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Published online: 31 Jan 2021.

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A practice perspective on knowledge, learning and innovation – insights from an EU network of small food producers

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ABSTRACT

Drawing on insider research with a three-year EU network created to support innovation in geographically marginalized traditional food companies, this paper makes three contributions to discussions of innovation in small and micro-firms. First, we shift focus away from conceiving of knowledge as a discrete entity, and of knowledge sharing, transfer and exchange as the passing of objects. Applying a practice perspective that conceptualizes innovation as situated in the everyday activities of organizing, learning and working, we extend open innovation ideas and identify three distinct sets of knowledge-creating practices that small and micro-firm actors in this network context engage in as they interact: seek-and-take, peer exploration and critical reflection. Second, we integrate these practices into a model that suggests how different kinds of knowledge boundary (entitative, epistemic, pragmatic and existential) are differently traversed by these practices, with more complex boundaries benefitting from a practice approach. Third, we refine a practical approach for policy interventions designed to stimulate small and micro-firm innovation. The relevance of our contribution lies in the significance of small firms within peripheral economies, and the particular challenges they face in accessing new knowledge for innovation.

Introduction

Small[1] and micro-firms[2] are known to depend on interaction with others for the sources of new knowledge that become their innovations rather than being the product of internal research and development (Batterink et al. 2010; Leyden, Link, and Siegel 2014; Jones, Macpherson, and Thorpe 2010; Montanari, Scapolan, and Gianecchini 2016). For micro-firms, with even more profound restrictions on time, resources and capabilities, systematic innovation is rare (Reinl et al. 2015). Further, evidence from family firms (most of which are also small and micro) (Ahluwalia, Raj, and Walsh 2017) suggests they particularly benefit from networking for acquiring new knowledge (Feranitaa, Kotlara, and De Massis 2017; Röd 2016). However, policy initiatives promoting networking and knowledge exchange between such firms and others have often failed to achieve the level of knowledge transfer and innovation expected (Pittaway et al. 2004; Vanhaverbeke 2017).

Innovation support interventions by regional and national governments or supranational bodies such as the EU, are often underlain by the theory of why a particular action might be expected to work. As theory-in-use (Schön 1983) this may well be implicit rather than explicit, making it all the more important for those who design interventions to be clear of 'what works for whom and in what

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circumstances' (Pawson, Greenhalgh, and Harvey 2005, 22). Although it is known that innovation in SMEs is reliant on collaboration with others to source new knowledge, there remain two important gaps in the literature. First, when this talks of 'knowledge transfer' (Casprini et al. 2017) 'sharing' and 'continuous exchange' (Feranitaa, Kotlara, and De Massis 2017), or 'input-activity-output' (Röd 2016), the activities remain a black box, where we know little of the actual practices that SME actors[3] engage in that produce sharing, exchange or transfer of knowledge for innovation. Second, whilst knowledge boundaries are mainstream in innovation studies, in the sense that the majority of innovations occur on the borders between disciplines or specializations (Leonard-Barton 1995), in the context of small and micro-firms in peripheral regions there is more to understand about the nature of these boundaries, the ways SME actors encounter them and the practices that dissolve them (Belussi, Sammarra, and Sedita 2010; Leyden, Link, and Siegel 2014).

In this paper, we apply a practice-based theoretical perspective to explore the question of how geographically marginalized micro-firms develop new knowledge for innovation in a networking context, where a network is defined as 'a firm's set of relationships with other organizations' (Perez and Sanchez 2002, 261). Drawing on Röd (2016) we use the term innovation to encompass generation or adoption of novelty across the full range of a firm's products and operational processes, and we understand innovation to encompass radically new or incremental improvements through the adoption of a well-established idea or technique. A practice perspective conceptualizes innovation as situated in the everyday activities of organizing, learning and working (Gherardi 2012). In other words, knowing, doing and innovating are entangled. This shifts away from what we term entitative thinking, where knowing is seen as the possession of objects abstracted from context or relations, and learning is conceived as the transmission of these from a source to a recipient. A practice perspective enables us to focus in this paper on the question of what micro-practices individuals engage in as they learn, confront knowledge boundaries, share knowledge, and innovate. We draw from empirical material collected as insider participants of a three-year knowledge and technology transfer network designed to stimulate innovation in traditional food companies located in peripheral regions of eight EU countries. We analyse interventions within the project through the lens of a practice perspective and make contrasts with approaches that treat knowledge as an object.

We make three contributions to the field of micro-firm innovation. First, we shift focus away from conceiving of knowledge as a discrete entity and knowledge sharing, transfer and exchange as the passing of objects. Rather, we use a practice perspective to supplement open innovation ideas and identify three sets of distinct knowledge-creating practices that small and micro-firm actors in this network context engage in as they interact: seek-and-take, peer exploration and critical reflection. Second, we integrate these practices into a model that shows how different kinds of knowledge boundary are differently enabled by these learning practices. We categorize these boundaries as entitative, epistemic, pragmatic and existential. We show that to traverse or dissolve more complex knowledge boundaries requires initiatives which go beyond seeing knowledge simply as a transfer of discrete pieces of information. Third, we refine a practical approach for policy interventions designed by regional, national or supranational governments (such as the EU) to stimulate small and micro-firm innovation, informed by an understanding of knowledge, learning and innovation as practice. The relevance of our contribution lies in the significance of small firms for peripheral economies (Leyden, Link, and Siegel 2014) and the particular challenges they face in accessing new knowledge for innovation as a consequence of their limited size and resources for research and development (R&D), coupled with their distance from dense conurbations which offer easier interaction with potential stimulators of new knowledge (Galbraith et al. 2017).

The remainder of the paper is structured as follows: The next section reviews the treatment of knowledge and innovation in SME innovation conversations. We present a rationale for why a practice approach to learning can add to our understanding of how small and micro-firms develop new knowledge through inter-organizational interactions. This rationale leads to our research questions. The ensuing section introduces our research context and describes how we generated, collected and analysed data. In discussing the findings, we move between the lenses of knowledge

as object transmitted and learning as practice to review different interventions across the project. Our purpose is to illuminate the implicit theory of knowledge, learning and innovation within each intervention and to identify the strengths and limitations of each for provoking different kinds of new knowledge. In concluding we present a model of knowledge boundaries with three distinct collaborative learning practices engaged in by SME actors. Finally, we draw conclusions and implications for policy and further research.

