

The components of the Portuguese agricultural knowledge and information system (AKIS) aligned to the EU-Agri-link project: an observational review/critique

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ABSTRACT

The major objective of this document is to present the advisory and extension systems, agricultural education and rural and agricultural research as it integrates with the Agricultural Knowledge and Information System (AKIS) in Portugal through a literature review of documented research including EU projects and first level data. The review also presents and describes the data collected surrounding the regions, Douro and Lezíria do Tejo in the Agri-Link research project related to innovation and the social and economic networks. The overview reflection is composed of seven parts: 1) An Introduction and Research Methods; 2) Agri-Link Project Results: Farm Advisory and Extension Systems and Extension Methods for the Lezíria do Tejo and Douro Regions with Triangulation Considerations; 3) The Approaches for Agricultural Extension in the Two Project Regions; 4) Perspectives on the Transformation of Agricultural Extension Services in the AKIS; 5) AKIS Considerations 6) Conclusion and Policy Implications for Portugal and References. The secondary purpose of the document is to describe the AKIS components in Portugal as well as the pluralistic agricultural extension system. The overall strengths and weaknesses in the Portuguese AKIS presented through past and present research about the agricultural reality. The EU-FAS (farm advisory system) implementation process by the Directorate of Agriculture and Rural Development (DGADR) is shown as well completed. The review contradicts the political reach of the EU-FAS in Portugal for small scale family farms that reflects many CETRAD and UTAD research projects.

Keywords: agricultural extension approaches, AKIS, small family farms

INTRODUCTION AND RESEARCH METHODS

Portuguese agriculture and rural areas are confronted by the reorganization of the agricultural sector at social, economic, cultural and political levels. The rural territorial regions in Portugal are facing challenges related to low-density populations, weird climate events, decrease in the number of farms and an ageing farm population. The general rural family farm population require greater competitiveness, entrepreneur spirit, social capital development and organization and a domination of the food chain marketing process, specifically to increase exports. The recent broadening of the scope of the EU-FAS (farm advisory system) program to include improved forest management and forest fire prevention is a positive starting point for Portugal, but still not adequately attending small scale family farms (ADE-ADAS- AGROTEC – Evaluators-EU, 2009). Small scale family farms require sustainable support in the agricultural sector. The concern for an equitable Agricultural Knowledge and Information System (AKIS) stimulates the analysis of the framework for this paper. The present paper is a rework and revision from an earlier document not published (Koehnen, 2021).

In this section, the agricultural extension services and farmers in the two distinct regions, Douro and Lezíria do Tejo of the Agri-Link project addresses the decision-making process for farmers and the advisory role in this process to adopt innovations (Madureira *et al.*, 2019). The description of the functioning for the Agricultural Knowledge and Information System (AKIS) is considered as a relevant aspect for these two regions, as well. The review provides information about the material and methods used for the analysis of the regions, while accenting an historical representation of the relationship to the past agricultural/rural extension concept. A supplemental analysis includes the agricultural education and research components within the Portuguese AKIS.

First, a general framework will outline the updated concept and definition of farm advisory services in the two regions. The EU-FAS (Farm Advisory System) in Portugal advises farm holdings on land and farm management associated to good agricultural and environmental practices (ADE- ADAS- AGROTEC – Evaluators-EU, 2009). An additional

component is the training and qualification of the farm advisors to carry out the EU-FAS. The agricultural extension approaches can be considered as a pluralistic network of private and public entities involved in training, farm advisory services, good practices, on-farm trials, demonstrations and research that uses a blended approach to advising and resolution of farm problems (Birner *et al.*, 2006; Swanson, 2008; DGADR, 2011, 2012, 2016).

The agricultural extension system benefits from active innovative farmers that share experiences and co-produce solutions (co-production of knowledge/social learning) while sharing with other farmers through information sharing and exchange, using information and communication technology (ICT) and individual contacts to farm holdings in their region through the Farm Based Organization (FBO) and private sector (Jensen & Jankoski, 1993; Madureira *et al.*, 2019). The farm advisory services clearly perform as a component in the Portuguese AKIS as well, but is represented as the pluralistic agricultural extension system in the figure to be presented in a later section.

A public authority or the Directorate of Agriculture and Rural Development (DGADR) governs the EU-FAS in Portugal. It oversees 295 designated bodies or entities that are primarily represented by FBOs. However, the most relevant designated entities are the major agricultural national level unions and federations of farm-based organisations, such as Confederation of Portuguese Farmers (CAP), the National Confederation of Agriculture Cooperatives and Farm Credit Cooperatives (CONFAGRI), and the Confederation of the National Agriculture (CNA), the later with a focus on family farms. It also comprises the Association of Young Farmers of Portugal (AJAP) and the National Association of Organic Farmers (AGROBIO). However, one of the novelties of the new Portuguese EU-FAS is the inclusion of the forest owners and forest holdings, represented by their national level associations, such as the *Forum Florestal* and the Portuguese Forestry Association (FORESTIS) (DGADR, 2016).

These entities oversee a network of local farmer and forestry producer associations in Portugal. The certification process to become a designated entity was completed through an evaluation of the FBO proposals presented at a public call and next

selected by a working and monitoring committee. This evaluation articulated to the FBOs competencies to implement the advisory aspects for agriculture and forestry service (SAAF). In addition, the Directorate evaluated the fiscal and social security financial conditions of the entities (Baptista *et al.*, 2014; DGADR, 2016).

These FBOs have 1165 advisors that serve more than 2995 farmers/year¹. These FBOs will carry out the SAAF in Portugal. The FAS target groups are cross-compliance farmers (who co-finance the costs of the services). They are, for example, newly installed young farmers, forest owners, and farm and forestry holdings that received 2020 funding in the form of the Rural Development Programme (RDP).

The early participation in the cross-compliance FAS activities from 2008-2016 in Portugal involved only about 3% of the farmers in Portugal (Baptista *et al.*, 2014) and it is less today. In the two Regions highlighted in this paper, the FAS topics are directed at efficient use of water through water sensors use in irrigation (water framework directive) and eco-functioning farming landscape for the enhancement of ecological infra-structures (agri-environmental measures). The FAS measures or themes identified by the farming systems in the two regions, Douro and Lezíria do Tejo represent an intensification of production as well as ecological concerns for rural development (Sadik, El-Solh & Saab, 2014) and in most situations a farm holding capable of taking advantage of these packages from the agricultural advisory service (Madureira *et al.*, 2019).

