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Catherine E. Laurent, Geneviève Nguyen, Pierre Triboulet, Matthieu Ansaloni, Noemie Bechtet, et al.. Institutional continuity and hidden changes in farm advisory services provision: evidence from farmers' microAKIS observations in France. Journal of Agricultural Education and Extension, 2022, 28 (5), pp.601-624. 10.1080/1389224X.2021.2008996 . hal-03506991

HAL Id: hal-03506991

https://hal.inrae.fr/hal-03506991

Submitted on 2 Feb 2022

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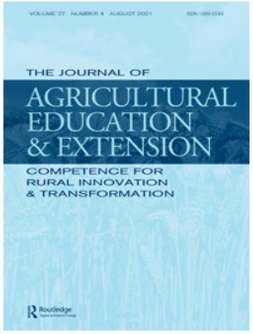

The Journal of Agricultural Education and Extension

Competence for Rural Innovation and Transformation

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/raee20

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To cite this article: Catherine Laurent, Geneviève Nguyen, Pierre Triboulet, Matthieu Ansaloni, Noemie Bechtet & Pierre Labarthe (2021): Institutional continuity and hidden changes in farm advisory services provision: evidence from farmers' microAKIS observations in France, The Journal of Agricultural Education and Extension, DOI: 10.1080/1389224X.2021.2008996

To link to this article: https://doi.org/10.1080/1389224X.2021.2008996

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THE JOURNAL OF AGRICULTURAL EDUCATION AND EXTENSION
https://doi.org/10.1080/1389224X.2021.2008996

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Institutional continuity and hidden changes in farm advisory services provision: evidence from farmers' microAKIS observations in France

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ABSTRACT

Purpose: The paper aims at better understanding the micro-foundations of current institutional changes in agricultural knowledge and innovation systems (AKIS).

Design: A survey of 98 farmers and interviews with 37 advice providers in south-western France were conducted to analyse the ways in which farmers combine different sources of advice (microAKIS). The farmers' practices were observed for general farm management and for 3 types of innovation (new crop diversification, digital decision support tools, and labour outsourcing).

Findings: The results highlight poorly-known characteristics of microAKIS regarding the variety of sources of advice used by farmers, and the limited number of reliable resources on which farmers can draw at key stages of the innovation process. They provide evidence of bottom-up mechanisms of institutional changes such as the routinization of the use of certain service providers that are often overlooked in AKIS analyses (e.g. upstream industries).

Practical implications: These results can contribute to reducing the misalignments of stakeholders' representations of AKIS and microAKIS, and therefore facilitate public debates and improve the efficiency of interventions in this area.

Theoretical implications: Studies of institutional changes resulting from the evolution of microAKIS are expected to complement analyses of increased pluralism of advice providers.

Originality: Linking the observation of microAKIS and the analysis of incremental institutional changes in AKIS allows the identification of transformations of the AKIS rationale that would otherwise remain partially invisible.

ARTICLE HISTORY
Received 3 February 2021
Accepted 4 November 2021

KEYWORDS
Agriculture; France; institutional change; advisory services; innovation; crop diversifcation; labour outsourcing; digital decision support tool

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1. Introduction and theoretical perspective

Farm advisory services, considered by the economic literature as a major driver of innovation in agriculture, occupy a central place in current debates around new challenges facing rural areas, including the agro-ecological transition, generational renewal of farming populations, and the digital revolution. Since 2003, this issue has been part of the debates regarding the European Union (EU) Common Agricultural Policy (CAP). For instance, the importance granted to farm advisory services was clearly established in the agenda of the CAP renegotiations for 2021–2027. Member States are expected to set consistent plans for their national Agricultural Knowledge and Innovation Systems (AKIS), that is, the agricultural information providers, the flows of information between them, and the institutions regulating these relations (Knierim et al. 2015). Experts are advocating for farmers to have access to independent advice and impartial knowledge (EU SCAR AKIS 2019, 88–89) likely to support a sustainable development of European agricultures. The delimitation of national advisory services and the definition of the profiles of providers of advice that would be relevant and should be formally accredited to advance this objective are the subject of political debates, both at European and national level.

In Europe, AKIS have evolved in terms of their themes, their target audiences, their funding methods and the nature of the service providers constituting them (Prager et al. 2016; Knierim et al. 2017). International comparisons and national monographs have reported these changes since the 2000s (e.g. Compagnone, Goulet, and Labarthe 2015; Knierim et al. 2015, 2017). One major anticipated change was a gradual shift towards a fee-based service market characterized by an abundant and varied supply, in which farmers would be able to choose their advisor (Garforth et al. 2003). Yet in France, the basic structural characteristics of the national AKIS seem to have changed little (Labarthe 2014): each *département*[1] has a partly government-funded Chamber of Agriculture, as well as cooperatives; in addition, other farmer-based organizations produce knowledge that is used at *département* level, including applied research institutes producing technical baseline data, and so on (Labarthe 2014). But a growing number of institutional analyses show that apparently unchanged institutional configurations can mask profound micro-transformations. To account for change, studies on the evolution of AKIS have focused extensively on a set of exogenous shocks as the primary cause of the institutional transformation underway, particularly the withdrawal of public funding. These analyses highlighted the plurality of service providers operating in the advisory sector (Knierim et al. 2017). In the French agricultural context more specifically, some studies show that actors often overlooked in studies on the structure of AKIS, including traders, bookkeepers, vets, etc., could be important providers of advice (Compagnone, Goulet, and Labarthe 2015; Dhiab, Labarthe, and Laurent 2020). In spite of these observations, most current policy debates assume that a broad description of the structures of AKIS at national level is enough to design the components of advisory systems that would make it possible to meet the new challenges faced by agriculture and by individual farmers. With few exceptions (e.g. Stuart et al. 2018; Klerkx et al. 2017), relatively little attention has been paid to the way in which farmers combine the various sources of advice to operate their farms, include new actors in their networks, and innovate. How these changes of farmers' advisory practices are in turn resulting in institutional

change is a blind spot. However, as highlighted in the review of Micelotta, Lounsbury, and Greenwood (2017), there is increasing evidence that institutional change is not only driven by exogenous changes in global institutions and by changes at the enterprises level: it may also occur via bottom-up change resulting from the evolution of day-to-day micro-practices. Ignoring these mechanisms can be misleading both for academic understanding of AKIS changes and for policy design.

In the economics and political science literature, analyses of institutional change have often shown a path dependency determined by institutions inherited from the past (Mahoney and Thelen 2010). This historical view recognizes a form of permanence and stability of institutions and enquires into how they may evolve. Institutions are defined as a set of rules operating at different levels of interaction, including not only operational and constitutional rules, but also habits, norms, beliefs, and values (North 1990; Hall and Taylor 1996). They are commonly seen as frameworks of constraint. However, institutions are changing under the influence of various forces. A body of institutionalist literature argues that rules also enable the freeing of action through 'institutional work' (Commons 1970; DiMaggio and Powel 1991; Scott 2014). This 'work' is based on the selection of certain institutional arrangements over others, by the private and public actors involved, and on the negotiation of associated rules and their legitimization and stabilization in shared routines and beliefs.