Framing: knowing, learning and knowledge boundaries in SMEs

Our intention in this section is to contrast how knowledge, learning and innovation have been linked in the open innovation literature compared to a practice perspective. We do this by deconstructing the language of knowledge and learning and their relationship to innovation in the literature. We then proceed to consider how knowledge boundaries have been conceptualized and to identify limitations which a practice perspective can help address. The literature on learning and innovation in SMEs is dominated by studies on small and medium-sized firms, even though 90% of the SMEs in Europe are micro (Achtenhagen, Ekberg, and Melander 2017). However, there is scant literature that differentiates the experience of micro-firms compared to that of small or medium firms (van Oostrom and Fernández-Esquinas 2017). Where there is, they draw differing conclusions, with some researchers arguing that 'micro-firms are fundamentally different from other firms' in their methods for development (Achtenhagen, Ekberg, and Melander 2017, 169) and others concluding that, in their approach to innovation, micro-firms are not particularly different (Baumanna and Kritikos 2016). Given the paucity of literature that explicitly explores innovation and learning in micro-firms, in this paper we draw from SME-wide literature as if it applies to micro-firms unless distinctions were made in the originals. We also consulted the family firm literature, given that such firms are frequently micro and experience similar constraints on innovation. However, as far as we could ascertain, this literature tends to make the firm the unit of analysis when talking of innovation, rather than the micro-practices of actors.

Definitions of innovation vary from the simple: 'adoption of a new idea or behavior by a firm' (Ahluwalia, Raj, and Walsh 2017, 39) to the more complex: 'generating and adopting new or improved products, services, processes, policies, structures, or administrative systems' (Röd 2016, 186). The term is broad, encompassing radical and incremental novelty, but it is implicit that innovation requires new knowledge (Gherardi 2012). However, the inter-relationship between knowledge and innovation is conceived of differently in the open innovation and the practice literature. The former is dominated by mechanisms such as 'knowledge transfer' (Casprini et al. 2017) 'sharing', 'continuous exchange' (Feranitaa, Kotlara, and De Massis 2017) and 'purposive inflows and outflows of knowledge to accelerate internal innovation' (Chesbrough 2006, 1). Implicitly this language conceptualizes knowledge as an object that is moved or transmitted from one place or person to another: to know is to hold the object, and to learn is to acquire it. There is an implied assumption of a linear relationship between the acquisition of new knowledge and its application to produce a resultant innovation. From a practice perspective, this terminology and its underlying theory-in-use are unsatisfactory because it conveys little understanding of the processes or micro-practices that actors engage in.

A practice perspective on learning

A practice perspective on learning alerts us to knowledge as something created through social interaction and in the course of wrestling with troublesome practical challenges or opportunities (Swan et al. 2007). It illuminates process dimensions of learning, that is, the kinds of interaction, dialogue and activity that produces new knowledge (Cope 2005; Pittaway and Thorpe 2012; Yakhlef 2010). Rather than conceiving of knowledge sharing simplistically as the transfer of pieces of knowledge, learning is understood to be multi-dimensional, dialogic and incorporating body and

emotion as well as potential identity shifts (Pyrko, Dörfler, and Eden 2017; Sturdy et al. 2006). Sources of new knowledge are not necessarily a supply of external expertise but may emerge from the SME actor's reflection, dissonance, or emotive experiences of failure or disappointment (Cope 2005; Pittaway and Thorpe 2012). A practice approach to SME learning recognizes that knowledge is socially constructed from the action. Knowledge emerges through interaction and dialogue with others as people work on issues of concern to them, and critically reflect on their assumptions, the dynamics of their situation, and their identities (Jones, Macpherson, and Thorpe 2010; Pyrko, Dörfler, and Eden 2017). Consequently, knowledge is localized and contextual (Swan et al. 2007); it is actionable knowledge that makes sense for the particular situation.

Understanding of learning as social practice has been significantly advanced by the community of practice (CoP) literature (Yakhlef 2010; Lave and Wenger 1991). As Brandi and Elkjaer (2011, 21) put it, social learning theory 'changes the locus of the learning process from that of the mind of individuals to the participating processes of individual members'. A significant distinction between a practice perspective on learning and open innovation is their contrasting conceptions of knowledge. As discussed above, the latter has been dominated by an entitative understanding of knowledge as something codified and concrete waiting to be found by an entrepreneur (Macpherson and Holt 2007). In contrast, with a practice perspective, knowledge is not an object or entity and does not exist independently of social relations and contextual practice (Swan et al. 2007). It is '*localized, embedded*, and *invested* in practice' (Carlile (2002:442, italics in original)). From this vantage point, a knowledge boundary may be epistemic (Berends et al. 2011) in the sense of a barrier to understanding between unfamiliar domains of practice, but social learning theory also presents knowledge as pragmatic, in the sense of being an answer to a problem or 'instruments for action' (Brandi and Elkjaer 2011, 32).

A practice approach conceptualizes innovation as situated in the everyday activities of organizing, learning and working (Gherardi 2012) and core terminology to describe knowledge is 'constructed in action', 'dialogic', localized', 'actionable'. This distinction has important implications for understanding the micro-processes of knowledge creation. Pyrko, Dörfler, and Eden (2017) offer a distinction between 'knowledge' as the potential to act and 'knowing' as the use of what one knows in practice. This contrast is useful for thinking about 'knowledge sharing' as a process in which knowledge is created through intense mutual engagement. A practice perspective also illuminates how learning is concerned not only with developing ways of knowing in practice but also with understanding who we are and what potential we have (Lave 2008). This sense of learning-as-becoming (Chia 2003) highlights how the process of forming and making use of new knowledge may also involve identity work, whereby actors transform their 'personal constructions or narratives' (Sveningsson and Alvesson 2003, 1165). Existential and emotional costs are often integral to the process (Sturdy et al. 2006). Participation in practice implies 'both issues of knowing and issues of 'being and becoming' (Brandi and Elkjaer 2011, 24) during which identities are changed (Roan and Rooney 2006). Learning through participation in communities of practice can, therefore, be considered as the development of both identities and practice (Handley et al., 2007). Applied to network settings, a practice perspective invites exploration of the kinds of practices that SME actors and others engage in with each other and at knowledge boundaries, which the next section discusses.

Knowledge boundaries and knowledge creation practices

We have argued that doing, knowing, learning and innovation are interwoven. Nevertheless, the notions of a boundary (Sturdy et al. 2009), and boundary fluidity (Gherardi 2012) are fundamental to a practice-informed understanding of innovation as an ongoing process within an organizational field. This begs questions of what kinds of knowledge boundaries exist and what kinds of practice most effectively traverse them to enable learning or knowledge creation.

From the discussion above, an entitative perspective on knowledge implies that the boundary to learning or knowledge acquisition is a simple gap in possession of knowledge that could be filled by transfer from a sender to a receiver. Alternatively, a practice perspective opens up

the possibility that a knowledge boundary may be epistemic (Berends et al. 2011) in the sense of a barrier to understanding between unfamiliar domains of practice. If knowledge is pragmatic, in the sense of being an answer to a problem or an instrument for action (Brandi and Elkjaer 2011), there may also be a pragmatic knowledge boundary in the sense that creation of new knowledge will require altering ways of doing things and disinvestment from habitual approaches. The SME literature has also recognized that individuals construct a sense of themselves in the course of running their business (Sturdy et al. 2006; Watson 2009) and a search for existential coherence leads them to seek connections between their internal self-identity and external social identity (Lewis 2013). This search can lead to strong boundaries that are not easily permeable to new knowledge as SME actors become particularly invested in their existing practices, caught in webs of belief (Tsoukas and Chia 2002) including dismissal of anything 'not invented here' (Casprini et al. 2017, 1462). From this literature and drawing on the philosophy of Karl Jaspers (Gordon 2000), we take the idea of an existential knowledge boundary.

