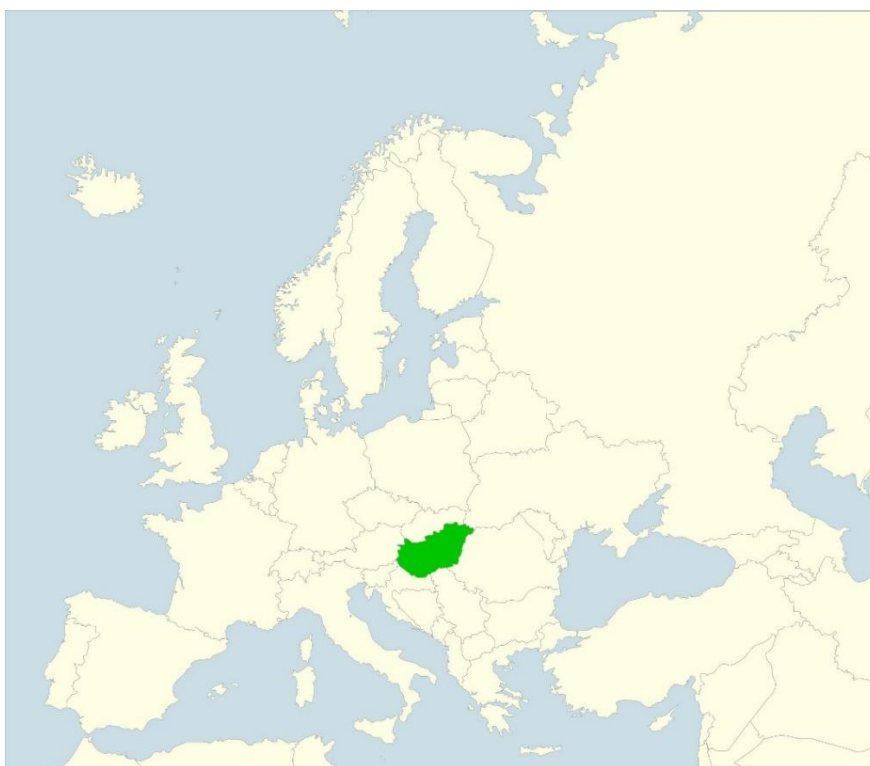


DEVELOPMENT OF THE AGRICULTURAL INNOVATION BROKERAGE CONCEPT IN EASTERN EUROPEAN COUNTRIES, BASED ON A HUNGARIAN SITUATION ANALYSIS

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Abstract: The Agro-innovation Broker (AIB) concept was introduced by the European Commission solely to increase the vast spread of innovative solutions in Agriculture. The concept can be perceived as an intermediary between the demand and supply of agricultural research and extension services. This paper's results are derived from the international research work that aims to develop a training curriculum in the field of agricultural innovation services with effective materials to boost capacity building actions in Central and Eastern European Countries (CEE). Based on consultations with stakeholders, the Hungarian situation analysis allowed comparison with other CEE countries and the expansion of an AIB vocational training curriculum. It helps to better understand the needs of agricultural innovation services through a clear view of advisors' competences. Our results suggest that apart from the similar knowledge requirements and skills of AIBs across CEE countries, country-specific expectations and needs should be addressed in AIB training.

Keywords: agricultural innovation, Agro-Innovation Broker, Central and Eastern European countries, Hungary

Absztrakt: Az Európai Bizottság felismerte az agrár-innovációs szolgáltatások működéséhez és az agrár kutatási eredmények gyakorlatban történő elterjedéséhez szükséges „közvetítő” nélkülözhetetlen szerepét. Ezt nyomatékosítva, hangsúlyozza az Agrár-Innovációs Bróker (AIB) szerepének és képzésének fontosságát. A bróker közvetítői, innovációs tanácsadói tevékenysége révén a kutatási eredmények sikerrel juthatnak el a végfelhasználókhoz. A cikk eredményei olyan nemzetközi kutatómunkán alapulnak, amely hozzájárul a Közép és- Kelet-Európa (CEE) agrár-innovációs folyamatait támogató AIB képzés és a hozzá kapcsolt oktatási segédanyag kidolgozásához. A témában érintettekkel folytatott személyes konzultációk alapján készített magyar helyzetelemzés lehetővé tette az összehasonlítást más CEE országok szaktanácsadási rendszerével és az AIB szakképzésben fejlesztendő kompetenciák meghatározását. Emellett hozzájárult még az agrár-innovációs szolgáltatások és a tanácsadókkal szemben támasztott elvárások jobb megértéséhez. Eredményeink arra engednek következtetni, hogy a CEE országokban az Agrár Innovációs Brókerek elvárt készségei és szaktudás-szintje hasonló, de mindezek mellett az ország-specifikus elvárásokat és szükségleteket mindenképpen be kell építeni az AIB szakképzésbe.

Kulcsszavak: agrár-innováció, Agrár-Innovációs Bróker, Közép és Kelet-Európa, Magyarország

1. Introduction

In the past two decades, the uptake and application of innovative ways in the agricultural sector has grown tremendously attributable to the fourth industrial revolution. One sector that has not been spared by these phenomenal changes has been the Agricultural Knowledge and Information System (AKIS). In pursuit for solution to address the grand challenges of sustainability and food security, the significance of innovation in the sector cannot be underestimated. The Organization for Economic Cooperation and Development (OECD) states that innovation plays an undisputable role in agricultural development through increased competitiveness of the sector, improved productivity, creation of job opportunities and even promoting resilience in the sector (Cahill, 2013).