The pace and scope of these changes may vary, as well as the starting points of the change processes (exogenous changes in institutional environment, changes at the level of the enterprise, changes in micro-practices (Micelotta, Lounsbury, and Greenwood 2017). Moreover, as Thelen (2009) has shown, based on the analysis of research in other fields of investigation (collective bargaining, vocational education and training, finance, etc.), strong evidence demonstrates that building up knowledge on the transformation (or permanence) of institutional structures can be a gradual and endogenous process. This type of process is not always directly visible; apparent institutional stability at the macro level may conceal profound changes at the micro-level, which concern both the meaning of the rules that prevail and the strategies that are implemented (Hacker, Pierson, and Thelen 2015).

There is empirical evidence that these phenomena exist in the case of the French AKIS. A striking example is that of the Chambers of Agriculture, which are organizations under State supervision but administered by elected representatives from the agriculture and forestry sectors (including representatives of farmers' unions). In the 1960s, they were entrusted with a central role in organizing and providing advisory services to farmers in the framework of a harmonized system throughout the country. Formally, these chambers still exist. Yet their functions have changed significantly for farmers, illustrating the phenomena of 'institutional conversion' described by Mahoney and Thelen (2010). While they still have public service missions (for example, supporting entrant farmers) and provide technical advice, Compagnone, Petit, and Barthès (2016) have shown that the ways in which advisors deliver this technical advice may now differ significantly from one region to another, with wide variations in the degrees of investment in specialized technical advice.

We therefore posit that analysis of the structure of a national AKIS provides only imperfect information on farmers' advisory situations and may hide bottom-up mechanisms of institutional changes. There is a need to fully consider the knowledge system that

farmers personally build. This includes the range of individuals and organizations from whom they seek services and with whom they exchange knowledge, as well as the processes involved and how all this is translated into innovative activities (or not); in other words, their microAKIS (Madureira et al., this issue, forthcoming). Our aim is to take full account of farmers' advisory practices, in order to further our understanding of the micro-foundations of current institutional changes in agricultural knowledge and innovation systems.

To this end, we carried out surveys in order to describe the sources of the advice that farmers use on a daily basis in their activities. We also studied the sources of advice on which they draw when making key decisions on whether to adopt or reject various types of innovation. Our data collection method is detailed in Section 2. The results presented in Section 3 highlight a wide variety of strategies for mobilizing sources of advice for both the overall management of the farm and the adoption of specific innovations. In Section 4, a discussion of the findings confirms that the apparent permanence of the AKIS actually encompasses profound changes in the situations of access and use of advisory services for farmers.

2. Material and method

Surveys of farmers were conducted in 2018 and 2019, in addition to interviews with advice providers in 2019 and 2020. Both were conducted in south-western France, in two NUTS3 regions, the Gers and the Pyrénées Atlantiques. Most of the surveys consisted of face-to-face interviews, although some were completed by telephone. Data collection and processing were based on a published protocol established by the international team of the Agrilink research programme (Madureira, Marques, and Santos 2019). The details (questionnaires, interviews conditions [consent …]) are presented in Ansaloni et al. (2019). The sharing of this approach at the project level facilitated the comparison of results between countries and innovation areas (Madureira et al., forthcoming).

The objective of the farmers' surveys was to investigate their microAKIS. We therefore collected data on the specific sources of advice that farmers drew on, not only to manage their farm as a whole but also at different stages of their decision-making processes on whether (or not) to adopt innovations (awareness, assessment, implementation). We consider that decision-making is a non-linear and iterative process and that farmers' sources of advice may vary throughout the process (Sutherland and Labarthe, forthcoming): when they become aware of an innovation, when they assess the interest of the innovation, and when they implement the innovation on their farm. Paying attention to the whole innovation cycle allows us to identify which sources of advice are mobilized at each stage, and thus to better understand the role of advice between farmers who had adopted the innovation (adopters) and those who had not adopted it (non-adopters) or given it up after testing it (droppers).

On the basis of our previous work, we selected three types of innovation that could lead to varying degrees of shifts or reconfigurations in the advisory service supply:

- a technological innovation: digital decision support tools (DDST) for nitrogen fertilization based on satellite and drone technologies (Barnes et al. 2019). The first DDSTs

for nitrogen fertilization were commercialized in France in the 2000s. The offer of this type of DST has been growing since 2010 and several digital DST services coexist in the same region. These DSTs are intended mainly for farms with a large surface area of rapeseed and/or wheat. They are designed to optimize fertilization, that is, to level out the yield per plot and improve the quality of production while maintaining or reducing the overall input of fertilizers.

- a product innovation: a new crop diversification (NCRO) of cropping systems into a novel market segment, chickpea. Throughout the 2010s, grain handling and marketing companies and public authorities have been introducing more and more incentives to revive the cultivation of pulses. In the study area, chickpea production may provide a partial alternative to sunflowers, which is omnipresent in these systems, thus opening up more rotation possibilities that support pest control and soil health. In particular, chickpea production uses less nitrogen fertilizer (Sinclair and Vadez 2012). This crop also has good drought resistance and, in this region, is harvested in August, which is low season for farm work.
- an organizational innovation: labour outsourcing (LABO), which consists in outsourcing farm work to external French or foreign service providers. These practices existed previously but they now meet new needs. LABO has developed considerably and taken on new forms in recent years for various reasons, primarily to support the expansion of farms and to relieve farmers of part of their role as employers. This is found on farms of all sizes and productive orientations. New actors have emerged (e.g. foreign service providers employing posted workers) (Depeyrot et al. 2019). In extreme but no longer exceptional cases, the entire management of the farm is outsourced through innovative subcontracting arrangements (Nguyen et al. 2020).

For each of these innovations, a sample of around 30 farms was purposively selected. In all three cases, an initial list was drawn up from key informants and then expanded using a snowball method, whereby the first farm holders in the survey were asked to indicate farm enterprises with technical choices similar to their own, as well as enterprises with very different practices in order to include adopters, non -adopters and droppers (Table 1).

- For the DDST fertilization, a first list of farms was provided by the main suppliers of this DST ($n = 3$) and by the chamber of agriculture. All these farms partly produced conventional wheat or rapeseed (as these DDSTs are suited to one or the other of these crops with high nitrogen requirements).

Table 1. Structure of the purposive sample. Number of adopters / non-adopters and droppers per innovation area.

	Digital decision support tool (DDST)		New crop diversification (NCRO)		Labour outsourcing (LABO)		Total purposive sample	
	n	%	*n*	%	*n*	%	*n*	%
Adopters	19	57.6	20	62.5	16	48.5	55	56.1
Droppers	5	15.2	3	9.4	2	6.1	10	10.2
Non-adopters	9	27.3	9	28.1	15	45.5	33	33.7
Total	**33**	100.0	**32**	100.0	**33**	100.0	**98**	100.0

- For new crop diversification (chickpea), the initial list was provided by the main grain collectors of the supply chain ($n = 4$) and the chamber of agriculture. This is a recent diversification crop for conventional field crop farms in the Gers.
- For new practices of labour outsourcing (from the outsourcing of all crop cultivation operations, to the workers' employment, and the full delegation of the farm management), the initial list was compiled from data from a previous questionnaire survey on 1,000 farms and from a list of farms with a highly labour-intensive activity (arboriculture) in a contiguous set of municipalities with the same advisory environment.