On the other hand, the small family farms (less than 10 hectares) and farm workers have limited benefits from the EU-FAS in Portugal. This farming style with a smaller dimension tends to be represented by extensive farm holding, with over 20% dependence on outside farm production sources of income (Baptista *et al.*, 2014). The total number of farm holdings registered in Portugal, 2019 is about 290,000 with an average of 13,7 hectares. This is 15,000 less farm holdings than in 2009 and is a reduction of 4.7% (INE, I.P., 2021).

¹ These figures were presented on 21 October 2020 by ADE evaluator at the Agri-Link long distance meeting of EU-FAS.

Second, the recent management of the agricultural extension services in Portugal was investigated, observed and assessed through the Portuguese case studies in the Agri-Link project. The desk work and the Portuguese Agri-Link case studies constructed information about farmer adoption of the innovations in two regions through interviews. The Agri-Link case studies were carried out through farmer interview questionnaires, as well as interviews with key stakeholders within the farm advisory services describing the interactions in the Douro and Lezíria do Tejo regions (Madureira *et al.*, 2019). The triangulation analysis of first tier data and variables in earlier research studies focused on agricultural education and extension case-study research activities, recognising, the importance for an historical perspective (Stake, 1995; Yin, 2009).

The two regions from the Agri-Link project, Douro and Lezíria do Tejo describe the present advisory service for agriculture and forestry (SAAF) by the DGADR. The framework analysis will explain the agricultural extension and educational component of the AKIS and why the Agri-Link data alters this scheme. The SAAF at the national level and within the two regions will be elaborated in the critical framework analysis from the results. An historical perspective leading to the present agricultural advisory system will be described and discussed. Also, a description of the role of farmer training will be presented from a holistic viewpoint and recognize the present SAAF certification process for training. The role of the Agricultural University, in this pluralistic agricultural extension system establishes a clarification of the various components in the AKIS. The AKIS university component describes the agricultural education and training, agricultural research and community outreach service as well as the transformational role of the subject matter specialist in these Agri-Link project regions through an assessment.

The agricultural extension approach in Portugal, prior to the privatization process, has been described as a general public ministry-based agricultural extension approach that functioned until the mid-1990s. The public regime was initiated in the 1970s (Cristóvão, 1986) and was overtaken by the privatization process. In the triangulation concern, additional studies (Koehnen & Gaspar, 1990;

Koehnen & Portela, 1993; Koehnen, 1997) surveyed directors of agrarian and forestry zones prior to privatization, and they identified farm and forestry advisory competencies (knowledge, skills and attitudes) considered important. The studies also identified the administrative duties of these agrarian and forestry zone directors aligned to the agricultural and forestry extension approach. The competency topics for these agents were identified as project management; socio/cultural capital capacities; understanding of human behaviour; participatory activities; appropriate technology; farming/forestry systems; communication; extension administration; programme planning; programme execution; advisory service evaluation and monitoring and social capital organization of young farmers (Koehnen & Gaspar, 1990; Koehnen & Portela, 1993). The survey research results were then aligned to the curriculum development of an educational rural extension and development master's degree at an agricultural university that upgraded the qualifications of both public and private rural development advisors (Koehnen & Cristóvão, 1993; Koehnen *et al.*, 1993). This university qualification scheme was also associated to the preparation of subject matter specialist (SMS) in integrated pest management (IPM) (Koehnen, 1994b). The subject matter agricultural specialist played a vital role within the two regions in the Agri-Link project as well.

The vocational technical training in agriculture both nationally and at the two regions has been carried out by the vocational agricultural secondary schools as well. Koehnen (1994a) assessed this vocational/professional educational system for new entrant preparation and quality of training. The study evaluated educational components, practical training and hands-on strategies. It also identified the employment location of these graduates as categories such as farming, farm managers or agri-business (23%); agricultural cooperatives/other agricultural institutions (10%) and farm advisory service (7%). At the time of the survey, over 50% of the graduates continued their education. The courses offered in these schools range from topics in horticulture, viticulture, agricultural production, animal production, forestry and natural resources and farm management that play an important role in preparing students for agricultural employment or entry to farming. The Douro and

Lezíria do Tejo regions have farmers that graduated from vocational agricultural secondary schools as identified by the Agri-Link case study (Madureira *et al.*, 2019).

Today, these vocational/professional schools have complemented specialized courses for certification of advisors that are developed in partnership with Polytechnic Agricultural Schools. The certified training courses organized by farm organizations such as the CAP, CNA and CONFAGRI and other FBOs have been directed toward the farming community and the advisors. Many additional training activities lie outside the EU-FAS themes that are included in the training programs. In addition, these FBOs have used agricultural training centres for their certified training courses. A blended training and learning scheme offered to farmers and advisors associated to attaining competencies (Koehnen & Portela, 1993; Madureira *et al.*, 2019).

In addition, in Portugal, distant learning platforms have been constructed in the Portuguese language through, for example, the EU-RURAL/ITER project for new farm entrants and women. The training topics and modules fall within organic agriculture, bio-diversity, direct selling, multifunctional activities, farm management, cross-compliance and animal welfare (Koehnen *et al.*, 2013). The RURAL/ITER project developed instructional materials in the form of modules and case studies for new entrants and women. A needs assessment questionnaire was responded by training specialists in the regional agricultural directorate, agricultural universities, vocational agricultural schools and training centres identifying training themes for the project. These respondents identified the relevant training topics for distant learning and ICT methods. This demonstrates the relevance of a mixed form of advisory/educational methods, best practices and AKIS social capital development in the teaching-learning process for farmers that includes long distance learning and was corroborated by (Madureira *et al.*, 2019) and other studies (Koehne, *et al.*, 2013; Almeida & Viveiros, 2020).