The notion of boundary is, of course, central to open innovation, with a range of conceptual tools including broker (Leyden, Link, and Siegel 2014), boundary spanner (Ebers and Maurer 2014) and boundary object (Star and Griesemer 1989). In terms of kinds of knowledge boundary that actors confront, and how people come to know something, a variety of typologies are presented to describe the nature and the kinds of practice that enable them to be crossed or dissolved. Carlile (2002, 2004), describing boundary working across CoPs, identifies three progressively complex kinds of knowledge boundary: syntactic, semantic and pragmatic, and three forms of 'knowledge-accomplishing activities' (Kuhn and Jackson 2008, 457) that enable knowledge-sharing across these boundaries: information transfer, translation/interpretation and transformation/negotiation. Waeraas and Nielsen (2016) use slightly different language and differentiate between transmission – the simple transfer of a piece of information from one source to another – and translation – meaning a process whereby 'group members translate the identified knowledge into a vernacular that speaks to their own context' (Waeraas and Nielsen 2016, 245).

These typologies are useful for identifying different kinds of knowledge boundary, and different conceptions of knowledge in the process of transmission or transfer (where knowledge is conceived as an entity to be moved unchanged) compared to translation (which conceives of knowledge as contextual and constructed). However, for our purposes, there is still a need to elucidate the micro-practices that actors engage in that underlie transfer, translation or negotiation. Siedlok, Hibbert, and Sillince (2015), from their study of participants learning to work together in an interdisciplinary research project, identified three sets of practice that helped cultivate a collaborative community: individual practices of enquiry, practices of engagement, and practices of enactment. A second paper from the same study (Hibbert, Siedlok, and Beech 2016) speaks more directly of learning practices that help collaborative engagement across disciplinary boundaries: exploring limitations, developing connections and developing shared interpretive horizons. While we have drawn inspiration from these ideas of learning practices, neither was a framework that we could directly apply to our study because of the difference in context. The focus of their analyses is on practices that help partners develop shared understandings. As we elaborate below, the collaborative project we discuss in this paper was an internationally dispersed network of dynamic and intersecting interactions between multiple actors, who individually or in sub-groups had desired outcomes, but who did not have to share a common objective or reach a common understanding. This network itself can be seen as a CoP – a cluster of multiple and other intersecting CoPs. Two recognized limitations of CoP literature are first, that it sheds little light on how individual members learn or innovate from their engagement (Fox 2000), and second, as Yakhlef (2010:39) puts it, how it addresses 'explicitly the role of individuals in the knowing process'. For our purposes, a limitation of CoP is that its emphasis is on what people are doing as they mutually engage together (Lave 2008). In this respect, Siedlok, Hibbert, and Sillince (2015) examine community-building and practices that support such engagement. However, as we elucidate below, in our research context the focus was not on shared practice

development that binds actors together. We, therefore, find Yakhlef's (2010) notion of individuals-in-interactions more useful for clarifying that our focus is on the knowledge-producing practices individuals engage in as they participate in a network.

Pulling the strands together – research questions

In this section, we have explored how knowledge, learning and innovation have been linked in the open innovation literature. We have considered how knowledge boundaries have been conceptualized and have shown how a practice perspective widens our understanding of learning beyond a simple gap that could be plugged with entitative knowledge, to recognize other potential boundaries that could be epistemic, pragmatic or existential. We recognize that these different kinds of knowledge intersect and that learning across each boundary may move between them. However, to help us analyse the micro-actions of SME actors that stimulate knowledge creation we are treating them as distinct. Our resultant research questions were:

- How can we understand the knowledge-creating practices that SME actors engage in as they interact with others in the network?
- How can we comprehend the nature of the knowledge boundaries they encounter?

Research context, methods and data

Research context

Our data come from a three-year European (EU) project (2013–2016) created to establish a network of small and medium enterprises (SMEs) involved in traditional food production. These were businesses in one of the three sectors of bakery, meat, and dairy; predominantly micro-enterprises, typically with up to five people employed. The project aim was to improve product and process innovation in the SMEs, through creating face-to-face and on-line encounters between SMEs and sources of expertise such as scientists and technology providers. The network (visually represented in Figure 1) encompassed nine regions from eight EU countries: Finland, Germany, Ireland, Italy, Poland, Portugal, Spain and the UK. Network members included SMEs, food science and management researchers, business advisors, industry service and technology providers, research institutions, third-level education providers, industry representatives and trade organizations.

Membership of the project gave participants, including ourselves, access to activities and events such as regional and national workshops, conferences and international brokerage events (see Table 1), which throughout the project, were attended by 935 SMEs.

