

Analysing the Bee-sectors Knowledge and Innovation System in Europe – findings from the Smartbees-project

Executive summary

The aim of this document is to describe European examples of Beekeeping Knowledge and Innovation Systems (B-KIS). This concept is closely related to AKIS – Agricultural Knowledge and Innovation System, both theoretical and methodological. By describing these B-KIS we will be able to:

- a) describe the general structure and functioning of activities aiming for knowledge development, innovation and learning within European apiculture;
- b) better understand how today's services for beekeepers and bee breeders are embedded into the national Beekeeping Knowledge and Innovation Systems (B-KIS);
- c) provide some conceptual elements to support the development of a national or regionally adapted communication strategy for improved sustainability of European apiculture.

We have built on work done in earlier EU-funded project, primarily PRO AKIS, and compared in what way B-KIS might differ from AKIS on a structural level and also apply the analytical model for knowledge and innovation systems to understand strengths and weaknesses. We do not repeat the literature reviews being done earlier. Instead our focus has been to collect some basic and new data from six national B-KIS in Europe; Romania, Germany, Poland, Denmark, Sweden and Norway. As a result of comparing the presented B-KIS we make an analysis focusing on differences in institutional arrangements and the diversity of methods and approaches across Europe.

The findings in this report will, together with the Smartbees-survey of beekeepers throughout Europe, create a foundation for suggesting regionally adapted communication strategies to increase honey bee health and genetic diversity. The methods and approaches to be used depend on the B-KIS, its strengths and potential weaknesses. Our ambition is also that this report contributes to the policy debate on how to develop advisory services and other supporting structures as instruments for a sustainable apicultural sector in Europe.

Introduction

The aim of this document is twofold; to present how a knowledge and innovation systems (B-KIS) in apiculture could be conceptualized, and to describe five regional/national B-KIS in Europe. By doing this we are able to;

- a) describe the general structure and functioning of activities aiming for knowledge development, innovation and learning within European apiculture;
- b) better understand how today's services for beekeepers and bee breeders are embedded into national or regional Beekeeping Knowledge and Innovation Systems (B-KIS);
- c) provide some conceptual elements to support the development of a national or regionally adapted communication strategy for improved sustainability of European apiculture.

The challenges facing apiculture are many today. One of the most important is of course related to honeybee health issues, having consequences for rural economy, biodiversity and long-term sustainability. Increased knowledge and competence are seen as central to our possibility to reach sustainable production systems. Innovation and collaboration among actors are seen as one of the most effective response to existing threats and challenges. This is related to the need for a more efficient (and responsible) scaling up and out of new technologies, management approach, local sustainable breeds, genetic material, etc.

From a policy perspective the question is whether or not today's B-KIS are well suited to meet such challenges or if new configurations of the knowledge systems are needed. Apiculture is challenging in many ways: Beekeepers are often part-time active, having a small amount of hives for personal or local use, not belonging to a long tradition of formal learning or advisory services, and lack often institutionalized structures on local level for innovation and knowledge development/individual learning. These features make beekeeping different from other parts of European agriculture in general

When discussing a knowledge and innovation system within the beekeeping sector, the same actors as within the agricultural fields come to mind; national authorities, research institutes, educational providers, advisory services, training centers, beekeepers' associations, beekeeper and bee breeders, etc. But there are important differences in many countries between the AKIS and the B-KIS. One important reason being that in each sub-sector of agriculture, as for instance milk production, horticulture, agroforestry, etc., the configuration of existing institutions is pluralistic. That is, there are no 'one size fits all'. Instead each region of Europe has developed their own ways to innovate and spread new information, which has to be acknowledged when developing policy and recommendations on communication strategies.

This report starts by briefly introducing the concept of AKIS and B-KIS. Thereafter it describes some of the B-KIS within an European context, and ends by presenting some conclusions.

From AKIS to B-KIS

The role of B-KIS descriptions in the Smartbees project

The aim of SMARTBEES is to improve our understanding of the underlying resistance mechanisms to infectious and parasitic diseases of the honeybee. The Smartbees project integrates biological, economic and social components to remove the Varroa-mite and its damaging viruses from the complex equation of honeybee health while at the same time retain maximal species diversity. By that the project will provide a solid framework for the long-term improvement of both honeybee health and genetic diversity. WP5 support the overall aim of the Smartbees project by adapting extension

tools to the beekeeping community across Europe in order to maximize the uptake of the project outputs.

The traditional model for knowledge development within farming systems, including apiculture, is based on the 'technology transfer model'. In short, it means that new knowledge and innovations are developed at universities, are tested on research stations, spread to advisors, and later to the beekeepers through different written or oral methods. It is generally speaking a linear model of communication, which in many respects has been successful when modernizing agriculture. However, this approach has some inherent problems, considering all beekeepers as a homogenous group; attempting to implement universal technologies with no regard for local context and regardless of the relative advantage; fails to manage complexity and variety; and ultimately draws a low level of participation and poor implementation. As a consequence there is a growing need to involve the beekeepers in ongoing knowledge processes, and one important way to do this is to develop and implement adapted methods for apiculture extension. It is also about creating a shared learning process, which enables the beekeepers to put forward their local knowledge and combine it with important insights from research – a collaboration which is instrumental for achieving a sustainable apiculture in Europe, and which lies at the core of Smartbees.