At the Douro region, advisory services and training is associated to the Association for Viticultural Development in the Douro Valley (ADVID). ADVID is a designated entity for EU-FAS and advisory services. They have been involved in plant protection

experimentation and farm advisory tasks since its foundation (Cristóvão *et al.*, 2002). The innovation under the present study was introduced and developed in the region by ADVID, a vine growers association that is a FBO focused on advisory service, R&D and network activities. ADVID supplies technical support to members and non-members in the area of integrated vine protection through individual visits, leaflets, farmer training and field demonstrations. The technical support to the Enhancement of Ecological Infrastructures (EEIs) is also delivered by request, but requires sharing the costs (Madureira *et al.*, 2019).

The association has conducted advisory group actions to disseminate and to support the implementation of the EEI among its associates and maintains strong linkages to R&D and their subject matter specialist were qualified at UTAD. ADVID promotes technological innovations to improve the quality of grape production from the vine (viticulture) and enology training to produce wines, second to none. In this region, there are high numbers of farmers with university degrees in agriculture and secondary diplomas from professional/vocational secondary schools. There is also interest in supporting the export of table bottled wine and port wine. The regional AKIS builds on the FBOs similarly to other regions in the country, although with a strong presence of the private agri-industry and upstream industry (suppliers of inputs, equipments and technologies) (Madureira *et al.*, 2019).

An intensive farming system is found within the Lezíria do Tejo region and these innovative and agriculturally educated farmers are better suited to take advantage of the AKIS through human and social capital skills. It is apparent that the FBO and consulting firms that are linked to an advisory service in this region complement the regional farming advisory service. The fact that the FBO was created by a group of innovative and well-educated farmers within the intensive style of agricultural production probably explains its continuous interest for knowledge and innovation. Hence, Lezíria do Tejo region is an innovative region for precision farming and smart farming, largely headed by AGROMAIS. Given the historical importance of irrigation in the region, the FBO also adopted the introduction of soil moisture probes (intelligent

irrigation sensors) along with other technologies to increase water use efficiency and to optimise the irrigation of specific crops.

The first “probes” were introduced by advisory input services in 1998 and were labour intensive, hence requiring a lot of farmer input and time and unfortunately provided limited results. The FBO tested this equipment for 4 years with on-farm testing, while learning about the advantages and disadvantages. The adoption of the intelligent irrigation sensors, known as soil moisture probes, in 2008 launched an ICT innovation dynamic for farmers, who were informed about moisture content by a mobile phone app. It focused on irrigation optimisation of water use headed by the FBO. It has since collaborated closely with high technology developers, start-ups and companies developing software for the probes in the development, transfer and uptake of innovations (Botha & Atkins, 2005). Hence, this is a case where “conventional” advisors played a fundamental role in the introduction and development of the innovation, by working with the leading technical sector in the design and supply of the technology, aiming at the best-fit for the farmers’ needs, and still consider their agri-ecological land area (soils and climate), crops, and irrigation system. The introduction of an agri-environmental measure (Measure 7.5) in 2015 paying farmers for efficient irrigation water use increased the adoption of the probes by the farmers, although the design of the FAS measure did not coincide with the adoption process for farmers according to the opinion of the interviewees, and including large dimension farmers, who chose not to accept the measure. In this region, there were also high numbers of interviewed adopter farmers with university degree in agriculture or vocational training in agriculture (Madureira *et al.*, 2019).

AGRI-LINK PROJECT RESULTS: FARM ADVISORY AND EXTENSION SYSTEMS AND EXTENSION METHODS FOR THE LESÍRIA DO TEJO AND DOURO REGIONS WITH TRIANGULATION CONSIDERATIONS

The regional Farm Advisory system for Lezíria do Tejo can be aligned to an advisory input supply service (UNDP, 1991) interested in profits. In this case, the private sector input system involves

sophisticated technologies associated to smart farming and the cost of technical advice is borne by the farmer through the purchase of the input. The private sector input system lacks impartiality in the negotiation process. The transfer and adoption of the technology does fit well for larger scale farmers. The decision-making process for inconsistent small-scale farming system could have an advantage with a fragmented and pluralistic agricultural extension approaches to assist in the adoption or non-adoption of the precision technology.

The region, in general, has a farm holding base or farming system that was prepared to take advantage of science-based technologies associated to a precision farm advisory service using subject matter specialist and demonstrations. The input supply system supplies these productive continuous farming systems with few economic challenges related to precision farming and the cost of the input, while the small-scale family holdings would be troubled by the cost of the technology (input) and confront a different adoption process as social and economic considerations affect their livelihood decision.

The characteristics of the agricultural extension approach aligns to the economic market, where the purchase price of the input and advice is covered by the farm holding. The advice is not always concerned with management and economic problems or other general issues, for example, and assistance

is associated to a private consultant and the regime that uses ICT, farm visits and on-farm demonstrations to adopt and accept the technology.

The Douro region has a farm advisory system that involves contracting for the service with a payment made by the holding for the EEIs. This farm advisory regime can take credit for instilling a positive attitude toward sustainable environmental practices on the participating farm holdings as well as influencing the smaller neighbouring holdings. Once again, this region represents farm holdings that can take advantage and make demands of the SAAF programme. The farm advisors in this regime play the role of subject matter specialist. The tools used are ICT, on-farm experimentation and training programmes for the producer and advisors. The SAAF aligns to this advisory regime that minimizes environmental degradation in the Douro Valley, while sustaining the UNESCO World Heritage Region. The Douro region has man-made terracing from centuries past, bio-diversity filled escarpments, palaces, monuments, churches etc. in line with the sustainable environmental practices or measure by land holdings under various dimensions (Madureira *et al.*, 2019). Today, the terraces are constructed by machines that require project planning and monitoring to avoid non-sustainable environmental practices.