Within each country, activity was focused on a 'hub' in geographically and economically peripheral areas including remote mountains in the Sub-Carpathian province of Poland, Bragança in northeast Portugal, and Kerry in south-west Ireland. Spain had two hubs. A key actor at each hub was a network learning coach (NLC), whose role was to survey SMEs with an initial 'Needs and Barriers' appraisal, to organize national training workshops (for example, on food safety, packaging and marketing) and to facilitate interactions amongst SMEs both within their national centre and in other national centres. Several countries also hosted an international 'Brokerage Event'. Some of these were sectoral, for example, focused on bakery, dairy or meat, whilst others were thematic, for example, focused on sustainability or internationalization. Project funding enabled some SMEs to travel to other national hubs to participate in international events. The context for this study was, therefore, exceptionally complex compared to the situations typically described in the literature: not only was it multi-disciplinary and multi-sectoral, but it also involved collaborators from nine centres, eight countries, with seven different main languages. It was also distinctive in its focus on innovation in predominantly micro-firms from economically and geographically peripheral regions of Europe.
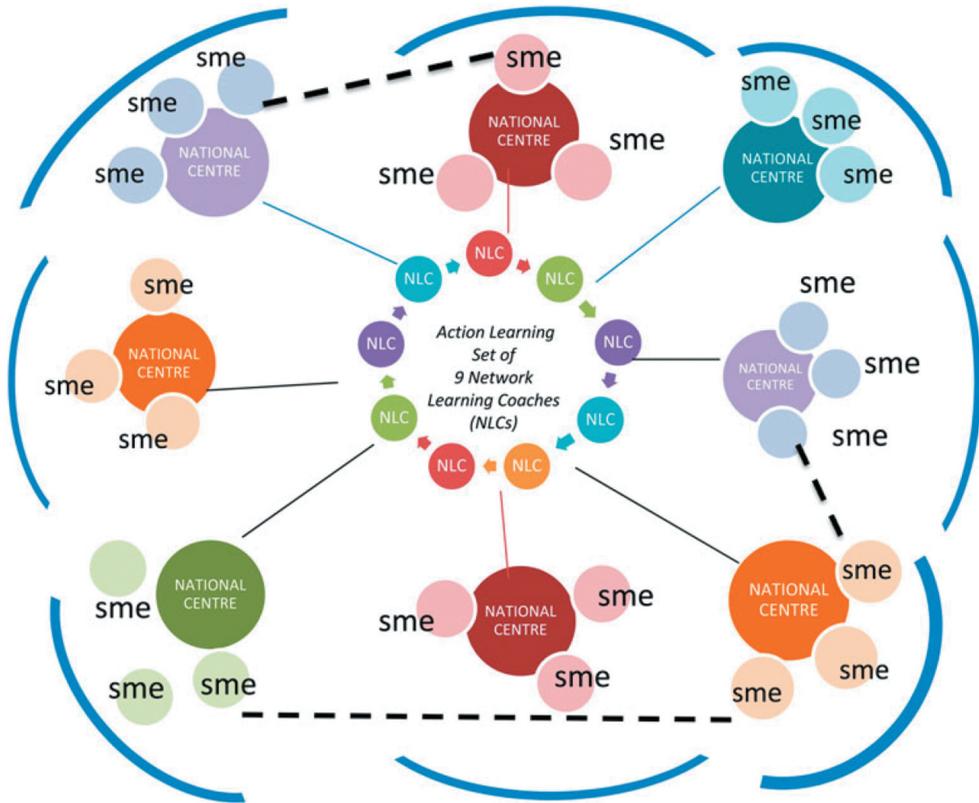
Figure 1. Network relationships between National Centres, NLCs, and between SMEs across national centres.

Table 1. Overview of project initiatives.

Intervention	Description
Needs and barriers survey	Survey to understand needs and barriers to technology transfer. 340 questionnaires and 20 workshops completed across all hub
Brokerage events	2/3 day thematic regional multi-stakeholder events targeting specific sectors (e.g. bakery) or themes (e.g. sustainability). 6 in total.
Training workshops	Short c2 hour sessions delivering training in each hub in themes including environmental management, labelling, food safety, intellectual property rights and supply chain management. Over 60 such events involving 866 SMEs
'Marketplace'	Open innovation online platform to broker offers and requests – food producers profile their technology/business needs and technology providers offer solutions.
'Missions'	Bringing people together with a common problem and relevant experts
'A Taste of Science'	Online magazine containing easy-to-read articles presenting new scientific knowledge and technological developments to food SMEs
Entrepreneurship training	Training in entrepreneurship and commercialization provided to food science researchers

We, the researchers/authors, acted as coordinators of the network action learning strategy across the whole project. Network action learning (Coughlan and Coghlan 2011) was integrated as a learning and coordinating mechanism at the three levels of the network: the project management board, between NLCs of each hub, and amongst the traditional food SMEs within each hub. This integration included designing action learning practices into training events with SMEs, as well as into the project management meetings. We also acted as action learning coaches for the NLCs, whilst they worked virtually as a group of peers.

Data gathering

The data we generated and gathered combined a mixture of ethnographic material, field notes, reflective conversations between ourselves, formal interviews, and documentation. Documents included interim and final progress reports for the overall project, a 'needs and barriers' survey of almost 1000 SMEs conducted by the project team, and a Strategic Research and Innovation report prepared for the whole project. Each formal meeting, event and action learning set (ALS) had a meeting note. In the final year of the project, we also collected data in the form of detailed case studies of 21 SMEs who had participated in the project. As project members participating in the full range of activities, we immersed ourselves in the field to capture the scope of interactions between project participants 'in the natural context of occurrence' (Adler and Adler, 1994, 378). We also kept an online research repository of observation notes.

Over three years, we spent a total of 32 days in the field, usually in pairs, attending all types of network interaction (training workshop, brokerage event, meetings, site visits, informal conversations). Our involvement began with the pre-planning bid stage of the project and spanned the interval from the initial kick-off meeting to the final event, including all the main whole project occasions as well as sub-meetings and local events. In our notes, we documented the material context of work, individual project events and activities, information shared, and observations of what we saw as well as network member quotes. In addition to observational notes, opportunistic conversations with network actors, formal evaluation meetings and materials and reflective conversations between ourselves, we conducted interviews of 20–30 minutes in the final year with the nine NLCs. By the standards of qualitative research, this constitutes a rich and extensive body of research material. Table 2 summarizes the data we have drawn from for this paper.

The empirical value of this setting is its complexity and the access afforded to a depth of situated material as insider researchers (Coghlan 2019). This access comes with a downside of potential selective recording as insiders. To mitigate this potential weakness, we adopted inter-rater coding and cross-referencing within the team (Miles, Huberman, and Saldana 2014).

Data analysis

Our approach to the analysis of the qualitative material shown in Table 2 was abductive (following Langley 1999 and Langley in Gehman et al., 2018). We were not seeking to test the theory by a large quantitative sample, rather we took the approach of presenting a conceptualized composition (Berends and Deken 2019) that uses concepts to label and discuss data, before the creation of an integrating model or framework. In this paper, we present data selected to illustrate our theorizing as the paper unfolds. Overall, the steps in our analysis were as follows. First, we applied thematic coding to the organized database. These descriptive codes were informed by our reading and were used to identify instances that related to our concerns. We employed inter-rater coding between two of the authors and through discussion came to an agreed understanding of definitions of these categories

Table 2. Project data.

Source	Details
Participant observation of events	12 project meetings of half-full day
	6 brokerage events of 2 days
	6 hub training events (2–3 hours)
	8 NLC action learning meetings (1–2 hours, online and face-to-face)
	24 Work Package team meetings (1–2 hours)
Interviews	9 interviews with network learning coaches (20–30 minute)
Documents	Final project report
	Strategic Research and Innovation Agenda report
	Taste of Science magazines
	21 SME case studies
Other material	29 meeting minutes

and refined the coding schema. Independently the two raters applied this schema to code the case study data. In the second step, we cross-checked coded data and discussed discrepancies with the other two authors. Through this process, we updated the coding schema until we achieved team consistency in our interpretations. Appendix 1 provides a sample coding analysis from steps 1 and 2. In the third step, we sought to develop a higher level coding structure to identify knowledge-creating practices associated with different project interventions and the kinds of knowledge boundary they assist. Finally, we drew together a framework to show this intersection.