According to Dolinska and d'Aquino (2016), one of the reasons behind the failure of the linear model in knowledge transfer could be associated with the unsuccessful adoption of a multisectoral and holistic system in stakeholder cooperation. To address this gap, the European Union, in its

capacity building in agricultural innovation services, introduced the Agro-innovation concept (European Commission and Standing Committee on Agricultural Research, 2013).

This gap has seen other stakeholders who do not in any way participate in agricultural knowledge development and dissemination but are enthusiasts and visionary in ensuring the farmers have the right information at their stake at the right time. This group of intermediaries who link the farmers with the service providers in the agri-food chain without the necessity of the farmers know-how has been termed as the agri-food innovation brokers (Klerkx et al., 2012).

In line with the European Union's agenda for an innovative and competitive agriculture, Hungary being a stakeholder in this mission, must ensure that its Agricultural and Knowledge Information System adopts the innovations in the market in order to improve competitiveness of farmers and to ensure that the farmers are competitive. The only way to understand the paradigm change, the situation and the needs of the Hungarian AKIS to achieve the defined objective is conducting a situational analysis to determine the state and the desired interventions in the sector. This paper aims to expound and present the real state of the Hungarian AKIS, the place for the innovation brokers and the anticipated government policies that will consider the sector's transformation.

Aiming to clearly present the real scenario of the Hungarian agricultural innovation, this paper draws its results from the research work of the project entitled "Capacity building in agricultural innovation services in CEE countries" (CATAllySt). The project was conducted in 8 research and development institutions from 6 EU member states (United Kingdom, The Netherlands, Czech Republic, Hungary, Poland and Slovakia). These institutions objectively cooperated to develop a training curriculum with effective training materials and tools in order to boost the capacity building actions in the field of agricultural innovation services in the Central and Eastern European (CEE) countries. The project focused on the promotion of innovation transfer, by combining a science-based approach with knowledge resulting from everyday practice and experiences.

Hungarian partners analysed the Hungarian situation concerning agricultural innovation services in order to compare it with the other CEE countries, and to outline development opportunities with specific focus on training curriculum expansion designed for future innovation brokers. The primary target group comprised of agro-innovation trainers, teachers and professionals in Hungary (i.e., farm advisors, extension service providers, local action group leaders, farmers, rural communities working in agriculture and training institutions dealing with capacity building in agriculture).

The Hungarian situation analysis of innovation services was based on national consultations with stakeholders through interviews and multiplier events⁶. This situation analysis helped to deeply understand the needs of agricultural innovation services and provided a clear view of the competences of farm advisors and extension service providers as well as the weaknesses of the existing training content in this field (Ujj et al. 2017).

2. The concept of innovation in Agricultural Knowledge and Information System

Over the past decade, AKIS has witnessed unprecedented changes that are immensely contributing to the new shape of the agricultural sector. Technology was the main cause of the majority of the changes disrupting the system (Lundahl, 1987). These changes included the sector's transformation from the times of adoption and adaptation of new ways of doing things in agriculture in the past to the present model which calls for multi-sectoral incorporation of different actors to establish a well linked network to ensure that information is at farmers disposal (Klerkx, Hall and Leeuwis, 2009; Dolinska and d'Aquino, 2016; Teno and Cadilhon, 2016).

⁶ An event that is organised to share activities resulting into tangible and meaningful outcomes with a wider audience.

Different scholars have different opinions on the existing schools of thought on how agricultural innovation system shaped the sector in the past, making it to be the centre of attention today in the field of Agriculture. Despite these disparities in thinking about the schools, one school of thought that cannot be underestimated when it comes to AKIS is the systemic thinking, especially at a period when everyone is calling for multi-sectoral approach to ensure that the grand challenges of agriculture are holistically solved (Diamond, 1996; Wigboldus et al., 2016)

An inclusive innovative system providing harmoniously introduced paradigm changes associated with agricultural innovation to ensure all the actors in the sector are immensely contributing towards uplifting the farmer, remains a dream for all. The question has been how and when could such be attained. Through innovative and disruptive ways in disseminating information to the farmer, technological adoption was accompanied by the transition from the linear model to the one which initially involved the farmers and the extension workers to bring third parties on boards who are not experts in agriculture but have the potential to link the farmer to the latest technologies that could be applied in the farm while linking with the market (The European Network for Rural Development, 2013; Dolinska and d'Aquino, 2016; Faure *et al.*, 2018).

Today, the concept of agricultural innovation is gaining prominence at both regional and national economies. The broad nature of the sectoral innovation presents a myriad of opportunities coupled with special challenge, which are beyond the farmer and requires external expulsive force to contain them and the only way is through risk transfer and management from the farmer to a third party (Perez Perdomo, Klerkx and Leeuwis, 2010; Kapronczai 2006).

However, innovation and innovative results do not always reach the end-users who could benefit from them. There is still a gap between extension service providers and potential end-users of the research results even though the number of stakeholders in agricultural innovation has grown and the complexity of innovation systems has increased in the past decades (World Bank 2006).

The European Union seeks to make its economy the most competitive and knowledge-based in the world. Knowledge is the key factor through which Europe can secure its competitiveness, while non-European countries compete with cheap labour and/or raw materials (Heichlinger *et al.* 2005).

2.1 Innovation capacity in Hungarian agriculture

Kapronczai (2018) agrees with this theory as he believes that only innovative national economies, with a single, state-of-the-art, knowledge-based and innovative agrarian economy, can face the environmental, energy, nutrition and social challenges that emerge.

Concerning the change of agricultural age structure and the qualification of farmers, Hungary is one of the countries in the least favourable situation in the European Union. Despite a slight improvement in the skills of agricultural managers over the last ten years, currently, about half of the largest commodity-producing farms manage their businesses without any qualifications (Hamza *et al.* 2017). In our opinion, this situation hinders the progress of the agricultural sector.