Interpreting the figures for the Lezíria do Tejo region displayed in Figure 1 will clarify the advisory

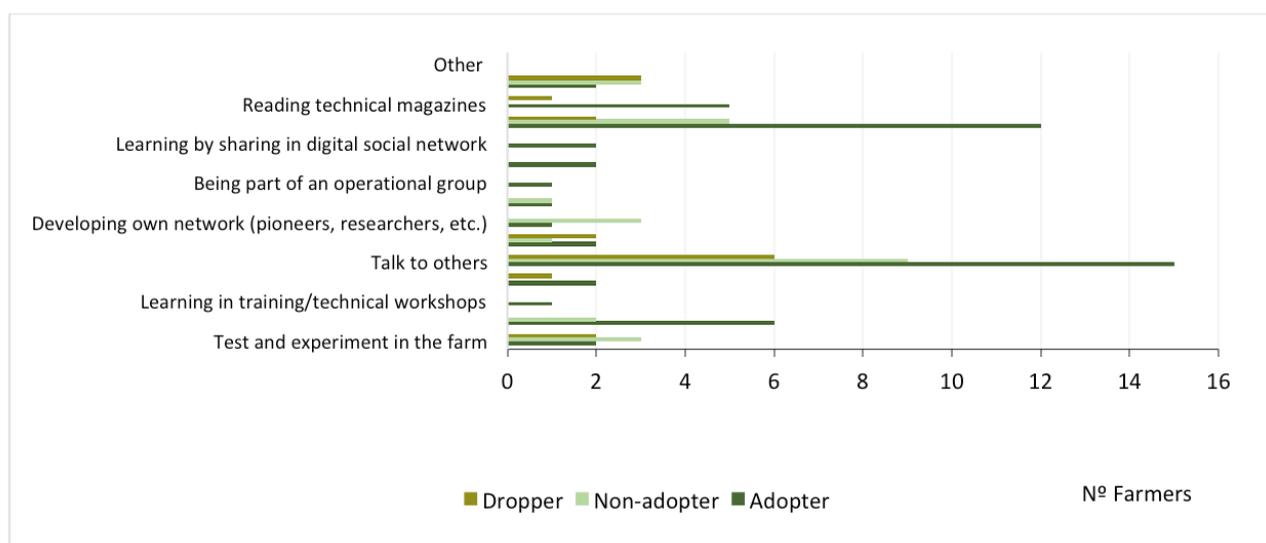


Figure 1 - Most important activities to obtain knowledge and skills to manage the farm. Source: Madureira *et al.* (2019), p. 65.

and training methods preferred by farmers in this region. Figure 1 gives the preferences of the adopters, non-adopters and droppers for the educational, training and advisory activities to obtain knowledge and skill competencies to manage their farms. The adopters are very active in acquiring skills and knowledge using a variety of methods and learning activities such as ICT, telephone calls, reading journals, face to face advice, farm visits, agricultural fairs, on-farm experimentation and certified farmer training workshops. In fact, the adopters mentioned all these activities to obtain knowledge and skills shown in Figure 1. The non-adopters selected activities such as visit agricultural fairs, ICT, publications, farm visits

to neighbours, talk to others and on-farm experiments. These methods are traditional agricultural extension learning activities approaches with the exception of SMS/ICT.

Figure 2 identifies the entities that provide farm advice for the adopter. They identified the national public sector, universities, FBOs, private sector input supply system, high-tech start-ups and private independent consultants aligned to a fragmented agricultural extension system.

Figure 3 show that the non-adopters identified fewer entities providing advice for them. The private sector input entities used ICT and individual

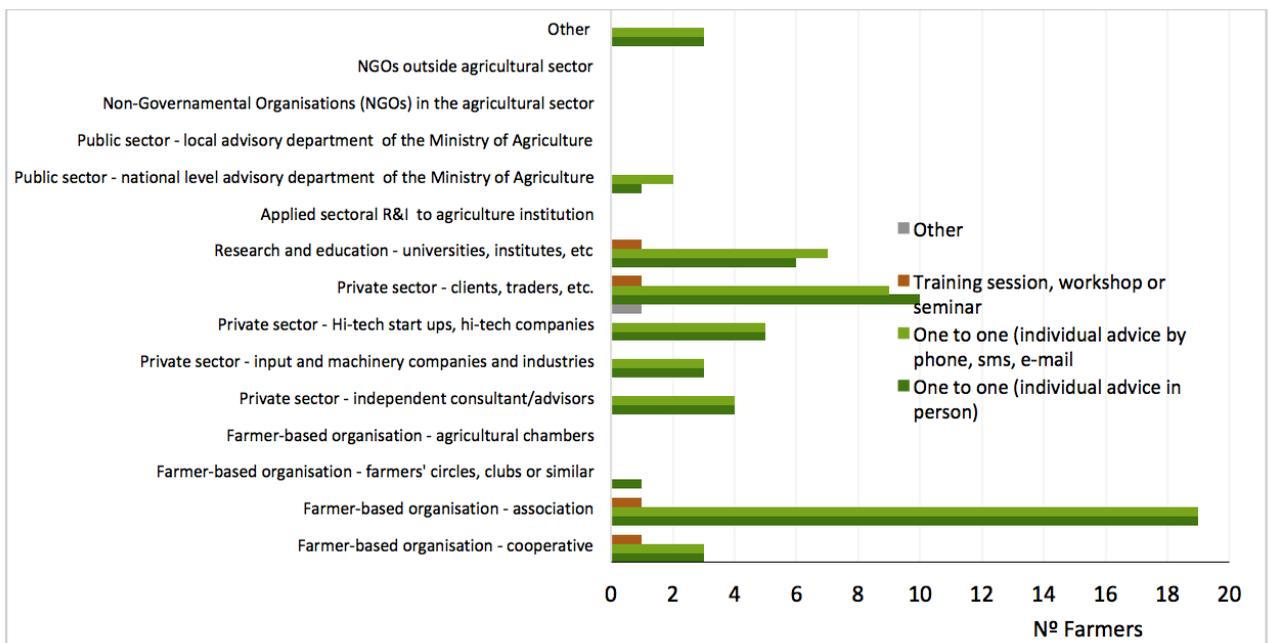


Figure 2 - Who provides farm advice and how (adopter). Source: Madureira *et al.* (2019), p. 66.

