a concrete policy output. This policy output is linked to the purposes of the SPI, i.e., expert advice, networking platform or fostering new governance arrangements. In those cases, where researchers have received a clearly defined commission to provide their expert advice in the policy process (Table 4), they have accomplished their task. SPI cases as networking platforms in open discussion formats have proposed solutions targeting small farms for integration in policy planning documents, including rural development strategies and public procurement regulations. Their uptake is still left open. SPI focusing on collaborative governance have been negotiating and in one case (PT1) also implementing new policy tools that envisage collaborative approaches to address the identified policy issues.

An added value outcome, in particular in multi-actor SPI, is enhanced social capital through improved links, networking and cooperation among stakeholders. The participating researchers have observed that new links and networks were established and consolidated, and more interactions and communication, “stronger and more dynamic cooperation among institutions” (Polish stakeholders’ network) and increasing trust among stakeholders were evidenced. Such social capital development can be transformed into political capital and empowerment in terms of extended, collaborative policy networks and increased capacity to work together to take decisions and design future policy. The SPI for LEADER in Valencia has increased policy-makers’ trust in the potential contribution of researchers to concrete and delimited policy needs, not only to make general diagnoses or in framing problems. Networking among different organizations and individuals helps to form an advocacy coalition for deliberation of the place and role of small farms in future agriculture and food policies. For instance, the SALSA CoP in Portugal that developed the 0 km Alentejo initiative has helped to enable links between researchers and farmers and has built collaborative capacity to influence decision-making in policy terms at a national level.

In all the cases, networking and collaboration in SPI generated cross-sectoral information flows and/or knowledge exchange and has improved participants’ knowledge on small farms. Researchers estimated that SPI participants’ understanding, and knowledge has improved regarding small farms’ situations and their contribution to agricultural and rural development and FNS, as well as regarding specific policy tools. Improved knowledge was specifically reported from those SPI cases where open format and multi-stakeholder discussions were organized. For instance, participants in discussions on small farms

in Latvia appreciated the multi-actor, discursive environment and the opportunity for experiential learning. One of the participating farmer organizations in such a discussion acknowledged that SALSA evidence will be helpful in future negotiation processes with decision-makers.

Finally, SPI experience has empowered participating researchers in terms of self-satisfaction, new skills, and networks. SALSA researchers have developed their participation and facilitation skills in multi-actor policy processes and collaborative networks have been extended and consolidated in the policy domain, enhancing capacity for future collaborations.

5. Discussion

The analyzed cases show that SPI that bring small farms’ problematics into the policy process are diverse: they are linked to different policy domains, levels and measures. This points to the diversity of policy tools that can be used to address small farms’ needs and realise their potential. The diversity of policy domains confirms the relevance of small farms not only in agriculture, but in the broader context of food systems governance (Galli et al., *this issue*, Rivera-Mendez et al., *this issue*), and rural and regional development (Shucksmith and Rønningen, 2011; Davidova and Bailey, 2014). On the other hand, there are few existing policy tools and SPI that explicitly address small farms, and most of such SPI in the sample were initiated by SALSA researchers. This indicates that the political weight and representativeness of small farms remains limited, despite the increasing awareness of the value small farms bring to the rural economy, communities and food systems, and the increasing recognition of their need for targeted support (Toma et al., *this issue*).

The proposed conceptualization of SPI as boundary networks reveals SPI as dynamic, open and flexible entities that mobilize stakeholders in the policy process in both short- and medium-term targeted missions and on an informal basis. Indeed, most of the analyzed SPI were informal network configurations. Small farms’ relatively poor organization or involvement in collective organizations (Tisenkopfs et al., 2011) which can serve as a channel to influence policy-making (in comparison with larger farms) are likely contribute to this informality. On the other hand, it is common that policy process involves numerous informal interactions and negotiations. However, while informal networks can be easier to mobilize, their drawback is their limited stability that undermines long-term goal attainment (Follesdal et al., 2004). Formalization of dedicated or inclusive SPI can improve representation and participation of underrepresented stakeholders, like small farms, in the policy process.