The surveys used semi-structured questionnaires. The sources of advice drawn on for the management of the farm as a whole were listed to characterize the 'whole farm microAKIS'. Those sources that were used more specifically to adopt or refuse the innovations studied were collected by distinguishing different stages of the innovation adoption process. These data made it possible to describe 'microAKIS innovations'.

Data were collected on the general characteristics of the farm (livestock, crops, surface area) in such a way as to be able to calculate the economic size and types of farming of each farm, using the same methods as Eurostat farm structure database. Then we were able to relate the structural characteristics of the sample of farms to those of the overall population of farms as presented in the Eurostat 'Farm structure' database. In Table 2 we see that our sample includes a much higher proportion of large farms than the general population of farms in the regions concerned (Table 2). This is logical because the innovations observed tend to concern the largest farms. However, the results must be interpreted accordingly.

Data on advice was collected from a closed questionnaire supplemented by open-ended questions. In the open part of the questionnaire the farmers themselves identified the sources of knowledge and advice used to make their decisions, and could mention changes that occurred in their advisory environment and in their own practices for finding relevant advice. We have taken into account formal sources of advice, as well as the informal networks mentioned by the farmers. Information on these service providers was also collected by analysing various primary data sources (scientific documents, activity reports, websites) and directly through interviews. Thirty-seven key informant interviews were held, including at least one representative from each category of a service provider. These interviews provided information on the changes that occurred in the advisory strategy of these providers in the research area, for activities both in front office (i.e. when the advisors are in direct contact with the farmer) and back office (i.e. knowledge generation that supports advisors' activities such as scientific monitoring, building and up-dating databases, scientific experiments, etc.) (Labarthe and Laurent 2013). The number of key informants interviewed for each category of service provider is provided in Table 3.

The surveys have shown that there is not 'one' definition of advice that is shared by all. 'Advice' and 'advisors' have different meanings. There are many providers of knowledge, not all of whom are universally considered be advisors by the study population. For instance, veterinarians may be included or not in the group of people providing 'advice'. In our data collection, all of the sources of knowledge mentioned by the farmers were taken into account. However, it is clear that not all of the sources of

Table 2. Distribution of the farms of the survey according to standard output classes.

	Standard output classes (Euros)	NUTS 2 Regions (Aquitaine & Midi-Pyrénées) 2016[a]		Digital decision support tool (DDST)		New crop diversification (NCRO)		Labour outsourcing (LABO)		Total purposive sample survey	
		n	*%*	n	*%*	*n*	%	*n*	%	*N*	*%*
Small	[0-8 000]	**17 170**	***21.5***	0	*0*	0	*0*	0	*0*	**0**	***0***
	[8 000– 25 000]	**13 650**	***17***		*0.0*	0	*0.0*	4	*12.1*	**4**	***4.1***
Medium	[25 000–100,000]	**26 540**	***33.2***	7	*21.2*	7	*21.9*	5	*15.2*	**19**	***19.4***
Large	[100 000–250 000]	**15 150**	***19***	12	*36.4*	17	*53.1*	7	*21.2*	**36**	***36.7***
	≥ 250 000	**7 440**	***9.3***	14	*42.4*	8	*2.0*	17	*51.5*	**39**	***39.8***
	Total	**79 950**	***100***	33	*100*	32	*100*	33	*100*	**98**	***100***

[a]*Source: Eurostat, farm structure, farm surveys. These two NUTS 2 regions include the départements (NUTS 3) of the study.*

Table 3. Main categories of advisory suppliers and number of key informants interviewed for each category.

Types of advisory suppliers	Status	Who is controlling the suppliers?	What does the supplier provide? What is its main activity?	Number of key informants interviewed
Chambers of Agriculture	Public organization supervised by the State and administered by elected representatives	Elected representatives from agricultural activities, professional agricultural groups and forest owners. State services for specific items	Advice and Training Various aspects of farm management support CAP subsidies management support	4
Farmers' groups	Professional association	Farmers	Peer to peer formal and informal exchange of knowledge on various topics. Contribution of different kinds of advisors for facilitation and advisory input. Advice and training on various topics, and provision of other services (e.g. bookkeeping, assistance for application forms for subsidies, etc.).	2
Cooperatives	Cooperative	Farmers	Cooperation for input provision (seeds, pesticides, fertilizers), output collection (grain, fruits), market information and other services. Cooperation for collective use of farm equipment. Advice	5
Downstream companies	Private firm	Private capital	Collection and/or marketing of farm products (National and international trading) Advice (technical, market).	0
Upstream companies	Private firm	Private capital	Provision of various production factors including labour force. Agricultural equipment dealers (harvest machines, etc.), sellers of fertilizers, crop protection products, etc. Farm labour providers (temporary employment agencies, farm contractors, etc.) Advice (technical, market, etc.).	10
Independent consultants	Private firm	Self-employed or small size enterprise	Advice on various topics	3
High tech companies	Private firm	Private capital	Provision of digital solutions (hard and/or software) (e.g. Start-ups) Advice	7
Applied Research Institutes	Association or 'Industrial technical centre'	Farmers' representatives, State, downstream industries	Knowledge generation (scientific monitoring, and applied research results). Contribution to advice and training of farmers.	2
Universities	Public and private	National State (directly or via contracts) and other stakeholders	Education and research In course training, action research	2
Decentralized state service	Public	State	Implementation and control of public intervention at local level. Information on regulations	2
Informal networks	Peer-to-peer relationship. Various individuals: family members, other farmers (neighbours, or not), friends with technical skills (e.g. technicians), etc.		Exchange of experience, access to information from wider networks, mutual advice	

Source: Farmers' survey and key informant interviews, report of activity of services providers.

knowledge were always reported. In some cases, this indecision on certain categories of interaction led to an underestimation of the number of knowledge sources relied upon by the farmer. This finding is both a limitation of the survey and a first result.

3. Results

3.1. The diversity of sources of advice mentioned by farmers

Farmers have different practices to build their knowledge base. To be able to compare the microAKIS, we have grouped the sources of advice into 11 broad categories (Table 3). The providers are differentiated according to not only their status and who controls them (public, private, farmer-based organizations, NGOs), but also the nature of the services they provide and the economic activities with which these services are associated.

The diversity of sources of advice presented in Table 3 is not exhaustive of the sources of advice in France. It only represents the spectrum of the suppliers of advice reported by the farmers of our sample, either for the general management of their farm (whole-farm microAKIS) or for a given innovation area (innovation microAKIS). For instance, in our survey, some sources of advice that we expected to encounter, such as NGOs, were not mentioned by any of the farmers. We also note the need to take full account of informal networks, mentioned by many farmers as an important source of knowledge and advice. However, the interviews showed new information and communication technologies (ICT) have greatly facilitated remote communication and access to information shared by geographically distant peers (e-mails, consultation of internet platforms). For people who are not very familiar with the use of internet, friends and relatives act as intermediaries. In addition, the level of farmers' education continues to rise. Former 'peers' have become friends: relationships formed during studies or on various occasions with people with a similar level of education and who hold technician or engineer positions in various organizations.