Findings

In this section, we report findings related to our first question of how we can understand the knowledge creation practices that enable SME actors to traverse the boundaries they encounter. We identified three sets of practices: seek and take, peer exploration and critical reflection. Below we present illustrative quotes and other extracts from the data which are indicative of the patterns evident. All text that is indented is data from the project. If italicized, it is direct quotes. Where it is not italicized, it comes from project documentation, such as the final report or project case studies report. In this latter, each SME actor spoke of their experiences in their own language (there were seven project languages) and their story was written up in English by their NLC.

Seek and take

This set of practices involves actors deliberately looking for and finding a solution from someone or something that holds specialist knowledge. We identified five activities: information-seeking, observation and boundary objects plus two drawn from Siedlok et al., 2015: searching for connections and seeking opportunities. We discuss each in turn.

Information-seeking. SME actors used several of the project interventions explicitly to seek out specific information for well-defined needs which they had identified beforehand. For example, the project had an online platform ('Marketplace') intended as an exchange forum where a search for information by one SME could be matched with solution offerings by another which might be located in any one of the eight countries involved. Food producers were invited to upload a profile of their technology or business needs to the platform and 164 did so. Exchanges included, for example, questions about the latest health and safety legislation, and a search for packaging technology that would extend a product shelf-life. Illustrations of the way SMEs phrased their requests include:

> *'We are interested in knowing new dehydration technologies for meat products.'*

> *'We are interested in meeting with a supplier of absorbent paper for our facilities, which allows us to determine specific measures and a specific absorptive capacity.'*

In parallel, solution providers were invited to upload their profile of the technologies or business solutions which they could offer, and 476 did so. The following example illustrates how they presented such solution offerings:

> *'We are looking for agrofood* (sic) *companies which are interested in efficient resources management through new methodologies, models and wireless technologies*.'

An example of successful information-seeking through the online platform is illustrated by one participant, a high-value gourmet Irish ice-cream producer, who had wanted technology to enable him to internationalize distribution. He found a Polish company on the online Marketplace which specialized in RFID and temperature tracking. Their resulting collaboration addressed the problem of maintaining consistent temperature control across longer journeys and through varying atmospheric conditions. Subsequently, the ice-cream producer was able to begin to export with confidence:

'not only do we know what condition our ice cream is being kept in in real time, the companies handling the pallet know that if it is mis-treated, we will know right away.'

In another project intervention, the training workshops, our data show there were numerous instances where food producers gained specific information, as the quotes below illustrate:

[the project] *'has arranged many excellent workshops that I have attended. Many of these workshops supply information and advice that I would find very difficult to find as a small producer.'*

'workshops have been a great source of knowledge to me, very enlightening … . I took a lot of info and tips away with me which is not easily got'

Several SMEs used the project 'brokerage events' as an opportunity to search for information. These thematic or sector-specific events brought stakeholders from across different countries together for presentations, dialogue, demonstrations and visits. For example:

The CEO of a Finnish diary producer visited four companies and an educational institution in Poland, looking in particular to become familiar with cottage cheese production. She said: *"We have co-operated and exchanged ideas especially in view of cottage cheese product development and production techniques. We have received new insight into international trade and marketing to guide our trade. In addition, the new knowledge about marketing in different European countries makes it easier for us to establish ourselves in different market areas."*

A second 'seek and take' practice which was a more exploratory and open-ended search for information was *observation*, whereby an SME actor acquired new knowledge through seeing how others operated and bringing ideas back to apply at home. This is illustrated by one meat producer from Finland:

[The company] made good use of both the training and the brokerage events to gather new ideas. At the 'Innovation and Packaging Solutions for Small Food Producers' brokerage event in Spain and the 'Sustainability for Small Food Producers' Brokerage event in Germany, they saw examples of 'good-looking meat product packages' which they have incorporated into their own packaging.

A third form of seek and take is *boundary objects* (Star and Griesemer 1989): non-human artefacts such as maps, forms, regulatory standards, or work processes that, accidentally or intentionally, act as a communicative device between communities of practice. As an illustration, a problem faced in common by all the food producers in this project was how to ensure they complied with most recent international food safety standards. In the Polish hub, the NLC, working with small-scale mountain cheese producers, recognized that, as geographically remote sole traders, they were at risk of non-compliance and consequently of being unable to continue to sell their cheese. He, therefore, re-interpreted the international standards into a guide for small cheese producers, in which he translated difficult-to-access scientific and regulatory information into readily accessible material for the producers. For many of the Polish producers, this guide functioned as a boundary object in the sense that it was tailored for local use in their world of small traditional food producers and helped them learn what the regulations said about food hygiene. However, in addition to providing this basic information, discussion of the guide's content within a workshop of cheese producers also raised their awareness that the regulators could make allowances for home producers such as themselves. The result was they were able to negotiate for these flexibilities with local inspectors more assertively and successfully.

Siedlok, Hibbert, and Sillince (2015) describe the practices of *searching for connections* and *seeking opportunities* in the context of a quest for collaborative opportunities. Despite the differing context, these descriptions were also pertinent to our focus on understanding individuals-in-interaction (Yakhlef 2010). The first practice is explained as a search for collaborators with a clear purpose in mind, whereas the latter is a more open exploration without a pre-defined intention or purpose. In our study, *searching for connections* is illustrated by a German meat producer whose aspiration to develop new products was facilitated by introductions made by the German hub NLC with potential

partners from the scientific research sector. *Seeking opportunities* is illustrated by an Irish meat producer in the way he used the Food Safety Brokerage event in Ireland brokerage event:

> The opportunity to meet and interact with other food producers from across Europe has not only been a fertile environment for the generation of new ideas, the format of these events has allowed him to develop and personalise the bond with other producers that would otherwise have been unlikely, if not impossible: 'Some of the best interactions have occurred on the bus on the way to a site visit or over a drink in the bar after dinner. In these moments you get to know who you can and can't do business with'.

Peer exploration

The second set of practices, we term 'peer exploration' which is characterized by actors entering interactions in a more open, enquiring way than the 'seek and take' set. Our data illustrate many examples of learning that started with producers' ill-defined problems. They sensed that they had to change something but did not have a clear idea of what or how. We define peer exploration as 'working it out' through the sharing of problems, insights, questions and experiences with others. We identified five associated activities: asking questions, presenting to others, discussion, working alongside and brainstorming.

Asking questions. Robertson, Casali, and Jacobson (2016) highlight that for innovation to happen in firms 'if they want good answers, then they must know what to ask and whom to ask' (2012: 830). Valuable questions can also be posed by others, as this UK baker says:

> When [the NLC] came to me to ask me about the challenges that I faced instead of telling me them, I felt this was the right approach"

The questioning was complimented by another peer practice, *presenting to others*, which was an activity mentioned by several participants as one they undertook at a brokerage or mission event. It enabled them to think anew about their business as they organized their thoughts and to benefit from others' insight through the questioning and dialogue that followed.