Technological innovation is significant in the agricultural sector, as rapid increase of digitization is expected (precision farming is a daily practice), mechanisation appears in some areas, and productivity is improving. On the other hand, the social commitment to environmental protection is strengthening and “green” thinking is spreading progressively (Goda *et al.* 2018). New food culture (i.e., traceability) has recently been articulated, where consumers would like to know the origin of their food, the farmer who produces it and the circumstances of the production (Tóth-Kaszás *et al.* 2018). Large and small farms require different skills and knowledge (such as the mechanism of short food supply chain, importance of labelling, etc.) which should be considered when reforming or planning agricultural training curricula designed for farmers or agricultural engineers (Magda *et al.* 2017). Studies (IVSZ 2016) have identified the main obstacles to the dissemination of innovative solutions in Hungarian agriculture as the lack of preparedness, skills and stakeholders’ outlook. Additional barriers are presented as agricultural innovation is not a priority, existing innovative

products are not well disseminated, and training and extension services do not meet present expectations.

2.2 Agro-Innovation Broker (AIB)

Lack of a well-established concrete multi-sectoral agricultural innovation network is attributable to the challenges of connecting different types of actors in the food sector. To offer a sustainable and long-lasting solution to this challenge, the European Commission's Standing Committee on Agricultural Research introduced the concept of the 'Agro-Innovation Broker'. This role would act as an intermediary between the demand and supply of agricultural research and extension services, establishing the link needed to help European agricultural innovation networks. Apart from the Netherlands, the specific role of Agro-Innovation Broker seems to be missing in EU countries (Hermans *et al.* 2011).

Klerkx-Gildemacher (2012) outlines the Agro-Innovation Broker as a person or organization that, "from a relatively impartial third-party position, purposefully accelerate innovation penetration and adoption through bringing together actors and facilitating their interaction. Innovation brokering expands the role of agricultural extension from that of a one-to-one intermediary between research and farmers to that of an intermediary that creates and facilitates many-to-many relationships".

Several characteristics and functions of the Agro-Innovation Broker have been described (Klerkx-Leeuwis 2009), but the innovation broker's specific competencies and the compulsory preliminary studies should be more precisely determined (EU SCAR 2013). This is of the highest importance because the improvement of the interaction between the labour market and the world of learning through clear recognition of all the knowledge, skills and competencies of workers are frequently invoked (Werquin 2010). Furthermore, specific skills are needed to facilitate effective processes of learning among farmers, other rural actors and entrepreneurs. According to the Commission, in addition to the competencies of farm advisors, a good understanding of innovation and the AKIS (Agricultural Knowledge and Innovation System) might fulfil this role (EU SCAR 2013).

Recognition of the outcomes arising from non-formal and informal learning is a trending topic in several EU Member States. In every sector, employers are clearly interested in the visibility of knowledge, skills and competencies so that they can match their workers better with the jobs or tasks to be performed (Werquin 2010). Concerning agricultural innovation, certain skills should be recognized, despite little understanding of agricultural innovation services and activities of an AIB. The skill set and competencies of AIBs have not been clearly defined and specific training materials have not been developed.

2.3 Advisory system in Hungary – A historical review

The Hungarian Advisory system has evolved over the past half-decade and undergone a couple of changes. The dawn of the first official Hungarian government advisory body dates to the 20th century and mainly relied on the institutions of agricultural education. Starting from 1965, the agricultural advisory services were based on large-scale (state) farms, co-operating with agricultural higher education and research institutes. According to Székely (2011), this situation led to the neglect of other stakeholders who could relay traditional information to the farmers.

At the beginning of the post-transition period, there was no new organization created that focused on coaching and advising agricultural stakeholders. The development of market-oriented, state-funded advisory system began in 1993. The disintegration processes – beside the integration processes in policy – were translated into the creation of the Network of village agronomists in 1994. Funded by the state and co-ordinated by the Hungarian Chamber of Agriculture, the Network involved former collective farms' professionals, providing free advisory services for emerging, small and medium farmers under the Ministry of Agriculture (Kozári 2014).

Hungary's EU accession raised demand for new knowledge related to the EU policies. Within the two-pillar CAP (CARP, Common Agricultural and Rural Policy), a sustainability objective came to the fore instead of productivity. Accordingly, the industrial-technological knowledge lost its primary importance and the distribution was taken over by integrators and business consultancies (Székely & Halász 2010).

The Hungarian advisory system today is layered, complex and fragmented. It involves multiple institutions and organisations and is characterized by strong government engagement. The latest developments in research, extension and education has resulted in "privatisation of service delivery or public-private partnerships, the multiplication of extension organisations, farmers contributing to the costs of these services, competitive bidding for research and extension contracts and tighter evaluation procedures" (Székely & Fieldsend 2013; Bányai *et al.* 2011). In terms of extension services (farm advisory system), free and sponsored advice is not clearly differentiated, and the quality of advisory service depends more on the personality of the advisor than on the organization (Nemes & Varga 2015).

Currently, the Hungarian Advisory system is anchored on the European Innovation Partnership (EIP-AGRI), which was founded in 2012 to rebuild broken relationships between research and practice and to bring innovation to the market. The newly developed network enables the establishment of close cooperation and partnerships between different actors within innovation and agriculture. The network will contribute to disseminating new and existing knowledge and developing it into innovation-based practices.

3. Methodology

One of the aims of the CATALySt project was to conduct a situation analysis of agricultural innovation services in Europe, particularly in CEE countries. The thorough situation mapping provided relevant information for the expansion of the innovation broker vocational training curriculum and its related learning materials (Goda *et al.* 2017).