We did however find the main categories of service providers present in France, which indicates that some practices have been consolidated. Our survey not only shows the important role of farmer-controlled organizations but it also confirms the rise of a diversity of private actors (Compagnone, Goulet, and Labarthe 2015; Goulet, Compagnone, and Labarthe 2015). Major differences structure this diversity: they concern the degree of specialization in the advisory activity (Table 3.), as well as the characteristics of the front and back office. Differences also appear in the way that providers cover the costs of advisory activities, and in the possibilities for farmers to control the type of knowledge underlying the development of this advice (Table 4).

Four main findings in particular stand out with regard to the diversity of sources of advice

- Most of the actors mentioned by farmers are not specialized in advisory services; they combine advice with other activities, on a commercial or non-commercial basis (cf. column 4 of Table 3).
- For most providers, the cost of advisory services is integrated into these other activities, which may make it appear free of charge to the farmers who benefit from it (see column 2 of Table 4).

Table 4. Conditions of farmers' access to the services of different types of advisory service suppliers: type of front office interactions, cost of service, and transparency of the knowledge used by advisors.

Types of advisory supplier	Farmers' access to advisors (type of front office interactions and coverage of the cost of the service)	Farmers' possibilities to access and control the knowledge used in back office
Agricultural chambers	• Thematic, face-to-face advice, phone • Public budget (tax on farm land and on farm income) + growing share of fee-for-service	• Knowledge produced mainly by public organizations or in association with public organizations. Knowledge dissemination to various types of stakeholders, in compliance with public rules
Farmers' groups	• Mix of training activities, group exchange facilitations, and one-to-one advice • Various systems for covering costs. Membership fee, selling services, public funding (on the basis of calls for tender) + fee-for-services	• Knowledge generation often limited at the level of the group. Knowledge brought in by various types of advisors with unequal possibilities for farmers' organizations to assess the possible influence of the conflicts of interest around the knowledge used by these advisors
Applied Research Institutes	• Limited front office interactions (open days, DST) • Farmers' compulsory contribution, tax (on farmers' income), public funding (competitive calls) + selling DST + various public-private partnerships with industries (e.g. seed producers, crop protection industries, etc.).	• Knowledge generation is the core activity (stations, etc.). Due to various public-private partnerships, some of the knowledge produced falls under business secrecy rules, another part is freely accessible (e.g. trials of varieties performances)
Cooperatives	• Various, face-to-face, group, phone, etc. All members • Farmers do not pay for advice. The cost is integrated into other commercial transactions	• Variable intensity of knowledge generation, depending on the organization. In principle, cooperative members (or their representatives) are associated to the design of back office activities.
Downstream companies	• One to one. Technicians spread over the territory. • Farmers do not pay for advice; its cost is integrated into other commercial transactions	• Variable intensity of knowledge generation, depending on the organizations. Business secrecy rules. Protection of commercially valuable information for the benefit of companies
Upstream companies	• Various. One-to-one, groups. Technicians spread over the territory • Farmers do not pay for advice; its cost is integrated into other commercial transactions	• Variable intensity of knowledge generation, depending on the organizations. Business secrecy rules. Protection of commercially valuable information for the benefit of companies
Independent consultants	• One-to-one advice • Fee for services	• Limited knowledge generation at the level of the enterprise. Advice uses various sources of knowledge from public and/or private organizations
High-tech companies	• Limited interactions • Farmers pay for services and/or technology	• R&D linked to the tool. Business secrecy rules. Protection of commercially valuable information for the benefit of companies
Universities	• Action-research • Specific research budget	• Knowledge generation and dissemination according to public rules to various types of stakeholders
Decentralized state service	• Face-to-face or phone	• Public regulations. Open access
Informal networks	• Informal interactions	• Various sources of knowledge. The links of interest corresponding to different types of knowledge can be overlooked

- The possibility for farmers and their representatives to access the knowledge used in the back office to support advisors' work is very uneven, depending on the nature of the providers (see column 3 of Table 4). This makes it more difficult for farmers to

assess the quality of the knowledge provided by the advisor and to discern possible influences of commercial activities on the advice given.
- Despite this diversity, there are still new challenges of the sector which are rarely covered by advisory services (legal advice, business strategy advice, advice for hiring employees, etc.).

The issue of the control of the knowledge used in back office is mentioned by a limited number of farmers in spite of significant changes that occurred. This can be explained by the low visibility of these changes. Indeed, the nature of certain tools has changed radically but it appears to remain the same. For example, Plant Health Bulletins are widely distributed and are consulted by advisors (and farmers) for information on the health status of crops. They have a warning function on the presence of pests and provide support for decisions on the use of crop protection products and they are used by farmers of our survey. These bulletins (formerly called agricultural warning bulletins) were previously written by government services. They could lead to treatment recommendations that differed from those associated with the risk assessments of agribusinesses and trade technicians. At present, these bulletins are written by a partnership structure that includes traders and pesticide suppliers (Compagnone and Simon 2018). This has led to more consensual information which, according to some agronomists (Guichard et al. 2017), is not always conducive to a reduction in pesticide use as recommended by the regulations. These changes are not very visible for farmers.

In addition, as mentioned in the methodological section, interviews with farmers and with providers of advice showed that there is no common understanding of how to define and categorize people and organizations providing advice. There are various reasons for this:

- As noted above, there are differences in the understanding of what exactly advice and advisors are, both between farmers and between farmers and other actors. In France, for example, occupational health and safety advice is generally not included in what public policies classify as AKIS. Yet prevention advisors and occupational physicians and nurses consider that they provide advice to farmers. The farmers themselves do not spontaneously mention the occupational health services as a source of advice, even though they have had interactions with prevention advisors and/or occupational physicians and nurses (that is, about 5 full-time equivalents for the 6000 commercial farms in the Gers).
- Boundaries between categories of suppliers can be blurry. This is, for instance, the case between some farmers' groups and cooperatives. It is also the case when a provider has a hybrid profile that makes it difficult to classify, for example between upstream and downstream companies when a company is active on both sides of the supply chain, or when an organization articulates several legal forms (e.g. cooperatives and their subsidiaries with private enterprise status).
- Some service providers have broadened their traditional scope beyond the limits usually taken into account. For example, sellers of agricultural equipment or cooperatives supplying equipment for shared use provide advice not only on this equipment but also on strategies for outsourcing activities.

The question of categorizing sources of advice thus becomes a key analytical issue, in particular to identify changes in farmers' advisory practices and bottom-up mechanisms of institutional change. Even if it seems useful to have common categories between regions and countries, on which to build comparisons, there is a need to be attentive to the micro-characteristics of advisory relationships: the use of overly universalizing analytical categories can mask important discrepancies in the actual content of these relationships.

3.2. Relative importance of provider types

The relative importance of the different farmers' advisory practices in our sample is given in Table 5. It shows the proportion of farmers who mentioned the various categories of providers, either in their whole-farm microAKIS or to becoming aware of an area of innovation (innovation microAKIS).