Most of the analyzed researchers–policy-makers’ interactions were embedded in multi-actor policy environment and consideration of this multi-actor context allows more comprehensive understanding of the researchers’ role in the policy process (Schut et al., 2013). Besides supplying their inputs based on their research expertise, researchers also acted as facilitators of multi-actor interactions whereby they raised awareness of small farming challenges amongst a broader set of actors involved in the policy process. Researchers’ involvement in these interactions may demand new roles and skills, such as science communication, co-design, group facilitation, and mediation of multi-actor interactions. As shown, the latter is of particular importance in multi-actor participatory policy process where many stakeholders and many types of knowledge are exchanged and integrated (van den Hove, 2007; Wynne, 1996). Although the multi-actor approach is increasingly practiced and is recognized as enriching in the European context, for many stakeholders working in multi-actor environment is a new experience. Researcher’s facilitation in such SPI is crucial to assure the effective participation of different stakeholders. Creating space for interactions, aligning motivations, and building trust is critical in stakeholder engagement, and to this end it is essential that one actor can serve as a go-between for actors that wouldn’t otherwise interact (Schoonover et al., 2019). Therefore, the SPI examples presented have generated not

only policy outputs, but also strengthened stakeholders' capacity to participate in the policy process and reinforced science-policy (-society) networks for better-informed policies. Recognition and understanding of such "subtle" impacts, beyond policy outputs, is crucial to improve effectiveness of science-policy interactions (Posner and Cvitanovic, 2019).

These policy and societal outcomes were markedly different among the three identified types of SPI, i.e., Expert advice, Networking platform and Collaborative governance. Each of the types tends to enable different kinds of relationships between stakeholders, and in turn has major implications for its performativity (Gustafsson and Lidskog, 2018). While the 'Expert advice' type of SPI is effective in providing targeted specified inputs to policies, Networking platform and especially Collaborative governance as a typical multi-actor SPI, can lead to enhanced social capital and collaborative capacity building among the stakeholders that can strengthen their participation in the policy process in long-term.

6. Conclusions

In this paper we have analyzed SPI related to small farms conditions, which is a poorly explored field in SPI studies. We conceptualized them as boundary networks that operate at the intersection of research and policy domains and that are often embedded in multi-actor environments. The SPI can address small farms' situation and needs at different policy domains and levels, with a range of existing policy tools and they can be situated in the policy process in multiple ways, i.e., through provision of expert advice, networking platform, and fostering collaborative governance. SALSA researchers' interactions with policy makers have brought about a range of policy outcomes, increased social capital and political empowerment for the participants involved, and their improved knowledge on small farms. In the analyzed SPI cases, SALSA

researchers have contributed with their evidence and skills to shape more inclusive agricultural and food policy process and to develop policy measures that better address small farms' needs and contribution to FNS.

This research shows the process and outcomes of SPI related to small farms as they are perceived by the researchers involved. Additional understanding leading to better management of SPI for small farms, could be furthered through a follow-up study of other influential stakeholders including policy-makers, farm advisors and large farms. Longer-term research with monitoring and evaluation elements (Posner and Cvitanovic, 2019) is needed to estimate effectiveness of SPI and the policies they contribute to, in particular in terms of their practical implications on small farms.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Annex A. Overview of SPI cases

Case of SPI	Description	Relevance for small farms	Relevant policy context
LEADER local action groups, Valencia Region, Spain (ESP1)	A consultative group made of university professors supported the regional government in the selection process of candidates to become Local Action Groups under the LEADER program 2014–2020.	LEADER in the Region of Valencia is supporting small food processors (activities of processing or marketing) located in rural areas). These small food businesses can also be small farms.	Implementation of LEADER and the way it supports small food businesses in rural areas
Rural district, province of Pisa, Tuscany region, Italy (IT1)	Multi-stakeholder workshops to support the process of recognition of the "Rural district" in the province of Pisa. Rural districts are established through an agreement between public and private actors, and once they are formally recognized, they set up a governance and operational plan.	The Rural District provides an opportunity for small farms to become more visible, and exploit synergies with other actors, with potential to enhance their multi-functionality.	Rural districts is a regional policy tool aimed to support innovative initiatives for improving territorial, environmental and landscape quality of the rural area.
The community for food and agro-biodiversity of Garfagnana, Tuscany region, Italy (IT2)	The community aims at improving local food system with attention to agro-food biodiversity and ecosystems. It supports production, selling and consumption practices that address the issues of food security, food ethics and food sovereignty.	A meeting was dedicated to the role of small farmers within the food system and the environment of Garfagnana. Small farmers are among the participating stakeholders at the SPI.	The project is financed under the Rural Development Program of the Tuscany Region (measure 10.2).
MENSA consortium for school meal procurement, province of Pisa, Tuscany region, Italy (IT3)	The consortium aims to strengthen short supply chains in the Pisa plain, focusing on promotion of consumption of local products in school meals.	The consortium develops innovative models of local supply to support small and medium local producers to link directly to catering companies. Small farmers are among the participating stakeholders at the SPI.	The project is linked to the sub-measure 16.4 of the Rural Development Program 2014–2020 of the Tuscany Region (cooperation measure).
Conferences of European Research Centre of Small Agricultural Holdings, Poland (PL1)	Yearly conferences of the Centre represent multi-actor discussion forum of small farms' situation. Follow-up communication targets policy makers and contains conference summaries and propositions to agricultural policy.	Small farms, their problems, opportunities and solutions are the central focus of the conferences.	The conference provides inputs to EU and Polish rural and agricultural policies.
Networking of Polish stakeholders, Poland (PL2)	SALSA Eastern European workshop launched networking among Polish stakeholders involved in rural policy making.	Networking is aimed at information and knowledge exchange and discussion of small farms' situation and needs.	Networking is providing inputs to Polish rural and agricultural policies.