All project partners from the CEE region have completed analysis of their situations (see CATALySt report, Goda *et al.* 2017). This paper presents only the Hungarian results in detail.

The research employed an integrated holistic system model by combining two system approaches in analysing the Hungarian Situation. The desire for the system approach was to address the following gaps, which have were not addressed in the previous methodologies applied in similar studies as outlined below.

In order to ensure the desired strong linkages, network model of innovation brokering was analysed, and, the study specifically combined two approaches of system analysis: The cross-sectional system analysis approach and the functionalist system analysis approach. According to Goda (2012), the cross-sectional view examines the relationship between two or more subsystems. The innovation systems model can be conceptualized as a cross-sectional approach, which tries to understand the system through the operation of each system and the relationships among them, as well as the possible formation of their balanced functioning. This approach played a significant role in understanding different outputs of relations and interactions between individual actors/stakeholders in the Hungarian agricultural innovation system.

The functionalist system analysis approach defines the functions within the system. The definition of functions within the system is expected, in order to draft the development plan. To ensure the most efficient utilization of development sources, the functions of subsystems and their possibilities within the system should be understood (Goda 2012). The combination of the two methods was suitable to highlight the problems of the Hungarian Agricultural innovation system, thus identifying the place and role of brokers in the complex system and to provide basis for drafting future developments.

The Functionalist approach improved the understanding of the main functions of elements within the AIS. Three main functions were determined in the reports. The first was the “Innovation and trainings”, which described the existing VET⁷ trainings for agricultural advisory and consultancy in the partner countries. The second was the “Innovation capacity”, which gave a general overview of innovation capabilities of farmers and farmer organizations, e.g., how innovation capacity is strengthened in agriculture by VET trainings. The third function was the “Innovation and partnerships”, which clarified the key actors and their roles within the innovation process in order to identify how partnerships are fostered for agricultural innovation by VET trainings.

Within the framework of the Catalyst project, the methods applied for the situation analysis were the following: document analysis, stakeholder identification and interviews with stakeholders / end-users, and focus group discussions with stakeholders (multiplier events).

According to Schut et al. (2015), “qualitative data provide the basis for the identification and analysis of the different dimensions of complex agricultural problems, and structural conditions enabling or constraining the innovation capacity. Such data may also provide narratives regarding the underlying causes and historical evolution of constraints.” The authors recommend multi-stakeholder workshops and in-depth interviews as qualitative methods in the framework of their ‘RAAIS’ (Rapid Appraisal of Agricultural Innovation Systems) diagnostic tool for integrated analysis of complex problems and innovation capacity (Schut et al. 2015). The methodologies involving different actors (i.e., the structured interviews and multiplier events) aimed at the collection of qualitative information and to open discussion between the relevant stakeholders, country by country.

The first validation round of the results was based on 15 organized structured interviews prepared with relevant stakeholders (2 farmers/farmer organisations; 2 researchers; 2 research institutes; 3 consultants/farm advisors; 2 Local Action Groups; 1 input provider; 1 applied researcher, product developer/technology and product provider company; agricultural product consumers; 1 Chamber of Agriculture representative; 1 agricultural VET provider). The structured interviews covered the three previously mentioned functions/topics – Innovation and trainings, Innovation capacity and Innovation and partnership (see interview questions below). The methods of interviewing were in-person or group discussions and telephone interviews with variable duration from 35 to 120 minutes.

In the framework of the structured interviews, the following questions/topics were included:

- In what form do you (or does your organisation) take part in the agro-innovation process?
- What are the major global and local challenges for agro-innovation?
- What are the remarkable innovations from the recent past?
- What is the need for innovation? (pros and cons)
- What is the desired organisational structure for innovation?
- How the process of agricultural innovation takes place in Hungary?
- How is the supply and quality of advisory and knowledge transfer?
- What are the quantity and quality of tools and services fostering innovation?
- What is the advisor/consultant knowledge/skills?
- How is the institutional preparedness?
- What are the current agro-innovation opportunities in rural areas/ obstacles?

⁷ VET: Vocational Education and Training

- What is the favourable system/organizational structure for the enhancement of the innovation activity?
- How is the future of agricultural innovation in Hungary?

The multiplier events represented the second round of validation, where all the CEE partners discussed the results of their structured interviews. The multiplier events aimed to collect relevant feedback from stakeholders/end-users.

Based on the findings, CEE partners finalized the Competence Matrix and Job Profile of Agro-Innovation Broker (AIB) for their own countries. Firstly, the desired pool of knowledge and skillset of the AIB was defined separately by four partner universities from Hungary, Slovakia, Czech Republic and Poland. Each list was submitted to a semantic analysis process where similar attributes were aggregated based on their core definition. The output of this process was two unified lists of knowledge and skills where each attribute had a rating from at least one partner, on a scale of values between 0 and 5 that can be described by a continuous function, so, instead of only discrete integers, the participants could also give fractions (e.g. 3.75) in order to provide the opportunity for a more discerning evaluation. Then, the lists were rationalised, based on the identified roles and tasks of the AIB. The rationalised and clarified lists were ranked using the arithmetic mean of the scores given by each partner to the listed knowledge and skill elements (which we named as 'Consolidated weight' in the tables displaying the results). Finally, with the use of ranked knowledge requirements and skills, input and output requirements were defined for the AIB trainings.

This paper includes comparative tables of the desired Competence Matrix and Job Profile of an Agro-Innovation Broker for CEE countries (see Tables 12, 23 & 34).