At the level of the whole-farm microAKIS, the main types of advisory service providers used are farmers-based organizations, with agricultural cooperatives used by more than 80% of farmers and farmers' groups (almost 50% of farmers). Independent consultants play an important role, with more than 40% referring to them. Next come value chain partners, upstream and downstream companies, which are engaged by 39% and 26% of farmers, respectively. Interestingly, the chamber of agriculture's position is low down on the list (16%). Finally, more than 45% rely on advice from their informal networks (mainly, but not exclusively other farmers). This configuration tends to be found across all the innovation areas, even though more use is made of consultants for digital DST, and fewer farmers turn to upstream firms for new crop diversification.

At the level of microAKIS related to specific innovations, and particularly at the awareness stage of the innovations studied, the figures differ. Farmers-based organizations come first: more than 50% of the farmers became aware of innovations through

Table 5. Number of farms (and %) reporting the use of one type of advice provider (each group of farms in the survey, awareness stage of the innovation, and whole farm microAKIS).

Innovation area	DDST		NCRO		LABO		TOTAL	
Awareness phase & whole farm microAKIS Type of advisory suppliers	Aware. N° (%)	Whole N° (%)	Aware. N° (%)	Whole N° (%)	Aware. N° (%)	Whole N° (%)	Aware. N° (%)	Whole N° (%)
Agricultural Chambers	2 (6.1)	7 (21.2)		5 (15.6)	1 (3)	4 (12.1)	3 (3.1)	16 (16.3)
Farmers' groups	8 (24.2)	20 (60.6)	3 (9.4)	6 (18.8)	14 (42.4)	22 (66.7)	25 (25.5)	48 (49)
Cooperatives	12 (36.4)	27 (81.8)	28 (87.5)	32 (100)	12 (36.4)	23 (69.7)	52 (53.1)	82 (83.7)
Downstream companies		4 (12.1)	4 (12.5)	10 (31.3)	6 (18.2)	12 (36.4)	10 (10.2)	26 (26.5)
Upstream companies	6 (18.2)	13 (39.4)	2 (6.3)	3 (9.4)	19 (57.6)	22 (66.7)	27 (27.6)	38 (38.8)
Independant consultants		22 (66.7)		9 (28.1)	1 (3)	10 (30.3)	1 (1)	41 (41.8)
High-Tech companies		1 (3)						1 (1)
Applied Research Institutes.		2 (6.1)		1 (3.1)		1 (3)		4 (4.1)
Universities	4 (12.1)	2 (6.1)				1 (3)	4 (4.1)	3 (3.1)
Informal network	4 (12.1)	14 (42.4)	14 (43.8)	13 (40.6)	16 (48.5)	18 (54.5)	34 (34.7)	45 (45.9)
State. Decentralized services						1 (3)		1 (1)
Total number of farms	32	32	32	32	33	33	98	98

Methodological note: The figures correspond to the number of farmers who report using one type of advice supplier. One type of supplier may include several suppliers (e.g. n=1 for upstream companies may be a situation where the farmers get advice from both a technician from a crop protection products firm and another from a farm equipment provider).

their cooperative. However, this proportion is lower than for the whole farm microAKIS, especially for 'labour outsourcing' and 'digital DST' innovations. Consultants are virtually absent. The survey highlights particularities according to the innovation areas. For labour outsourcing, the upstream companies (mainly farm contractors but also farm equipment providers and crop protection product sellers) are most frequently cited (66.7%) as a source of advice. Informal networks are the second most frequently cited source of awareness raising for the innovation areas 'LABOur outsourcing' and 'New CROp diversification' (48.5% and 43.8% respectively). They are much less frequent in the innovation area 'Digital DST' (12.1% of the farms). For this innovation area, fewer operators report having sought advice from various service providers.

3.3. The diversity of microAKIS patterns

3.3.1. Whole farm microAKIS

Farmers combine their sources of advice in different ways (Figure 1).

As with any multivariate analysis, individual farmers' practices can be grouped according to different logics, yet some broad patterns emerge:

1. 'Multi-embedded microAKIS': farmers obtain advice from farmers' groups, cooperatives and private companies in the sector;
2. 'Cooperatives and private enterprises': farmers rely mainly on cooperatives and private actors (upstream or downstream enterprises, consultants);
3. 'Farmers-based organizations and independent consultants': farmers rely on several sources of advice but not on advisors from upstream or downstream companies;
4. 'Farmers-based organizations': advice is sought almost exclusively from farmers-based organizations or informal networks;
5. 'Cooperatives only': farmers in this group all make use of cooperative advisors; they are the only ones to mention only one type of source of advice;
6. 'Zero cooperative': farmers in this group do not mention any advice from cooperatives; with the exception of one farmer, they rely on at least two other sources of advice.

Beyond the diversity of the whole farm microAKIS, we found that cooperatives are a major source of advice. By contrast, relatively few farmers (16%) consider chambers of agriculture to be a source of advice, even though they may use them for other services. This reveals a deep change in the former institutional feature of the sector, and is consistent with analyses showing chambers' loss of influence in the field of advice.

The data in the next section show that when searching for information in one of the three areas of innovation studied, farmers use other combinations of knowledge.

3.3.2. Innovation MicroAKIS

Figure 2 provides more detailed information on the strategies for combining sources of advice for the 98 farmers surveyed, according to the field of innovation, the stage of innovation and whether farmers are adopters, non-adopters or droppers.

This figure shows the wide diversity of farmers' microAKIS. However, three stylized facts emerge.

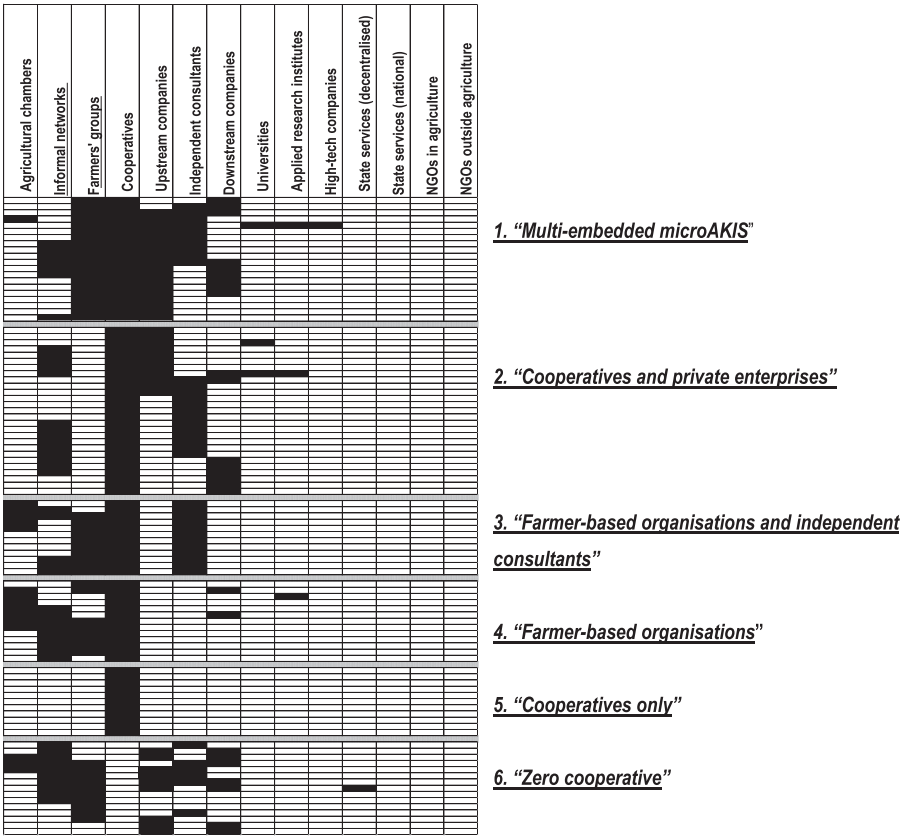

Figure 1. Whole farm microAKIS. Main sources of advisory services reported by the farmers. 1. 'Multi-embedded microAKIS', 2. 'Cooperatives and private enterprises', 3. 'Farmer-based organizations and independent consultants', 4. 'Farmer-based organizations', 5. 'Cooperatives only', 6. 'Zero cooperative'.