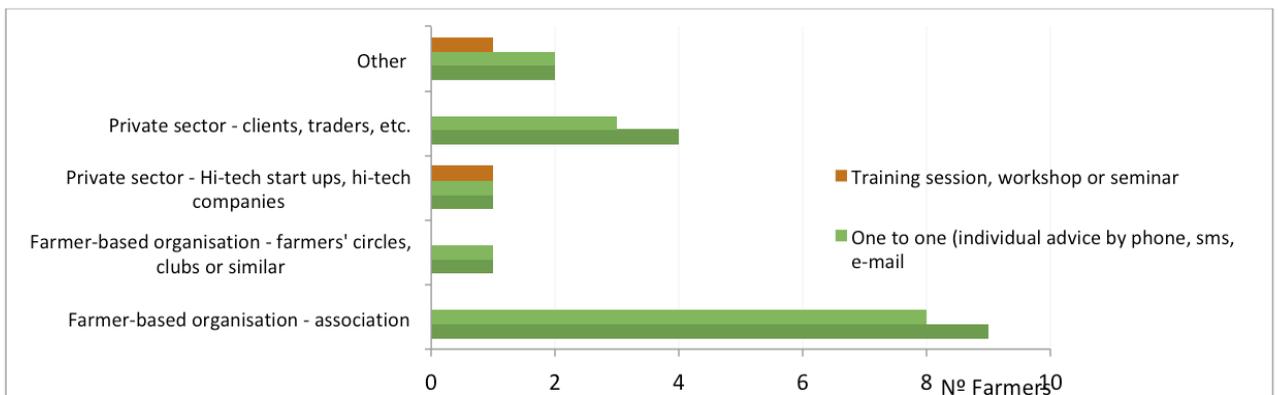


Figure 3 - Who provides farm advice and how (non-adopter). Source: Madureira *et al.* (2019), p. 66.

advice. The FBOS were also supplying advice that used group methods such as farmer meetings or circles, and training activities such as workshops and seminars.

Figure 4 represents the responses from the Douro region and the preferences of the adopters and non-adopters for the training and advisory activities to obtain knowledge and skill competencies to manage their farms. The Douro adopters in a similar vein to the Lezíria do Tejo adopters are very active in acquiring skills and knowledge using a variety of methods and learning activities such as ICT, telephone calls, reading journals, face to face advice, farm visits, agricultural fairs, on-farm

experimentation and certified farmer training workshops. In fact, the adopters mentioned all the activities to obtain knowledge and skills found in figure 1. The non-adopters selected activities such as visit agricultural fairs, ICT, publications, farm visits to neighbours, talk to others and on-farm experiments.

Figure 5 identifies the entities that provide farm advice for the adopter. They identified the national FAS, agricultural university and polytechnic agricultural institutes (certified training partnering with vocational secondary schools in the region), FBOs, private sector input supply system and independent consultants.

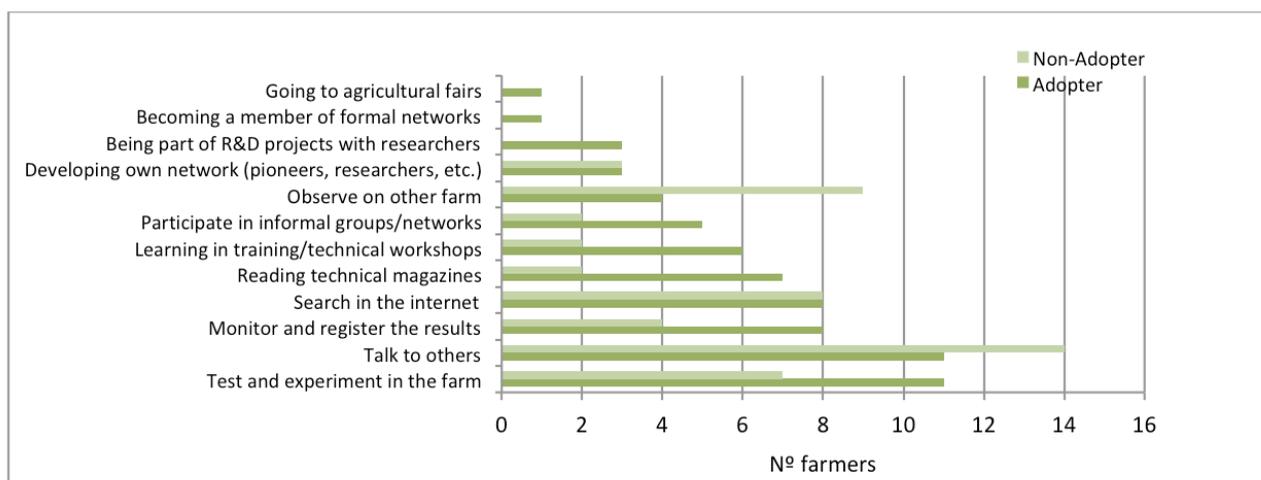


Figure 4 - Most important activities to obtain knowledge and skills to manage the farm. Source: Madureira *et al.* (2019), p. 34.

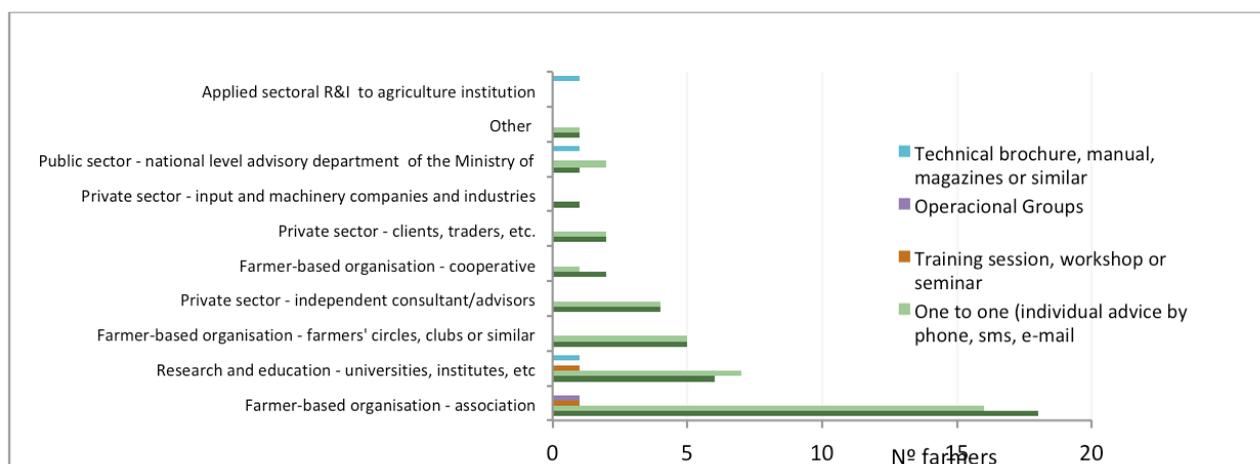


Figure 5 - Who provides farm advice and how (adopter case). Source: Madureira *et al.* (2019), p. 35.