4. Results

The results obtained helped to achieve a comprehensive situation analysis regarding the needs assessment of the agricultural innovation services in Hungary. The results are divided into 4 subgroups in order to gain a better understanding. These groups are as follows:

4.1 General overview of the stakeholders

Before the interviews and multiplier events required for the situation analysis, it was necessary to identify and describe the concerned stakeholders, namely the main groups of actors related to agriculture, who can be potentially involved in the dialogue about the situation of agri-innovation and the designing of a widely acceptable, yet locally specific profile of an Agro-Innovation Broker. The identified stakeholder groups – the representatives of which were interviewed and participating in the multiplier events – in Hungary were as follows:

Agricultural organizations. In 2000, nearly 7000 organizations were involved in agriculture and their number has been growing steadily over the last 10 years. In 2016, 9388 organizations carried out agricultural activities, which was more with 16% than the number registered 3 years earlier. More than four-fifths of the organizations used land for their activities, until the new regulation on land use entered into force and encouraged the organizations to change their 'management framework'. As a result, between 2013 and 2016, the number of organizations that cultivated over 2500 hectares reduced by half. The number of farms dealing with animal husbandry increased by more than one third between 2013 and 2016, so the primary role of farming (land cultivation) was reduced.

Farmers. In 2016, nearly 422,000 individual farms carried out agricultural activities. Unlike the agricultural organizations detailed above, the number of individual farms dropped since 2000 – almost to two-fifths. One of the reasons is that many older farmers, especially those over the age of

65, ended their agricultural activities. Between 2010 and 2016, the number of farmers in the 55–64 age group also decreased by 35,000. In their case, it can be assumed that younger generation has taken over their agricultural activities. The number of individual farms focusing on animal husbandry was less with 120,000 compared to the data gained in 2010. The number of mixed individual farms (plant production with animal husbandry) also decreased. In 2013, 47% of the individual farm production aimed at self-sufficiency, 32% of the farms sold their surplus on the market whilst only 20% produced primarily for market sale. The statistics show that farmers demand innovation and as for their competitiveness, they must increase their productivity and efficiency and provide added value that is coupled with successful marketing.

Researchers/research institutes. Hungarian agricultural research, development and innovation mainly comprises research institutes that belong to the Ministry of Agriculture (MA), the Hungarian Academy of Sciences (HAS), and institutes and/or knowledge centres that function within university faculties. Under the direction of the MA, the National Agricultural Research and Innovation Centre (NARIC) integrates 12 research institutes. The research institute network of the HAS consists of 10 research centres, including 39 research institutes and 5 independent research institutes.

Farm advisor/consultant. The structure of the Hungarian Agricultural and Advisory System is based on advisory centres that cover different territorial levels (national, regional, sub-regional), the professional advisory centres and the registered advisors' network. Agricultural integrators also provide consultancy for their clients, and the large-scaled, profit-oriented agricultural organizations often employs experienced international experts. The advisory service of input supplier companies mostly serves sales and marketing purposes. The advisory system could provide the basic institutional background for the agricultural innovation brokerage.

Leader Local Action Groups. Local Action Groups (LAG) are non-profit-making compositions including public and private organisations from rural villages with a broad representation of different socio-economic sectors. Licensed traditional small-scale farmers, private entrepreneurs, NGOs-, public companies, churches and religious organizations, local governments, associations and institutions can be members of the LAGs. Through the European Agricultural Fund for Rural Development, LAGs can apply for financial assistance in the form of grants to implement Local Development Strategies. The main objective of the Local Development Strategies is to deliver support to their respective rural areas as LAGs can recognize better the needs and priorities of their territory since they are part of the territory itself. Therefore, LAGs can play an important role in fostering local innovative initiatives. The entire countryside of Hungary is covered by 103 LEADER Local Action Groups.

Service/technology provider. Within the framework of profit-oriented activities, there is a wide range of diverse agricultural service and technology providers who take part in the innovation process by offering high tech technology and related knowledge. Besides the basic agricultural services – focusing on seed, fertilizer, pesticide and machine supply, there is a vast variety of administrative, financial and information services aiming at promoting efficient farm operation and management.

Hungarian Chamber of Agriculture. The Hungarian Chamber of Agriculture (HCA) is a professionally qualified public body that deals with the agricultural production, the rural development and the whole domestic food chain. Its tasks and objectives are the following: providing practice oriented services for its members (in the field of information exchange, training, administration, professional events, measurement and forecast systems, finance, energy, telecommunications, trade and export development); lobbying for professionally appropriate agricultural policy decisions to create favourable business environment; lobbying for international protection for the Hungarian agriculture's interests to provide advantageous competitive conditions for the Hungarian agricultural products. HCA was established in 2013 and currently it has 360,000 legal members.

Agricultural VET providers. In 2013, additional 43 vocational schools were added under the supervision of the Ministry of Agriculture. This act affected 59 schools with 26 000 students. The former National Agricultural Advisory, Education and Rural Development Institute (NAKVI) used to be in charge of the operation, while these institutions acted as independent units. Thereby a unified agrarian vocational training institution system was established. The Ministry of Agriculture strictly defines the content of courses and the examination requirements. (Regulation 56/2016 (VIII.19.) of Minister of Agriculture).

4.2 Clients and working environment

One of the aims of the interviews and organized multiplier events was to identify the potential target group of innovation brokerage and to determine the role of the Agro-Innovation Brokers. The findings were as follows:

All stakeholders agreed that the agricultural raw material and food production with their related branches (e.g., rural tourism, service providing, etc.) require innovative ideas driven by economic viability and market competitiveness to vitalize local communities and stabilize population in rural areas through provision of prosperous livelihood and adequate income. Within the framework of the European Union's EIP-AGRI, the 'Operational Groups' – that consist of farmers, advisors, researchers, NGOs etc. – work together on technological, organisational or social innovations in order to convert their innovative ideas to practical solutions.