Methodological note: Information was visualized using the reorderable matrix methodology of Bertin ([1981] 2011). First, the values of an initial numerical table were converted into discrete steps. Each line represents one farm ($n = 98$), and each column corresponds to a category of service provider. A cell is black if the farmer reported receiving advice from at least one actor of that category of service provider. The matrix was then reordered manually to reveal patterns. Finally, meaningful groups were identified and named.

First stylized fact, there are clear patterns in how sources of advice are combined according to the field of innovation. For DDST adopters, the combination schemes are simple since the majority of farmers use only one or two sources. For a number of adopters, a cooperative-centred pattern can be observed. For others, however, the combination of sources varies widely from one farmer to another. For NCRO adopters, the number of sources mobilized is equally low. However, a distinct pattern emerges for all farmers, structured mainly around cooperatives and secondarily around exchanges within informal networks. It is among LABO adopters that we find the most complex combination schemes. These are distinguished by the importance of the number of sources used, irrespective of the stage of innovation. Moreover, all the diagrams are multi-embedded. But apart from the fact that upstream firms are found in a

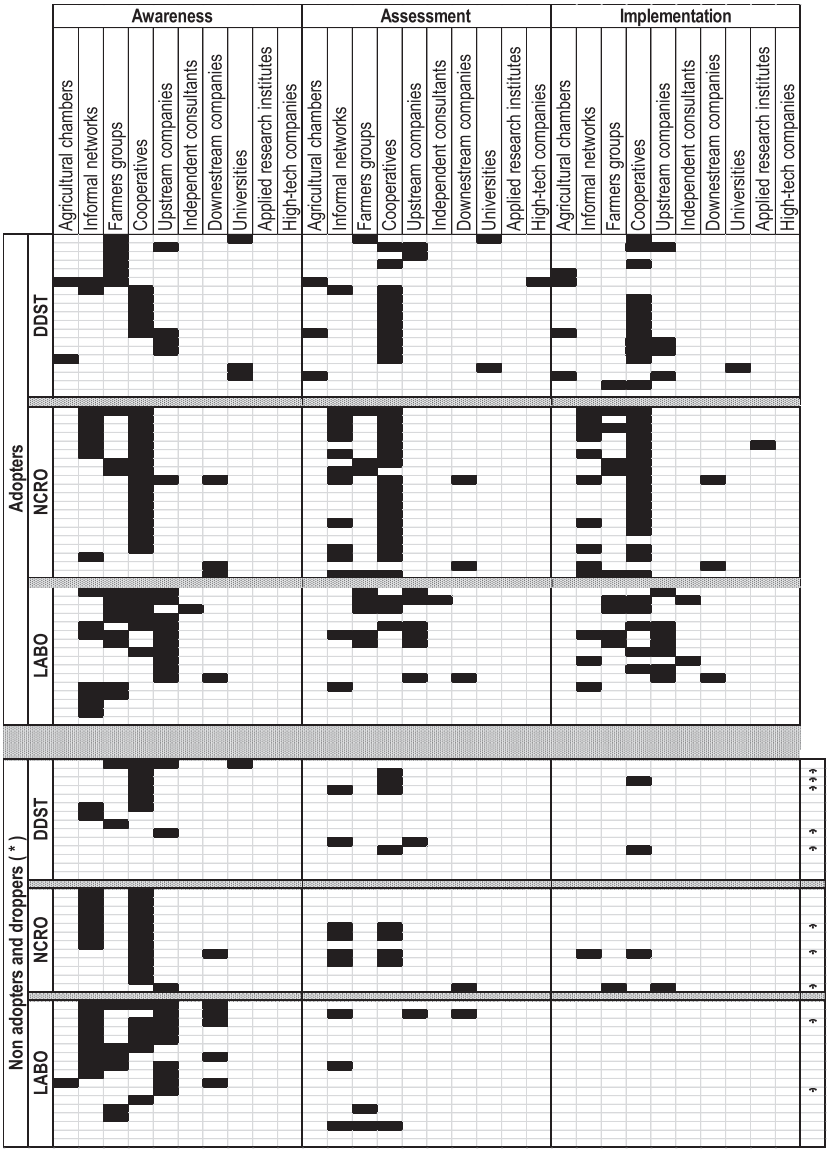

Figure 2. Main sources of advisory services reported by the farmers of the sample, according to innovation areas. Awareness, assessment and implementation stages of the innovation process (adopters, non-adopters and droppers).

Methodological note: Each line represents one farm ($n = 98$ farms). Farmers who adopted the innovation and then dropped are included in the 'non-adopters' group and tagged with a star in the bottom right column. Data processing according to the Bertin Matrix method ([1981] 2011).

number of schemes, they all differ substantially from one farmer to another. We suggest that this variety in the combination of sources is related to the nature of the innovation: deficit of sources for an innovation associated with a digital technology (DDST), a limited but recognized number of sources for a more classic innovation

(NCRO), and diffuse sources for an innovation requiring a global approach to farming (LABO).

The second stylized fact relates to the level of stability of patterns of a combination of sources of advice during the innovation process. We observe that farmers draw on a multiplicity of sources at the beginning of the process, during the awareness stage, then they rely on fewer sources during the evaluation and implementation stages. The difference in the number of sources mobilized during the first stage as compared to the second and third stages is particularly noteworthy for DDST and LABO adopters. For these innovations, farmers seem not to find adequate sources of advice at crucial moments in the process, and those previously mobilized in the first phase would not be considered relevant. Other types of sources are then used. The adoption of new crop diversification stands out with relative stability or even an increase in the number of sources drawn on. Interestingly, at the evaluation and implementation stages, some NCRO adopters diversify their sources beyond cooperatives to include more peers. Informal networks appear, alongside cooperatives, as a key source of advice. Interviews have shown that they are most often exchanges of experience between peers, which clearly help in decision-making and implementation of innovation. On the other hand, for innovations such as the use of outsourcing (LABO) or digital technology (DDST), a farmer's apparent use of multiple sources can be misleading. At key stages of adoption, farmers rely on only a limited number of types of advisory providers. For labour outsourcing some farmers consider that no relevant source of advice is available. The weight of cooperatives and farmers' networks, which is relatively significant at the outset, diminishes in favour of upstream firms. In the case of DDST adopters, the importance of farmers' networks, which are used extensively in the information phase, decreases in favour of cooperatives and chambers of agriculture.