A variation of presenting a narrative involved presenting the challenge for peer *discussion*, as the following example illustrates:

> A Spanish baker joined the project with the challenge of how to implement new labelling regulations as well as optimising labelling on different products to give a better end product to consumers. He attended a training workshop on Food Labelling which asked for real labels to be used as examples during the workshop. [He] sent some labels that were discussed by … an expert on food labelling and more than 30 participants. Thanks to this, [he] learned a lot and was able to apply all necessary changes to their labels in order to meet with new regulatory standards.

A fourth peer-exploration practice involved participants *working alongside* one another, sharing knowledge through a combination of showing, discussing and experimentation in a hands-on, experiential way:

> A bakery brokerage event in Portugal brought 26 bakers from eight countries, ingredient suppliers, researchers and bakery students together for two days, with the seminars and practical hands-on baking sessions in a partner's bakery. Bakers shared their experience and knowledge on regional breads and baking methods, working together and baking traditional breads while also developing new products. [The Portuguese baker] found the contacts made at this event to be very valuable, as well as the information obtained in new cereals and products.

A final variation to peer exploration of problems or challenges was evident in the use of *brainstorming* as a more 'blue-sky' approach to generating ideas, as illustrated by a Finnish dairy producer:

> The company approached a traditional brewery company with the idea for a joint project. Together they brainstormed various innovative products, five of which were selected and further developed while three were successfully launched. This partnership resulted in the design of an innovative line of protein-enriched drinks.

Critical reflection

The third set of practices we term critical reflection. By this, we mean making space and taking time to look back, to take a different perspective, to question assumptions or reimagine the future. Reflection on experience (Dewey 1933) and reflection-in-action (Schön 1983) involve mulling on past or current activity and events within their context, to increase understanding about what works or not, as well as why. Critical reflection advocates a deepening of critical thinking to examine anew previous taken-for-granted things to avoid the 'lure of familiarity and false recognition' (Tomkins and Ulus 2015, 600). We identified two critical reflection practices, *finding breathing space* and *reaffirmation*.

Our data contain several illustrations of how critical reflection led producers to significantly rethink or re-imagine their businesses, in the sense that the SME actor was prompted to question fundamental aspects of their entrepreneurial or business identity. Sometimes simply the *breathing space* and time away from day-to-day business provoked a rethink about practice, as this quote from a UK baker illustrates:

> 'Small businesses spend so much time firefighting and battling that it is hard to take time for strategic projects. This [brokerage event] has helped me find a breathing space, where I can be in work mode and be challenged to think about my business in a different way. I have been able to come back and put that thinking into action'.

At other times, re-imagination of the business direction came less as a rethink and more in the form of validation or *reaffirmation* of the SME actor's sense of their chosen path, as the following account of an Irish baker illustrates:

> 'The founder … had been selected for a highly sought-after bank accelerator programme in her home country. Part way through she withdrew from this, uncomfortable with its philosophy of encouraging participants to concentrate on a limited number of products in order to scale up production and target large markets. At the start of her involvement with the EU food producer network, she was uncertain of her direction and still wondering if she had made the right decision. Dialogue with other niche food producers who were also resisting a mass production route enabled her to gain a deeper understanding of her own venture and to reconnect with her original ideals'.

In this example, peer exploration stimulated critical reflection, which helped the SME actor articulate what had previously been unspoken instincts about her values and direction for her business. This resonates with Lewis's (2013) insight that an entrepreneur's search for existential coherence leads them to seek connections between their internal self-identity and external social identity.

The findings above illustrate a variety of practices which enabled SME actors to create knowledge. In the next section, we discuss how the various project interventions supported these different practices.

Discussion - Interventions supporting knowledge-creating practice

Earlier in the paper, we contrasted ideas of knowledge as entity with knowledge as epistemic, pragmatic or existential. We argued that each can present a boundary to knowledge creation or learning, which can be traversed by particular knowledge-creating practices. Our findings illuminate how different knowledge-creating practices are supported by distinct interventions and also that these vary in how they enable the traversing of different knowledge boundaries. The variety of project initiatives intended to stimulate knowledge creation were presented earlier in the paper (Table 1). The findings above shed light on different ways in which these interventions supported different kinds of practice which we present now in Table 3.

Seek and take practices, as seen with the online portal Marketplace, training workshops and the Taste of Science magazine, introduced SME actors to new scientific or commercial knowledge and demonstrated novel technologies. A 'seek and take' approach works well when a knowledge gap is well defined and well understood, and the boundary can be resolved by the transfer and acquisition

Table 3. Interventions providing the opportunity for knowledge-creating practices.

Knowledge creating practices	Seek and take practices	Peer exploration practices	Critical reflection practices
	Information seeking Observation Boundary object Searching for connections Seeking opportunities	Asking questions Presenting to others Discussion Brainstorming Working alongside	Finding breathing space Reaffirmation

Interventions

- Brokerage events
- Training workshops
- Marketplace
- Mission
- Taste of Science
- Entrepreneurship training

of basic information. To this extent, an entitative perspective on learning, knowledge and innovation can suffice. However, often SME actors cannot initially define their knowledge needs. They may well have a practical sense of what is not working adequately, but they cannot articulate what they do not know. The boundary may be epistemic, in the sense of the actor needing to develop an under-standing of the ideas or technologies on offer and to make sense of what is required (as in the example above of bakers 'working alongside' each other to develop new products). A boundary may be pragmatic, in the sense that the SME actor is developing their knowledge through practically working an issue out in the specific context of their business (as with the examples above of the Spanish baker and his labels). To learn at these boundaries requires engagement with others that is more dialogic and iterative than a 'seek and take' approach. Our findings show how practices of peer exploration and critical reflection can help traverse both epistemic and pragmatic boundaries.

However, at other times, the knowledge boundary for the SME actor is more existential, in the sense that they are challenged by fundamental questions about their business values and direction (as in the final two examples of critical reflection above). That business owners might spend time ruminating over their entrepreneurial identity is well recognized (Watson 2009). The challenge is understood to be a work in progress as they seek to intertwine their self-identity with social identities (Lewis 2013). Our findings illustrate that traversing such a knowledge edge can be helped by both peer exploration and critical reflection, either together or separately. The questions, exchange and challenge from the former can help to bring clarity, to surface emotions or to reveal contradictions. With the latter, taking time to question the familiar and look at the habitual from a fresh angle can help SME actors to reimagine their business direction.

We summarize these intersections of knowledge boundary and knowledge-creating practice in Figure 2, in which the shaded areas represent what kinds of knowledge are supported by which practices.