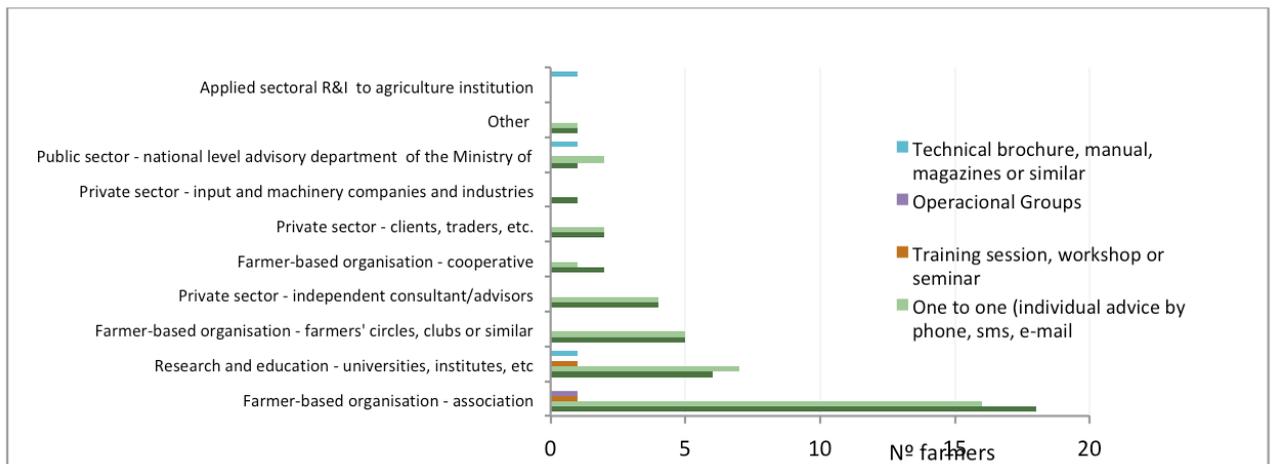


Figure 6 - Who provides farm advice and how (non-adopter case). Source: Madureira *et al.* (2019), p. 35.

Figure 6 show that the non-adopters identified fewer entities providing advice as is the case for Lezíria do Tejo non-adopters. The non-adopters acquired publications from the public sector for learning. The private sector input entities used ICT and individual advice. The FBOS were also supplying advice that used group methods such as farmer circles, training activities such as workshops and seminars.

In both regions, the adopters and non-adopters used a blended learning regime in acquiring information and knowledge for the management of their holdings. The farm advisory service and training regime is a fragmented agricultural extension system in both regions. The pluralistic agricultural extension approaches and training regime has its roots in the historical agricultural extension regime found in Portugal as it transformed to the privatization process. Clearly, the adopter respondents from these regions have higher levels of agricultural education than the majority of farmers in Portugal. In general, the national agricultural sector is represented by the extensive family farming production system. In an opposite scenario to these two region case studies, the majority of agricultural holdings in Portugal (>60%), the managers have completed the 1st cycle of basic education as 4 years of education (Baptista *et al.*, 2014).

THE APPROACHES FOR AGRICULTURAL EXTENSION IN THE TWO PROJECT REGIONS

In this section, a description of the evolution of the supply of agricultural advisory services for both regions, based on the findings from the Agri-Link project is discussed. The comparison of the two regions reveals a similarity in the importance of the subject-matter specialist, as well as many farmers with higher agricultural degrees or diplomas from vocational secondary schools in their region. The FBOs are quite dynamic and active to solicit aid for quality performance of the farm advisory service regime. The dynamic and well-placed farmers represented at these organizations are knocking on the door of the EU-FAS authority (farmer-led) and lobbying for financial assistance to benefit the advisory service regime associated to EU measures. The exclusiveness of the supply of advisory services in the two regions benefits a particular farm holding system not necessarily representative of a majority of farm holdings in Portugal.

The region of Lezíria do Tejo, where the innovation is location-specific associated to the irrigation production system and where the farmers are members of the advisory input service/supplier entities is documented. The suppliers sell their inputs (sensors and advice) to the farmers in the region. The agri-economic and agri-ecological conditions in

this region favour an intensive farming style with many of the participating farmers educated at agricultural universities and vocational secondary schools. The type of advice is related to farmers, who own the supplier and demand-led. The qualitative interviews classify the innovative farmers as actively sharing experiences and experimenting with the innovation and requesting inputs to facilitate a co-produced solution. The advice is also disseminated in the form of ICT, but other methods such as training and face to face contacts and farm visits are associated to these farmers, who are interested in additional themes such as bookkeeping, while an active subject-matter specialist supplies science-based technology to the FBO through research and training.

Innovation transfer and dissemination happened from awareness to adoption often by FBO members, who are active and dynamic farmers. They assisted in triggering the adoption of the innovation. The private input supply sector initiates the process for innovation adoption through the sale of inputs, equipment and advice. These farmers demand a science-based technology in the form of inputs and advice by ICT methods and farm experimentation. The private sector input supply contribution to the FAS is interactive, while furnishing advice about the sensors or other inputs that are purchased by farmers. These private sector input suppliers also use individual, group and mass media (ICT) to generate interest and awareness to the farmers for their decision-making process of accepting or not the innovation.