Bearing in mind that the basis of the agri-food business is farming, and the most exposed and innovation requiring actors of the product chain are the farmers, they are the main target group of innovation brokerage. In the European Union, unfortunately, it is an obvious tendency that the number and proportion of young farmers are decreasing. Agricultural sector has low prestige among the youth, due to the limited access to land and capital, and the deficiencies of agricultural education and training system. In parallel, elderly farmers carry on farming after reaching the retirement age (KPMG 2016).

The project's interviewees shared the same opinion that farmers' society is aging, and younger farmers with higher innovation capability have fewer opportunities in agriculture, therefore, the lack of sector-specific, competitive knowledge inhibits sectoral development. Based on this, the challenge is twofold: the 'senior' generation of farmers need to be encouraged and interested in innovation, while the 'enthusiastic' more innovative young farmers should be supported to achieve their goals.

It can be stated that the major target group of innovation brokerage is the farmer or community of farmers who:

- Are aware of the importance of the market-oriented production and added value creation.
- Recognize the need for innovation.
- Have the willingness to change.
- Have innovative ideas at least in an initial state.
- Are ready to pay for assistance in the conception, implementation and marketing of innovations.
- Are able to work in 'team' (because innovation brokerage presumes partnership).

The role of Agro-Innovation Brokers can be formulated as follows:

- Detecting innovation potential in local agriculture, food processing and communities.
- Encouraging concerned actors to innovate.
- Encouraging local communities and potential actors of innovation to cooperation.
- Assisting in creating ideas and identifying market needs.

- Aiding in innovative project generation, tendering, fundraising.
- Arranging knowledge transfer from special experts towards clients during the project implementation process.
- Assisting and monitoring the sustainability of innovations.

4.3 Tasks and responsibilities

According to the conclusions from the stakeholder interviews and multiplier events, the Agro-Innovation Broker as a service provider must supervise the whole innovation process from the initial idea to the market launch. Figure 1. demonstrates the simplified innovation process model. The amount of help and support needed by the service users may vary during different project stages, depending on their own skills and experience. However, the brokers should be able and prepared to intervene as deeply as possible. Nevertheless, this expectation has its limitations in practice because even the most qualified brokers cannot be experts in every field of knowledge. Thus, the prerequisites to the efficient operation of innovation brokerage are the professional network and the appropriate background institution providing information periodically.

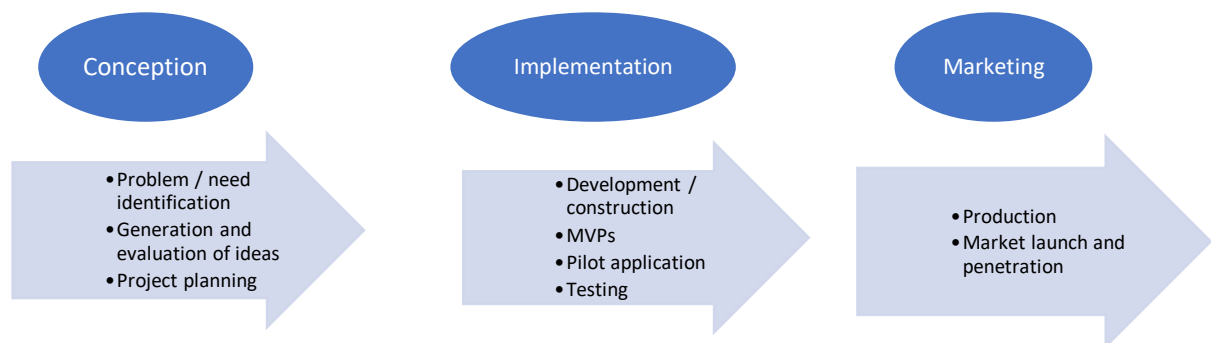


Fig 1. Simplified model of the innovation process. Source: own editing based on Tiwari et al. (2007)

With reference to the stakeholders' interviews, it can be stated that the Agro-Innovation Broker plays the most significant role in the first (conception) phase of the innovation process which includes the identification of customer needs by market research, generation and selection of ideas adapted to a business model and project planning. In the next phase of implementation aiming to construct and to test minimum viable products, besides the constant supervision and control by the brokers, the assistance of experts with special knowledge is also needed. During the phase of marketing, for the end product design, the commercialization planning and the market launch, the AIB has the same decisive role as in the implementation phase.

College/university degree in agriculture. The stakeholders agreed on the requirements of the Agro-Innovation Brokers' education. Without a thorough knowledge of a special area of agricultural expertise and at least a broad overview into the field of agriculture, brokers would probably rather do harm. In addition, it would be unthinkable to specialize, provide the right service and obtain credibility and recognition in the business. Although the degree is undoubtedly indispensable, this is not a enough criterion for promoting innovation, and other barriers to entry need to be introduced for efficient selection of quality professionals.

Multiple years of experience in farming, enterprising or R+D+I. The stakeholders conceded that besides the theoretical knowledge (certified by the diploma), the practical experience in farming, entrepreneurship or research, development and innovation activities is crucial in providing the feasible innovations and confident actions throughout the whole process.

Minimum age-limit. Concerning the qualification and experience of innovation brokers, some stakeholders recommended the determination of minimum age, optionally specified by country decision-makers. The aim of the age limit would be to ensure that new entrants are adequately prepared and mature.