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Case of SPI	Description	Relevance for small farms	Relevant policy context
Development Strategy of the Malopolska region, Poland (PL3)	A team from the University of Agriculture in Krakow prepares the Development Strategy of the Malopolska region 2021–2030 with a particular emphasis on the Regional innovation strategy.	Support for small farms has been included in the proposition as a crucial element of agricultural development in the Malopolska region	The development strategy is a key planning document of the Malopolska region until 2030.
0 km Alentejo, Portugal (PT1)	SALSA Community of practice in Alentejo has developed the 0 km Alentejo food concept and requirements for labelling to support small family farms and short food supply chains. The Km0 Alentejo initiative has been set in place in local restaurants and canteens.	0 km initiative has set in place practical initiatives to support small family farms and short food supply chains.	Following discussions on 0 km initiative, the CoP proposed support measures and regulation to small family farms to be addressed by local and national policies.
Result Based Agro-Environmental Payments for silvo-pastoral systems, Alentejo region, Portugal (PT2)	Researchers together with farmers and technical staff of the administration co-constructed a scheme of Result Based agri-environmental payments to be applied as a pilot to a Natura 2000 site in the silvo-pastoral system Montado.	The scheme provides better acknowledgment and also financial support to small-scale farmers for the benefits they provide in terms of farm biodiversity, landscape identity and cultural values.	The scheme is to be applied under the national Rural Development Program in the programming period 2021–2027 of EU Common Agricultural Policy (CAP).
Cross-party group on crofting, Scotland, the UK (UK1)	The cross-party group discusses and brings to the attention of members of the Scottish Parliament items of policy that affect crofting.	The cross-party group is exclusively organized to further the interests of small farms operating as crofts through policy development.	The cross-party group is linked to Scottish and EU rural and agricultural policies
Discussion rounds of the National agricultural development policy for small farms, Latvia (LV1)	Discussions with key stakeholders, including small farmers' representatives, decision-makers, advisors and researchers, evoked small farms' situation and proposed recommendations to better address their needs in agricultural policy in Latvia in the next programming period 2021–2027.	Small farms' situation and needs, and better tailored public support measures were the central focus of the discussions.	The discussions were aimed to contribute to the formulation of national agricultural policy in the next programming period 2021–2027.
School food procurement, Latvia (LV2)	Discussions between the Ministry of Agriculture and researchers about improving the national green public procurement regulation, with a particular attention on schools' meals.	One of the issues discussed was the eventual changes in public procurement regulation to make school food procurement tenders better tailored to local small farms.	Discussions provided inputs to the National public procurement regulation.
Advisory group for the measure on small farms and small food businesses, Greece (GR1)	The advisory group consisting of researchers from the Agricultural University of Athens supported the planning and policy implementation process of a new sub-measure for the development of small farms and small food businesses of Rural Development programme.	The new measure is aimed to support the development of small farms.	The activity addresses planning and policy implementation process of a sub-measure 6.3 of Rural Development programme 2014–2020.
SALSA CoP for the National Agricultural Development Strategy, Greece (GR2)	SALSA community of practice in Greece created a multi-stakeholder forum aimed to support information sharing and joint learning, and to raise awareness and support the elaboration of policy recommendations regarding more enabling conditions for small farms and food businesses.	Small farms and enabling them policy measures are at the central focus of the community.	The launched discussions with stakeholders aim to contribute to the overall design and specification of the National Agricultural Development Strategy (2021–2030).
SALSA macro-regional workshops (EU1)	SALSA organized discussions in multi-actor environment on small farms' needs and policy tools and other support mechanisms for maintaining and enhancing the contribution of small farms to sustainable FNS.	The workshops called for the maintenance of pro-small farmer policies in the implementation of the CAP and the national strategic plans.	The relevant policies include CAP 2021–2027, EU-Africa High Level Policy Dialogue on Science, Technology and Innovation focused specifically on Food and Nutrition Security and Sustainable Agriculture, and post-Brexit policies on FNS.

Annex B.

The questions addressed in SALSA questionnaire on science-policy interface for small farms

1. What is the example of SPI?
2. What is its purpose? How it is linked to policy process?
3. Who is involved?
4. How do interactions happen? What activities they involve?
5. How do researchers contribute?
6. Are there some observable or expected outcomes? (F.i., policy outcomes, SPI (group dynamics, capital of trust), researchers' self-development or other)

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