In the Douro region, the farmers and private capital own the advisory service regime. A contracting service is functioning efficiently for the Douro region. The ADVID is a dynamic and farmer-controlled organization that charges a fee for the advisory service and training activities. The dynamic members interact strongly in the regional AKIS with the support of subject-matter specialists from UTAD, a territorial placed agricultural university. The ADVID is a demand-driven farm advisory service system from the viewpoint of the participating farmers, who often have university agricultural degrees and/or diplomas from vocational secondary agricultural schools. They actively lobby the EU-FAS to support their region and wine growing system. These dynamic leaders in

the ADVID have been recognized by their competence and concerns for the ecological and diversity protection in the focus region. These concerns are balanced by rural development and environmental and ecological protection for the region as well as the success stories for the production of quality wine for export. This product and the investment in the Douro valley ecological landscape is associated to increased wine tourism as well. More importantly, it has limited the environmental damage and protects ecological diversity (Madureira *et al.*, 2019).

PERSPECTIVES ON THE TRANSFORMATION OF AGRICULTURAL EXTENSION SERVICES IN THE AKIS

In this section, the overview addresses findings about the agricultural extension and education regimes, and the private sector advisory role. The level of agricultural education at the farm holding in these advisory regimes establishes a link to pre-service training through agricultural education and training activities. This training preparation reflects the rural development success at the regional and national level. However, the role of in-service training has been documented for FBOs members and advisors in these regions, as well. This in and pre-service training for the learning of competencies and skills for farmers and advisors is linked to the traditional actors and should include new players as well.

These advisory service systems function well with the agricultural educated farm holdings that represent an intensive farming system driven by an acceptance of science-based knowledge and technology. The region suppliers are an element in the sub-system of the Portuguese AKIS identified in the past as agricultural extension and in this research project, it is referred to as an agricultural farm advisory service. In each region, the balance of power for decision-making in the flow of recommendation lies within the farmer component of the AKIS. The general farm holdings need to be better integrated in the policy framework of the EU-FAS in Portugal.

The regions are represented by the intensive farm holding, but problems of exclusion/inequalities to

access circle groups and farm visits has been lessened by innovative farmers sharing information, knowledge and science-based technology with their neighbours within the territorial proximity to other farmers.

A public authority or the Directorate of Agriculture and Rural Development (DGADR), the EU-FAS in Portugal oversees the designated bodies or entities that are represented primarily by FBOs. The two designated entities in the Agri-link focus regions have interactions or relations within the AKIS public and private components surrounding the agricultural extension, education and agricultural research sub-systems.

The back-office activities for these FBOs (ADVID and AGROMAIS) are associated to the agricultural research sub-system such as on-farm experimentation, agricultural research through subject-matter specialist and the transfer of science-based technology. In the decision-making for adopting the innovation, there is a flow of tested recommendations to the FBO advisors and farmers and back-stopped by agricultural researchers (Madureira *et al.*, 2019).

In addition, they are concerned with qualified and certified training for their advisors and farmers. This is connected to farmer-led problem-solving activities through both ICT methods and workshops with in some cases subject-matter specialist. The certified training component for both the advisors and farmers falls within the agricultural education sub-system (Polytechnic institutions). The back-office activities also involve the improvement of networking within the AKIS by promoting and training facilitators (Sutherland *et al.*, 2016). The Strengthening of inter-organisational communication in the AKIS contributes to relevant meetings between entities, strengthens communication among the entities and promotes a market driven approach, decentralized system and farmer-led focus (EIP-AGRI, 2020); (Swanson, 2008). And, should promote the involvement of less advantaged farm holdings in the governance of these FBOs. In closing, the monitoring and evaluation of back-office activities for a farmer-led process by the public authority requires further development and strengthening (Koehnen, 2015).

AKIS CONSIDERATIONS

The AKIS scheme (see Figure 7) needs to consider an update as a result of the data from the Agri Link research project in the two regions (Douro and Lezíria do Tejo). The AKIS scheme² (Figure 7) should include two additional components such as: 1) private sector input supply system and consultancies (Almeida & Viveiros, 2020) and 2) a public policy, regulations and measures component for greater transparency in the construction and representative engagement of rural and urban populations affected by a broad-based rural development process (Cordovil, 2021).

The Directorate actors are linked to such areas as policymaking, regulation and monitoring research, information, education and training. The FBOs have been the beneficiaries of EU-FAS policies, regulations and measures. These entities are also involved with farm agricultural extension education, training, and information and innovation transfer. The private sector input supply system (innovation transfer as well) links to the industries providing farm equipment and inputs, or the consultancy firms, usually small, that deliver services in such areas as project development (and farm investment plans), farm accountancy, and training (Baptista *et al.*, 2014). This fragmented advisory and extension system plays a role in minimizing inequalities for a segmented farming population in rural areas.

In both regions, the Agri-link project described many farmers in the FBOs with agricultural education degrees or vocational/professional secondary school diplomas. A national ministry has supported a public policy favoring these educational programs aligned to the national farming community, woman and new farm entrants. These educational programs found at agricultural universities, polytechnic colleges and vocational/professional schools (theoretical and practical

² Main actors of AKIS from Pro-AKIS study:

The Portuguese AKIS involves a set of actors performing a variety of functions, namely: policymaking; regulation, monitoring and evaluation; research; education; training; information, extension and consultancy work.

In Portugal, remnants of the public extension system can be found in the Regional Directorates and the EU-FAS (Baptista *et al.*, 2014)

on-hands learning) have been directed at farmer sons and daughters and new farm entrants. Both regions, are served by these publicly funded agricultural educational institutions. These AKIS institutions within the agricultural education sub-system can mitigate the EU-FAS that serves 2995 farmers/year in Portugal, by a) supporting the intensification of scientific agricultural production for the small-scale family farm, b) focusing and supporting new entrants, young farmers and rural women and c) facilitating small scale family farm training. In addition, a recent presentation by a young farmer pointed out that this pre-service education is not enough. Young farmers demand advisory services to accompany and give advice to their European financed proposals during the lifetime of the project (Animar, 2021).