Fulfilment of a mandatory project and/or innovation management training. Innovations are mostly developed in specific projects or within a set of multiple projects. The project planning, implementation and sustainability, besides the professional agricultural qualifications, create a demand for extra competences that must be acquired theoretically no later than the first contractual contact with the user.

Implementation of an innovative test-project. In addition to the expectations regarding schools, trainings and professional experience, the barrier to entry can also contribute to the selection of individuals most suitable for the innovation brokering activity: the candidate broker in collaboration with an actual user implements an innovation project (so called 'test project') which is supervised by another broker or auditor. Evidently, the rules and conditions of that input challenge should be realistic and thoroughly developed.

4.4 Institutional structure, knowledge background, financing

This section includes the results in terms of the innovation brokerage framework. The main conclusion of stakeholder interviews and multiplier events is that the institutional system of innovation brokerage needs to be built very carefully. Most of them agreed that the best institutional structure would be a network of state-controlled private enterprises. As shown by shared experience, the fully state-organized system is slow and bureaucratic and does not provide a fair remuneration and motivation for brokers as public servants. At the same time, an entirely competitive approach entails the issue of control. Trusting the Agro-Innovation Brokers makes the farmers the most exposed to the effectiveness and reliability of these actors. Without a state guarantee for the suitable selection and correct functioning of the innovation brokerage, the system would be unviable.

Knowledge background is an essential factor for the innovation brokerage. As mentioned above in this chapter, the knowledge and preparedness of brokers have some limitations. Besides the information system and professional network of the service provider private enterprises, the state must maintain a constantly expanding public expert database that would help partner searching in a certain field and ensuring collaboration occasionally. It would be advantageous if farmers could contact Agro-Innovation Brokers at local level, near their residence.

Funding is the most sensitive condition of each initiative. Continuous, long-term contribution and support for a specific innovation require quasi full-time dedication from the Agro-Innovation Brokers. Government incentive in some form is therefore indispensable and required for fostering innovation in agriculture, in order to provide proper innovation brokerage service for every farmer and not only for the wealthiest ones. According to the expected changes in the EU's agricultural support policy after 2020, the agro-innovation services should be co-financed. Otherwise, without support of the innovation brokerage activities, the service provider enterprises would be forced to cut costs, which questions how many projects / clients could be efficiently managed by one Agro-Innovation Broker simultaneously.

5. Discussion and Conclusion

The elements of the Agricultural Innovation System were defined by the cross-sectional system analyses approach. The brief historical Hungarian overview about changes in the past decades explained the development of the agro-innovation service's institutional background, such as National Coordination and Governance of Agricultural Innovation. The role of research and advisory services in the innovation process is unquestionable in all European Countries.

In the 'Results' section, the strengths and weaknesses of the existing system of agricultural extension and consultancy are detailed, based on three main functions; Innovation and trainings, Innovation capacity and Innovation and partnerships. It is important to recognise the needs of agricultural innovation services and to better understand the view of different stakeholders.

The corresponding chapter in the CATALySt report (Ujj *et al.* 2017) aimed to structure the findings of previous studies and create a recommended job profile and competence matrix of Agro-Innovation brokers (AIB). The four CEE countries' (Hungarian, Slovakian, Czech and Polish) reports described an ideal AIB job profile, which features their tasks and responsibilities.

5.1 Agro-Innovation Broker job profile in Central and Eastern Europe

Based on the four countries' research, seven main roles were identified by the partners, presented in Table 1. These roles are the following; Local actor, Network creator, Project generator and fundraiser, Project manager, Innovation manager, Knowledge transfer, Auditor and evaluator. These defined roles complement the previously mentioned concept of Klerkx-Gildemacher (2012).

During the need's assessment, 17 types of desired knowledge requirements were identified (Table 2) which were divided into two main parts, input and output requirements. The knowledge requirements that scored above two are recommended as necessary input conditions. All four countries indicated high preference for these knowledge requirements. It can be agreed that this is the minimum knowledge required by candidates before applying for the AIB training.

Tab 1. Roles of an Agro-Innovation Broker in Central and Eastern Europe. Source: own editing based on own research

Roles	Tasks
Local actor	<ul style="list-style-type: none"> - Identifying partners in the environment in which the broker operates, identifying potential partners who wish to work for innovations in the areas of agriculture, forestry, food production and achieve measures to activate rural inhabitants - Suggestion of solutions adequate to the needs
Network creator	<ul style="list-style-type: none"> - Vitalizing local communities and co-operation between actors, cooperation in developing business plans for the undertaken investments - Creating links between business and cooperatives, understanding the functioning of vertical integration mechanisms in agribusiness and identification of opportunities for the actor in this respect - Participation in the meetings important from the point of view of interested stakeholders (Agricultural Advisory Centres, Local Action Groups, Chambers of Agriculture, fairs, exhibitions, etc.)
Project generator and fundraiser	<ul style="list-style-type: none"> - Aiding in innovative project generation, tendering, developing of activity plans for the groups - Finding suitable sources of funding - Cooperation in developing business plans for the undertaken investments - Preparing feasibility studies and seek funding
Project manager	<ul style="list-style-type: none"> - Teamworking - Participation in creating teams of partners with a common goal - Developing activity plans for the teams / groups - Preparing formal documents necessary for the group functioning (agreements)
Innovation manager	<ul style="list-style-type: none"> - Encouraging concerned actors to innovate (which allows the advertising of the service), helping in idea creation and identifying market needs
Knowledge transfer	Organizing knowledge transfer from special experts to clients during the implementation of projects
Auditor and evaluator	<ul style="list-style-type: none"> Monitoring of the team and how the project goals are achieved - Monitoring of the group functioning and project realization - Assisting to ensure the sustainability of innovations - Monitoring success and sustainment

The aggregated ranking score of six output requirements (Knowledge of local conditions of local policies and regulations, Knowledge of local conditions of traditions, Agribusiness knowledge: The functioning of agribusiness networks, Knowledge of project management, Methodology of trainings – organization of trainings for farmers and enterprises, Rural development knowledge) are low. Individually, however, partners identified these as vital knowledge requirements and gave them high scores. These knowledge requirements should be taught and developed during AIB training.