Our purpose in presenting this typology is not to argue that any one knowledge-creating practice is superior to another, but to elucidate how each practice can contribute to the resolution of different kinds of knowledge boundary, all of which may have a contribution to innovation. Further, we do not present Figure 2 as a 3 × 4 matrix to suggest either that simplistically any boundary could only be crossed by one learning practice or that any practice could be used for any or every knowledge boundary. Our data do not support such a conclusion – for example, we did not find any examples of
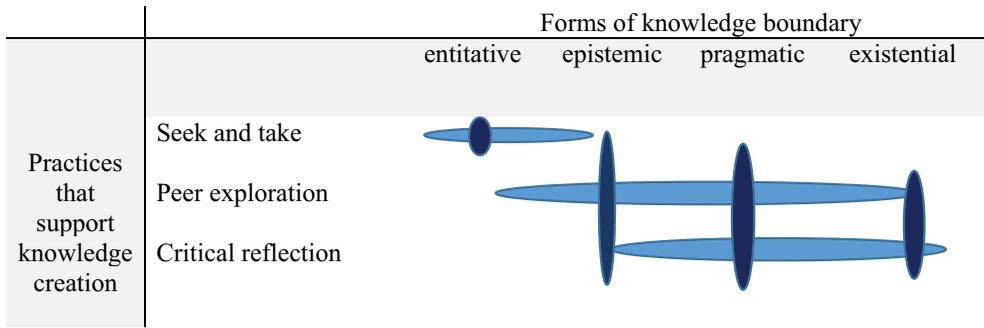
Figure 2. Knowledge-creating practices at different knowledge boundaries.

pragmatic or existential knowledge being helped by a 'seek and take' approach. Instead, what we illustrate in Figure 2 is that 'seek and take' practices are likely to produce entitative knowledge only. Peer-exploration practices can extend understanding (across epistemic boundaries) but also facilitate pragmatic knowledge through supporting new ways of doing things and letting go of unfruitful habitual practices. This latter can open up changes to business identity. Critical reflection can also support such re-imagination and is more likely to produce redefinition of direction or sense of purpose.

We also suggest from our findings that there can be movement through boundaries and interconnection across practices over time. The story of the Polish cheesemakers, referred to earlier in the paper, exemplifies this point. Entitative boundaries faced them initially, as they confronted a need to know about basic hygiene regulations. An initial training workshop provided this information (seek and take). Interaction with each other and the NLC at this workshop (peer exploration) furthered their understanding of the regulatory framework (epistemic boundary) as well raising awareness of how they could negotiate with inspectors over allowable exceptions that could be applied to them as traditional food producers (pragmatic boundary). The traversing of all three boundaries was further enabled by dialogue between the NLC and food companies through a boundary object (seek and take practice) combined with peer exploration (discussion and questions). From this example, we can speculate that the awareness that SME actors have of their knowledge boundaries might unfold in an order of increasing complexity. By this, we mean that they might initially express entitative and epistemic needs, and only become aware of pragmatic or existential boundaries through increased interaction with peers or facilitation of critical reflection. This would be worthy of further research.

Conclusions and Contributions

In this paper we have been concerned with the nature of knowledge boundaries which small and particularly micro-firms experience and the kinds of practice engaged in by SME actors as they interrelate with others, that support learning across these boundaries. Our context was a particularly complex one of micro and small traditional food producers in a geographically spread and multidisciplinary network in which they interacted with food scientists, business advisers and other producers. The collaborative setting was also distinctive compared to most found in the innovation literature. In our context, SME actors were participating in multiple communities: within their regional hub, within their sector network (baking, meat or dairy) and within the overall project. Participants were not working towards shared understanding or outcomes. Rather, the SME actors pursued their objectives within their own companies 'at home' as they engaged in multiple dynamic interactions within the network 'away' (Coughlan and Coghlan 2011). For this reason, our focus in

this paper has been on individuals-in-interactions (Yakhlef 2010). These observations and our analysis lead us to propose the following contributions to theory and policy implications for interventions to support micro-firm and SME learning and innovation.

Theoretical contribution: understanding knowledge, learning and innovation from a practice perspective

We opened this paper by identifying two important gaps in the literature on SME innovation through collaboration, which gave us our research questions: first, how can we understand the knowledge-creating practices that SME actors engage in as they interact with others in the network and, second, how can we comprehend the nature of the knowledge boundaries they encounter? The field of SME innovation has been well served by ideas such as boundary, boundary object, knowledge transfer and integration. However, we have argued that the field has been dominated by an entitative perspective on knowledge, learning and innovation that implicitly conceives of knowledge as an entity to be passed from one source to a recipient and applied then to bring about innovation in products or processes. We have presented evidence that such a perspective can be effective to a degree when actors have well-defined knowledge needs that match clear solution offerings. We capture this as a 'seek and take' strategy to knowledge creation or learning. However, we have also shown that there is much to be added by bringing a practice perspective to learning and innovation, which conceptualizes them as entangled in the everyday activities of organizing and working (Gherardi 2012). By applying the standpoint that people create new knowledge as they work to address issues they confront in practice, we have extended the frame of thinking about the activities SME actors engage in within a network that supports their learning and innovation. Our particular contribution from a practice perspective is to add peer exploration and critical reflection to the repertoire of potential learning practices for SME actors. Our further theoretical contribution is to interconnect these three learning practices to different kinds of knowledge boundary that SME actors face, represented in Figure 2. In particular, drawing from the practice literature on identity and learning-as-becoming, we have articulated an explicit existential boundary, which is well recognized in philosophy (Gordon 2000).

Policy implications for interventions to support learning and innovation

The design of many knowledge exchange and technology transfer projects is predicated on a theory-in-use that implicitly conceives of knowledge as an entity that can be moved, transferred and acquired. Correspondingly, knowledge is seen to come in discrete chunks of information that can be transferred from one mind to another. In this kind of transaction, the knowledge boundary is anticipated to be simply a gap in possession and the action required to cross the boundary is expected to be one of transfer. Knowledge transfer occurs when one party has the expertise and another takes or receives it. Communication is assumed to be unobstructed, such that the knowledge holder can lucidly articulate their package of expertise, and the knowledge seeker has a clear definition of what their knowledge gap is and recognizes the knowledge holder's formulation as a suitable fit. In contrast, a practice perspective on knowledge creation sees the flow as a process of emergent meaning-making that happens over time, as people develop understanding through interaction and dialogue and as they wrestle with issues in their practice.

This perspective has policy implications for the kinds of intervention required to achieve a fuller range of learning and innovation for SMEs. One practical implication of our model (Figure 2) is that interventions will fail to stimulate the full range of potential learning unless they are based on a recognition that there are different kinds of knowledge boundary, and, as highlighted above, that these may present themselves in an order of increasing complexity. Interventions based on knowledge acquisition and transfer, such as a repository, a knowledge-sharing portal or training workshops have a place. They work as a 'seek and take' mechanism for SME actors to access new

information and technology, as shown in Table 3. However, they have limited effectiveness unless SME actors already have clearly defined knowledge needs. In policy terms, it is not new to advocate the importance of networking as a means to enhance SME innovation (Garud et al., 2014). However, a practice perspective implies that learning from collaboration events such as training sessions, regional or sector conferences, will be considerably expanded if their design integrates interactions that promote peer exploration and critical reflection on the issues of genuine concern facing the participants. The implication that knowing, doing, learning and innovating are entangled (Gherardi 2012) necessitates interventions that are situated in the everyday activities of organizing and working. This means including activities such as having actors make presentations to one another; introducing exercises for deliberate questioning (for example, using action learning (Revans 1982)); creating time for discussion or brainstorming ideas, or setting up opportunities for working alongside one another on practical tasks that replicate participants' problem. It also means creating time for and engaging facilitators of critical reflection.