The third stylized fact is based on a comparison between the group of adopters on the one hand, and the group of non-adopters and droppers on the other. In the initial awareness phase, the two groups show broadly the same pattern of advice for the two areas of innovation: new crop diversification (NCRO) and labour outsourcing (LABO). The same is not true of digital decision support tools (DDST), where the awareness of a significant proportion of non-adopters has not been raised by advice received from a particular source. This could be explained by the fact that this is a specialized technology (not adapted to all farms) and is still emerging. Non-adopters are therefore made aware of these innovations through a range of sources of advice, which are sometimes quite varied. On the other hand, most non-adopters do not mention having sought advice for the purposes of assessing these innovations, with the exception of a few droppers. We also note that a significant proportion of droppers (6 out of 10) did not receive advice on implementing the technology. Thus, for farmers who do not adopt or who give up, advice seems to occupy only a marginal place in the key phases of their reflection on innovation, even though it is present in their AKIS whole-farm and in the initial phase of the innovation process. Finally, we note that certain sources on which the group of adopters drew heavily during the assessment phases (chambers of agriculture for DDST, cooperatives for NCRO and upstream firms for LABO) feature little, if at all, with droppers during the same stage of reflection on innovation.

4. Discussion

At a superficial level, the resources available to farmers in the survey region appear to be fairly consistent with those described in the national AKIS. However, detailed observations highlight poorly known characteristics of microAKIS, concerning the variety of sources of advice mobilized by farmers. Our findings also provide evidence of quite different dynamics, depending on the area of innovation. More importantly, they show that at key stages of innovation adoption (assessment and implementation), farmers rely on a very limited number of advisory service providers. Contrary to expectations, and despite their importance for back office activities, high-tech companies in the case study site play a very limited role in providing direct advice to farmers, even for an innovation such as Digital DST. In the area of organizational innovations that rely on other forms of labour, farmers themselves mention a lack of advisory resources.

Behind the apparent permanence of macro-institutional arrangements, the analysis of microAKIS reveals significant changes that profoundly alter the meaning and impact of the current rules. We can account for these changes by using the four main mechanisms of incremental institutional changes described by Mahoney and Thelen (2010, p. 15-16): Displacement, Layering, Drift, and Conversion. Displacement corresponds to 'the removal of existing rules and the introduction of new ones', Layering to 'the introduction of new rules on top of, or alongside, existing ones', Drift to 'the changed impact of existing rules due to shift in their environment', and Conversion to 'the change enactment of existing rules due to their strategic redeployment'.

This identification of four different mechanisms helps to clarify the components of institutional change, including at the micro-level, and to analyse bottom-up institutional change processes.

4.1. Four mechanisms of institutional change at a micro-level

Displacement. In the French case, the phenomena of displacement described by Mahoney and Thelen (2010) appear moderate. However, some of them may be masked by the use of the overly 'universalizing' analytical categories mentioned earlier, such as 'informal networks'. The importance of informal networks and peer relationships has been described in various contexts (e.g. Sumane et al. 2018), including in this issue (Kilis et al., 2021; Koutsouris and Zarokosta, forthcoming). What is striking in our findings is that the informal networks described in the surveys actually cover very different types of interactions from those that would have been described 30 years ago (Darré, Le Guen, and Lemery 1989). Farmers' interviews highlight several phenomena. First, geographic proximity is less important for exchanges with other farmers due to the development of ICT; the informal network of farmers can extend far beyond the region. Second, as farmers' education continues to rise, farmers' peers are not only farmers and include people with whom they share the same level of education: technician or engineers. In addition, a growing proportion of farmers have direct links to professions outside the sector (via multiactivity, direct selling, and spouse's profession) that bring them into contact with various fields of expertize.

Layering. Our research has revealed a phenomenon of layering. For instance, new sources of advice that are not strictly dedicated to the agricultural sector are mentioned, such as consultants with cross-cutting skills in water management or environmental standards. However, here again these trends are masked by the use of broad categories, as these other consultants are generally grouped together in AKIS analyses with consultants specialized in agriculture (e.g. Knierim et al. 2017). By contrast, high-tech firms play only a marginal role among the farmers interviewed. The development of decision support tools does not replace advice based on interpersonal relationships, but instead adds a layer to the advisory activity, mainly in the back office, and changes the practices and networks of advisors (Rijswijk, Klerkx, and Turner 2019). This is quite common in the field of robotics in animal husbandry where farmers have to manage on their own to acquire expertize in the use of machines and the adaptation of breeding practices. On the strength of this expertize, some go so far as to offer consultancy services.

Drift. We also find a high degree of permanence in the macro structure of AKIS while deep structural changes have taken place. Such a situation has been described as institutional drift, elsewhere. An example of a shift in farmers' economic environment: some production (particularly arboriculture) and some forms of outsourcing rely now on the use of many precarious workers with various occupational statuses. In France, the relative proportion of these employees is increasing (almost 800,000 persons in 2016 that include about 20% of foreign workers) while the proportion of family labour is declining (less than 475,000 persons in 2016) (Depeyrot et al. 2019). Yet the overall structure on advisory services on employment issues remains largely unchanged. Several farmers explicitly mentioned the lack of advice in this area of labour reorganization. As a result, some farmers renounce to reorganize part of their activity, not because they are not innovative, but simply because they do not find advice adapted to their needs. This is evidenced by the use of limited advisory resources for the assessment of innovations in this innovation area.

Conversion. The most important phenomenon is probably institutional conversions. In France, the notion of 'agricultural advisor' refers to the emblematic figure of the advisor of a chamber of agriculture, who provides free advice based on knowledge, the quality of which is validated by public systems. Gradually other sources of advice have become predominant (Table 3 and Figures 1 and 2). Formally, advice from the sources most often mobilized (cooperatives, upstream and downstream companies) has the same aspect: free advice which claims to be based on quality knowledge. However, this advice is free of charge in appearance only, because its cost is integrated into that of other business relationship (Table 4). It does not have the redistributive effects of government-funded advisory services. In addition, it is based on a back office that favours knowledge likely to support the company's profit strategies in particular market areas (Le Velly and Goulet 2015). Even tools issued by public authorities can exemplify this conversion phenomenon like in the example of the Plant Health Bulletins mentioned in Section 3.1.

4.2. From microAKIS to Akis: bottom-up institutional change

As stated in the introduction, the construction of institutions depends on the selection of certain actor arrangements, their legitimization and the stabilization of shared routines

and beliefs. Our results highlight at least three such processes which, in a bottom-up dynamic from the micro AKIS, contribute to the transformation of the global AKIS.