Tab 2. Required knowledge of an Agro-Innovation Broker in Central and Eastern Europe. Source: own editing based on own research

Knowledge requirement	HU	SK	CZ	PL	Consolidated weight	
High-level knowledge of a specific field of agriculture	5	4	3	5	4.25	Input requirements
Economic knowledge – assessment of the economic efficiency of farms	3	5	4	3	3.75	
Economic knowledge – developing business plans, estimates and economic analyses	3	5	3	3	3.5	
Agribusiness knowledge: Agriculture Policies, EU Common Agriculture Policy	3	3	4	4	3.5	
Economic knowledge – financing and accountancy and taxation	3	4.5	3	3	3.38	
Knowledge of law: Concerning agriculture and agricultural enterprises	3	3	3	3	3	
Knowledge about specific functioning of the scientific and business environment in a given region (Practical knowledge/experience of working in enterprising	5	2	2	3	3	
Knowledge of foreign languages (English)	5		2	4	2.75	
Practical knowledge/experience of working in farming	5			3	2	
Practical knowledge/experience of working in extension	5			3	2	
Knowledge of local of market trends	5	3			2	
Knowledge of local conditions of local policies and regulations	5				1.25	Output requirements
Knowledge of local conditions of traditions	5				1.25	
Agribusiness knowledge: The functioning of agribusiness networks			5		1.25	
Knowledge of project management		5			1.25	
Methodology of trainings – organization of trainings for farmers and enterprises				5	1.25	
Rural development knowledge	5				1.25	

Seventeen desired skills were identified during the need's assessment, Table 3. These skills were divided into two main parts as before, i.e., inputs and outputs. The skills that scored under two are recommended to be input requirements. These are general skills that are essential for AIBs. Skills scoring above two (Networking capability, Dedication, Innovation management, Data management, Teamwork, Project management, Marketing) are recommended output requirements. These skills are recommended to be developed during AIB training.

Agreeing with Klerx & Leeuwis (2010) and Heichlinger et al. (2005), the importance and role of innovation in agriculture is unquestionable at the European Union level, and, in accordance with Kapronczai (2018), generally speaking, it is the only way of facing future challenges for the national economies. The judgement in the role of Agro-Innovation Broker varies from one country to another. Due to similar circumstances and historical background of the CEE countries, their

stakeholders view the same knowledge and skills of the AIB training as important. During the expansion of the AIB vocational training, it was essential to define the roles that an Agro-Innovation Broker should perform after the completion of the training (which turned out to be completing the concept of Klerkx & Gildemacher, 2012). In order to successfully fulfil these tasks, it was necessary to define the required knowledge and skills, in harmony with the suggestion of Werquin (2010).

Tab 3. Required skills of an Agro-Innovation Broker in Central East Europe. Source: own editing based on own research

Skills	HU	SK	CZ	PL	Consolidated weight	
Networking capability: cooperate, network with key farmers and innovators, decent behaviour and nonverbal communication, ability to communicate in a diversified environment, good interpersonal and communication skills.	5	5	4	4	4.5	Output requirements
Dedication: workmanship, strong work ethics, offer proper advice, ability to evaluate the performance of the agricultural enterprise, cooperative and designing the solution for given issues.	5	5	5		3.75	
Innovation management: transform newest research results to farmers, ability to look for opportunities in introducing innovations and knowledge transfer, ability to exercise control over defining what is advantageous for a farmer and what is not, ability to involve partners in the process of implementing innovations in agriculture.	5	5	2	3	3.75	
Data management: work with data and information, create analysis, analytical thinking, seeking and interpreting information from agricultural and financial markets.	4	4.25	2	2	3.06	
Teamwork: ability to shape relationships within the team leading to the realization of appointed goals.		3.5	4	4	2.88	
Project management: confront, solve the practical problems, concept thinking, assist with project writing, write reports, projects for grant purposes, investigate problems.	5	5			2.5	
Marketing: skilled in promoting innovation in agriculture, food production and forestry.	4		3	3	2.5	
Leadership experience; motivate; coach; think strategically.	4	4			2	Input requirements
Active listening, empathy and sensitivity to other peoples' problems.		4		3	1.75	
Flexibility; Flexible attitude in answer to dynamically changing work environment.	4			2	1.5	
Reliability, trustworthiness and credibility.	5				1.25	
Learn, desire for new knowledge; The ability to constantly learn in the field of agribusiness.		2.5	2		1.13	
Determination, self-confidence	4				1	
Stress handling ability	4				1	
Presentation skills			4		1	
Negotiation skills		3.75			0.94	
Ability to take reasonable risk				3	0.75	

Our research results suggest that AIBs in CEE countries should also fulfil those tasks that are required from them in the practice in Western European countries (particularly as in the Netherlands) and are involved in the definition of the Agro-Innovation Broker. In terms of knowledge and skills, expectations are high in CEE countries. All CEE countries' expertise agrees that there are elementary knowledge and skill sets required (confirmed by high scores), that will be complemented by country-specific expectations. These specifically described knowledge requirements and skills should be transferred to future innovation brokers within the framework of the Agro-Innovation Broker vocational training.

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