Policy interventions that promote the extension of SMEs' networks have been strongly influenced by the open innovation literature. Indeed, in a European context, the steer within innovation policy from both national governments and the EU is for collaborative innovation networks (e.g. with the EU's Framework 7 and Horizon 2020 programmes). Our findings add insight into the language of 'knowledge exchange' and 'technology transfer' that prevail in these policies. By conceptualizing the knowledge-creating practices behind these terms we provide policy-makers with additional understanding of the kinds of interventions which will better stimulate a broader range of learning and innovation. The relevance of our practice perspective lies in the significance of small firms within peripheral economies, and the particular challenges they (and most especially micro-firms) face in accessing new knowledge for innovation as a consequence of their location, size and limited resources.

A further policy implication of this study relates to the extensive requirement by funders, both EU and other, for collaboration amongst multiple partners. Frequently, these are complex, multi-stakeholder, with manifold boundaries of language and geography. For such contexts, our findings supplement evidence for ways to cultivate constructive networking relationships where each stakeholder can learn and add to the learning of others. In practical terms, this means designing interventions, like the brokerage and mission events in this project, which invite SME actors to work on issues of practical concern to them with peers. It means embedding reflective, problem-based dialogue within an intervention, so that, for example, training workshops are not just didactic delivery of specialist knowledge (seek and take), but become also an opportunity for presentation, discussion and questioning (peer exploration). This approach, we suggest, will also contribute a network learning solution that can address the concern over failure in network innovation initiatives voiced in the literature (Vanhaverbeke 2017).

Limitations and further research

This study was conducted in the setting of a complex multi-country EU network of food producers, scientists, business support agencies and other stakeholders. Created to stimulate 'knowledge exchange and technology transfer', this was a complex and dynamic network of deliberate and opportunistic interventions. There were multiple boundaries of language, geography, discipline and profession, which provided rich opportunity to observe the practices that actors from small and micro-firms used to interact with others. Though derived from this specific context, we are confident that our insights into the intersections between types of knowledge boundary and kinds of learning practice have applicability in other settings. However, further studies in different sectors or other geographical regions would be valuable to substantiate the broader applicability of our conclusions. Additional research would also be valuable to follow up some of the companies who participated in this network, to explore how learning from different elements of this project may have further developed and translated into innovations.

As with all studies, this one suffers from some limitations, which also provide opportunities for future research. The study explored knowledge exchange and technology transfer by small and particularly micro-food producers. As a sector, food has different characteristics to others – the use of natural and perishable materials, the presence of standards and regulations and the localization of taste. In this context, the firms are of a particular strategic type. Further, the firms' engagement in the network was facilitated by funding and facilitation supported by EU project funding. This context and firm characterization raise the question about how a complex and dynamic network of firms of different strategic types and in different industries might engage with and respond to interventions intended to stimulate innovation. In addition, firms operate within a task system or a set of activities through which inputs are transformed into outputs. The characteristics of the task system, including heterogeneity, interdependence, variability and un-analysability impact the effectiveness of an organization (MacKechnie 2006). The relative complexity of the task systems within which the firms operated was not considered and could add further to the understanding of knowledge, learning and innovation.

Notes

1. An SME as defined by the European Commission, is an enterprise with fewer than 250 employees, up to €50 m turnover or a balance sheet total up to €43 m (EU recommendation 2003/361).
2. A micro-firm is defined by the EU as one that meets two of the following three criteria: fewer than 10 employees, turnover up to €2 million, balance sheet total up to €2 million (EU recommendation 2003/361)
3. Most SMEs in the project described in this paper were micro-firms with only 1 or 2 members who participated in project events. Typically this was the owner-manager or CEO, sometimes the original entrepreneur, or another such as the Director of Production, Operations or Marketing. We use the term 'SME actor' to encompass all these.

Acknowledgments

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

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Appendix 1. Sample Coding Analysis – Steps 1 and 2

Main code	Sub codes	Material: Sample quotes from SME participant/project documents
Seek and take	Observation	At the 'Innovation & Packaging Solutions for Small Food Producers' Brokerage event in Spain and the 'Sustainability for Small food producers' Brokerage event in Germany, they (Finnish meat produced)saw examples of 'good-looking meat product packages' which they have incorporated into their own packaging.
	Information seeking	[the project] has arranged many excellent workshops that I have attended. Many of these workshops supply information and advice that I would find very difficult to find as a small producer.
	Boundary object	[Polish cheesemaker] then received a handbook written by the [NLC], titled 'Rules of the Manufacturing process and Hygiene for Officially approved farmer and artisan Cheese factory', which was useful for small scale traditional cheese producers. This information was very useful for a conversation which he had with a veterinarian who subsequently changed his attitude during the inspection.
	Searching for connections	After such successful international visits it is much easier to network across borders. We have found new co-operation partners for our production needs as well as possible suppliers who will be useful in the future
	Seeking opportunities	Some of the best interactions have occurred on the bus on the way to a site visit or over a drink in the bar after dinner. In these moments you get to know who you can and can't do business with.
Critical reflection	Finding breathing space	Barcelona gave me a breathing space and an opportunity to challenge my mindset.
	Reaffirmation	The project has helped [Irish dairy producer] to recognise the intrinsic value and quality of her produce.
Peer exploration	Asking questions	When [NLC] came to me to ask me about the challenges that I faced instead of telling me them, I felt this was the right approach
	Presenting to others	A UK meat producer was invited to present at a mission in Ireland, where she met with a number of Irish meat producers keen to start or develop charcuterie businesses. On the second day of the event she ran demonstration classes. Through this event she not only built new relationships but took home new product ideas and improvements to her craft that have significantly improved her efficiency of production.
	Discussion	He attended a training workshop which invited participants to send sample labels for discussion by the expert speaker on food labelling and the more than 30 other participants. As a result he was able to apply changes to the bakery's labels in order to comply with new regulatory standards.
	Brainstorming	The [Finnish dairy producer] approached a traditional brewery company with the idea for a joint project. Together they brainstormed various innovative products ...
	Working alongside	A bakery brokerage event in Portugal brought 26 bakers from 8 countries, ingredient suppliers, researchers and bakery students together for two days .... Bakers shared their experience and knowledge on regional breads and baking methods, working together and baking traditional breads while also developing new products.