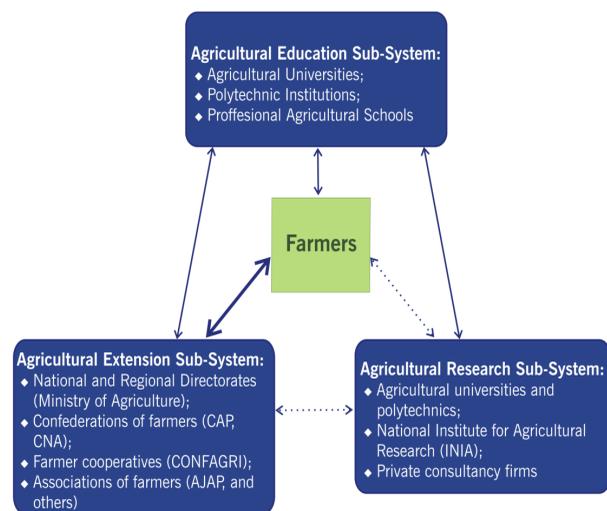


Figure 7 - Portuguese AKIS Scheme. Source: Baptista *et al.* (2014).

CONCLUSION AND POLICY IMPLICATIONS FOR PORTUGAL

The Portuguese AKIS, where the agricultural extension system is a sub-system, is highly fragmented with a high number of organizations involved in the supply and delivery of farm agricultural services and training. This fragmentation requires improvement in the coordination and strengthening of the inter-organizational communication process by actors and stakeholders that can be

facilitated at the national and regional level. The coordination of inter-organizational communication should be strengthened for greater representative engagement of the stakeholders (Koehnen, 2015). The policy reformulation considerations are investment in a search for pluralistic extension systems such as found in India to strengthen equitable AKIS policies for family farming operations in Portugal (Singh *et al.*, 2013). The recognition of a strategic pluralistic agricultural extension plan should be a focus for all farming systems in Portugal. A more intense monitoring and evaluation of the agricultural services needs to be strengthened to carry this out.

The majority of farmers in Portugal (more than 60%) can be identified within an extensive family farming production system that is friendly to the environment, but has low levels of productivity and the low utilization of chemical inputs. They have an important position to maintain and use practices for the conservation of natural resources in their communities and provide these communities with food security at local market. These farming systems require additional focus on the farming system approach (Norman, 1980) to address and identify agricultural policies for this social system. The duality in the socio-technical regimes from this group and the innovative farmers in the Agri-link project analysis are recognized as a natural transformation for these innovative farmers. However, the structural dualism requires specific agricultural policies to address these historical farming system differences to strengthen social and human capital development for these resilient family farms in the Portuguese social-economic environment. Agricultural research universities, polytechnic colleges and professional/vocational schools can play a role in this discussion along with the designated entities in EU-FAS as well as the farmers. These interactions can facilitate the national and the regional rural development ministries to develop a farmer-led policy development and adaptation for family farms.

The vocational/professional educational program and university training prepares young farmers and new entrants to strengthen their decision-making capacity (Welch, 1970; Hayami & Ruttan, 1971; Huffman, 1974). Huffman states “the assumption is that schooling augments skills that facilitates

the gathering, processing, and interpreting of information, thereby enhancing allocative ability, reducing uncertainty, and contributing to efficient decision-making” (1974, p. 85). The document describes that pre-service education or educational qualification (human capital) has influenced innovative farmers in adopting or not the innovations in the two Agri-link regions in Portugal. Additional reflection and research to carry out case studies from small family farming production systems requires intensification through agricultural research projects focusing on this research population. This case-study assessment could enlighten policy makers of the importance for strengthening decision-making capacity, thinking skills and social and human capital development for all small farm family farm members (Lima & Koehnen, 2019).

The success of ICT in Agri-link projects in the two regions establishes a path for using ICT farm advisory service for other extensive agricultural production system such as the family small-scale farm holdings. It might also consider e-learning from the experience gained by EU-RURAL/ITER project case and other examples from the scientific literature, in order, to complement the classical forms of knowledge dissemination, such as farm visits and method or result demonstrations (Kolshus *et al.*, 2015). The e-learning platforms should be targeted to the majority of family farm holdings to disseminate and open discussion about problems associated to climate change and other topics (FAO, 2013; Bayer, 2018; Lima & Koehnen, 2019).

The mass media communication methods to inform and make farming groups aware of new measures and policies as well as appropriate technology and innovations is important. All actors and stakeholders in a fragmented socio-technical farming regime should be engaged in identifying production and marketing problems. The farmer-led assessment will strengthen and improve all farming systems outreach approaches through mass media communication methods. The mass media tools are appropriate to develop quality radio broadcasts, other communication formats and e-learning platforms that highlights the conditions and appropriate innovations for these extensive family farm production systems. Policies should strengthen the capacity of the vocational

agriculture and tertiary agricultural education institutions to support and invest in the generational development of young people and new entrants in agriculture for future installation in farming and forestry enterprises (Koehnen *et al.*, 2013; Schulleri *et al.*, 2013; Austin, 2014; Pollnow, 2021).

There is a weakness of monitoring and evaluation of the Portuguese FAS and agricultural extension systems including the AKIS inter-organizational summative relationships. The process should be more continuous so as to identify the positive and negative aspects associated to the pluralistic farm advisory service regime in Portugal and discover how it can strengthen dialogue by the distinct and pluralistic actors in the sub-systems.

The performance of the farm advisory system has shown to be positive for the decision-making process of adopting innovations in the two regions of the Agri-link project. By following the flow of the adoption process, the study identified the relevant farm advisory service tools and methods most used for the farming community. The flow of tested recommendations that are co-produced or not; are science-based innovations and should be disseminated. The role of a demand driven advisory system would relate to science-based innovations representing a need by the farming system.

The EU-FAS in Portugal has the SAAF mode that includes forestry holdings. In the Agri-Link project, there were no regions investigating these forestry holdings. In the future, a research project should investigate the AKIS scheme for small forestry holdings involving the sub-systems: agricultural and forestry extension service, agricultural and forestry education and forestry research. Also, the actors involved in the input supply system and their role in disseminating information and technologies for this production system should be investigated. Can the research discover if forestry innovation is a viable foundation for sustainable and adaptive development for greater resilience for these systems (Meybeck *et al.*, 2012; Katila *et al.*, 2020, Miller *et al.*, 2020; Miller *et al.*, no date)? In addition, the actors involved in the input supply system and their role in disseminating information and technologies for this production system should be further studied.

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