The first one concerns the construction of norms about who is legitimate to provide advice in agriculture. MicroAKIS are a source of institutional change when they lead to the selection of certain types of service providers by trivializing and legitimizing their intervention and thus strengthening their power. The differences in innovation microAKIS between adopters, non-adopters and droppers suggest an important change in the advisory relationship and the way in which practices can influence institutions. Among adopters, regardless of the field of innovation, some advisors are very much involved from the beginning to the end – probably partly because they respond better to the farmers' needs. In so doing, they develop a long-term support relationship rather than a one-shot advisory contact (Figure 2). This is the case for advice from input and equipment suppliers, which partly fills the vacuum left by the withdrawal of the chambers of agriculture from technical advice. Little by little, relationships of trust are being built between farmers and advisors, based as much on the human qualities of the advisor as on the technical content of the messages he or she delivers. Gradually, these stakeholders gain legitimacy to assert their key role in the AKIS. These relationships contribute in the long run to determining how, based on their individual experience, farmers express their opinion about the different advisory providers in the various forums in which they hold responsibilities (cooperatives, chambers of agriculture, etc.). In the French case, these micro-mechanisms help to explain the difficulties encountered in setting up advice on crop protection products that are not linked to any commercial interest.

A second bottom-up process results in the transformation of the rules that regulate the development of the content of the advice. Formally, the interaction with the advisor from cooperatives or input suppliers resembles what it was with the technical advisors of the chambers of agriculture. However, the very nature of the advice that is given has changed. In most cases the knowledge bases that are used are not public. As other work has shown (e.g. Dhiab, Labarthe, and Laurent 2020), the advice offered is based on a back office built primarily to support the particular business interests of each advisory service provider. In the front office dimension, the advisors' work remains embedded in this knowledge base which influences the nature of the advice delivered (Baret and Vanloqueren 2009). In this context, we note that, for many farmers, interactions in informal networks appear to be important levers for keeping a critical distance when it comes to engaging in new innovations.

A third process leads to the emergence of a market for a very specific type of global advice. The analysis of the whole-farm microAKIS shows that farmers' demand for advice has evolved beyond the technical dimension of the activity towards a more global advice, supporting farmers at various key moments in their farm cycle, and integrating other dimensions related more to business management. Therefore, new services are being purchased, which farmers are discussing in various forums. These behaviours lead to what Compagnone, Goulet, and Labarthe (2015) describe as the emergence of a market for a new form of advice and expertize around either traditional actors who have widened the spectrum of their services and provide a package that integrates adapted advice as a complement, or actors who used to support enterprises in other economic sectors and are now extending their range of activity to agricultural enterprises. Although

there has been such an emergence of new service providers, mainly from the private sector, our results do not indicate a radical shift towards a service market where farmers pick and choose. Such a market remains marginal.

The results suggest other mechanisms of bottom-up institutional change. This is particularly the case of the creation of new informal networks using the Internet and based on new perceptions of the notion of proximity. They profoundly challenge the spatial organization of AKIS. This subject would deserve in-depth investigations that could not be carried out in this research. Already the analysis shows how some of the current changes in AKIS originate at the microAKIS level when new farmers' practices are stabilized and extended to other farmers via various types of exchange. This confirms the relevance of conducting observations at a micro-level to better understand actual institutional changes of AKIS, following work carried out in other sectors of activity (e.g. Thelen 2009).

Conclusion

Our findings confirm the methodological interest in analysing farmers' microAKIS. They highlight poorly known characteristics of farmers' practices, which concern both the variety of sources of advice mobilized and the limited number of reliable resources on which farmers can draw to innovate. They corroborate the results of other recent research describing the heterogeneity of the sources of advice used by different social groups of farmers and of the modalities of integration into AKIS (e.g. Klerkx et al. 2017; Cofré-Bravo, Klerkx, and Engler 2019; Stuart et al. 2018). The results also show that the categories traditionally used to describe advisory service providers are falsely universal. They are often associated in the literature with organizations where advice is the main activity; yet such organizations account for only a small percentage of the sources of advice. There is a very significant fragmentation of representations of what the organization of farm advisory service provision in France is all about. Because it is partially invisible (when considered only at macro-level), this fragmentation introduces huge misalignments between different views of what advisory services are: that of policymakers, that of providers, that of the beneficiaries, and that of the rest of society. These misalignments concern both the front office (who delivers the advice, under what conditions?) and the back office (who selects the knowledge used to inform technical and organizational change, and who controls its quality?). Ultimately, the use of these categories has important practical implications when deciding who is part of the AKIS and who is concerned by AKIS-related policies.

These findings also confirm the relevance of a theoretical approach that takes full account of the farmers' advisory practices in order to better understand the micro-foundations of institutional changes in AKIS. These new practices contribute to producing or reinforcing new rules that gradually impose themselves socially as norms, as shared ways of thinking the organization of agricultural advice without necessarily translating them into formal regulations. In France, they have tangible impacts, in particular the emergence of a small market for new types of advice, the development of new norms, and the legitimation of the increased role of upstream industries in the delivery of advice, in back office design, in the creation of new networks. MicroAKIS analyses also show that behind an apparent institutional continuity at the macro level, fundamental

changes occur that are partially invisible. This is the case when the continuity of free access to technical advice is actually concealing the fact that the costs of the service are integrated into a more comprehensive commercial relationship (sale of inputs, equipment, provision of other services, purchase of crops, etc.) that shapes its content.

These results are context-specific. However, they demonstrate that it is misleading to assume that a broad description of the structures of AKIS at national level is enough to design advisory policies. They call for more evidence-informed policy-making, based on a better understanding of real farmers' practices, of advisory providers' profiles, and of the various mechanisms of institutional change. Learnings from the French situation call for vigilance on specific issues that may have major practical consequences: content of the back office and its control, economic model of advisory providers, and new participants in the informal networks on which farmers rely.

Many studies on institutional change (Thelen 2009; Mahoney and Thelen 2010, 2015), including in France (Culpepper, Hall, and Palier 2006), have shown the political benefits of having the institutional changes invisible. Politically, it can be much more difficult to gain acceptance for reform by making rule changes explicit and negotiated, than by endorsing a change in the interpretation of existing rules. It may also be advantageous for interest groups that certain institutional transformations remain little debated. However, this invisibility has a cost. It can also be a source of growing inequalities between farmers in terms of access to the fundamental resource that is knowledge. Its consequences therefore need to be assessed. For instance, what about the hidden changes of the French microAKIS and AKIS? Has the apparent gratuity of advice provided by companies with other commercial objectives favoured the social acceptability of the content of certain advice that is given to farmers? Does a misrepresentation of the relative importance of actors in the provision of advice lead to the elimination of some actors from policy debates and negotiations on this topic, or on the contrary, to the overemphasis on others? Has the partial invisibility of the advisory role of firms upstream and downstream of agriculture hampered societal debates on the type of development models implied by the knowledge they disseminate? Has it contributed to strengthening their intangible assets? Answering these questions would require a precise analysis that is beyond the scope of this article. However, they open up a research agenda for institutionalist approaches to AKIS that would allow a more precise understanding of the mechanisms of their transformation.

Note

1. In France there are 101 'départements', which are administrative divisions that correspond to level 3 of the Eurostat 'Nomenclature of Territorial Units for Statistics' (NUTS 3).

Acknowledgements

The authors would like to thank Soungalo Ouattara for his contribution to the data collection, Liz Libbrecht for the English translation, Lee-Ann Sutherland and the reviewers for their helpful comments on the first versions of this document. They are also grateful to all those who responded to their many questions during the interviews and surveys.

Disclosure statement

No financial support that could have influenced the outcomes of this work has been received.

Funding

This work was supported by European Union`s Horizon 2020 research and innovation programme [Grant Number 727577].

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