Through WP5, Smartbees do research on beekeepers' needs and learning strategies, as the means to develop understanding of this unique knowledge system. How must new tools and strategies function, when building on best available knowledge in extension and dissemination science? The main goal is to develop regionally adapted strategies for knowledge development involving beekeepers and bee breeders (regarding performance testing, interpretation of results of genetic evaluation, region-specific Varroa-management strategies, etc.), and provide support to established breeding structures within and between the European countries. The hypothesis is that this will be made possible by integrating the potentials given by modern information technologies, new insights in pedagogy, and by developing the skills in process management and facilitation within the European honeybee sector.

The Knowledge and Innovation System (B-KIS) operating in the apiculture sector describes the existing stakeholders, arenas and information flows within a geographic area, normally a country or region. It is a snapshot that describe who does what, with which purpose, and how. Diversity is explained by dynamics and contexts, and new initiatives can be critically analyzed. We have chosen to use the approach developed within another EU-funded project, PRO AKIS, to collect and organize relevant information (Kania et al, 2014). Based on the model developed in sub-task 5.2.1 data regarding regional B-KIS was collected through the strategic sampling of some regions in Europe. The B-KIS diagram was created by the national partners within the Smartbees project. The output is an analysis and description of B-KIS, on conceptual level, across 6 sub-regions of Europe. We have used the network within Smartbees to collect the information.

Defining a knowledge and innovation system

The purpose of this study is not to present and discuss the well established concept of AKIS (Agricultural Knowledge and Information/Innovation Systems) or AIS (Agricultural Innovation Systems). This has been done both in scientific literature (Balzat and Hanisch 2004, Dockes et al. 2011, Faure et al. 2012, Hall et al. 2006, Kania et al. 2011, Klerkx et al. 2012) as well as in projected funded by the EU (for instance; PRO AKIS and SOLINSA). Nonetheless it is relevant to make some introductory notes on what an AKIS is in order to understand what components are important to look for in national/regional B-KIS. According to the World Bank definition (World Bank 2012) an *“Agricultural knowledge and information system (AKIS) indicates a system that links people and institutions to promote mutual learning and generate, share, and utilize agriculture related technology, knowledge, and information. The system integrates farmers, agricultural educators,*

researchers, and extensionists to harness knowledge and information from various sources for improved livelihoods. Farmers are at the heart of this knowledge triangle”¹.

A knowledge and innovation systems includes all actors involved in knowledge production and accumulation within a specific sector, representing the (inter)national to the local level and belonging to different disciplines. But a knowledge and innovation system also consists of material elements such as databases, training activities, apiaries, etc. Each national/regional B-KIS will reflect an inherited infrastructure, creating an unique network and circulation of knowledge, which enables or hinders specific investments in knowledge development.

Advisory services, in many forms, have an important role in bridging research and practice (Madureira et al 2015). Within Europe such services range from that of individual mediators to training centres and demonstration apiaries, where often public advisors transmit and disseminate new findings and information to beekeepers. However, in the case of the many apiaries connected to institutes or beekeeping associations the advisors participate in the process of knowledge generation, together with researchers and other actors. In both cases the role of the advisors is a result of a national and regional B-KIS infrastructure and where public initiatives and funding are important to enable coordination, methodological and conceptual development, as well as novel research.

The general purpose of an AKIS is to strengthen communication and knowledge development to people involved in agriculture or adherent rural activities. According to Klerkx et al (2012) it is possible to use three distinct analytical frameworks to describe these knowledge and innovation systems:

1. The infrastructural approach, making a more or less static analysis of actors network and their interaction, existing research and educational infrastructure and how these aspects support or does not support knowledge development.
2. The process approach, making a dynamic analysis in order to understand how technology, practices, markets, and institutions co-evolve over time.
3. The functionalist approach, which focus on whether or not specific or necessary functions of the knowledge and innovation systems are fulfilled or not.

In this study we have used an infrastructural approach in our description and analysis of national/regional B-KIS. By doing so we are able to:

- Apply the AKIS concept in order to describe different knowledge infrastructures in Europe.
- Analyze what knowledge actors might be missing when aiming for a sustainable apiculture in Europe.
- Better understand the knowledge flows within the apicultural systems, comparing different solutions within Europe, and perhaps learn from each other.

We have chosen the national/regional scale as it fits well with our pre-understanding of how beekeepers have chosen to organize themselves and the way the states have built an infrastructure supporting apiculture.

What constitutes a national/regional B-KIS?

Rivera and Zipp’s (2002) model identifies four main actors with an interest in knowledge development and innovation also relevant for apiculture:

- Research
- Extension services
- Education and training

¹ In comparison an “Agricultural innovation system (AIS) indicates a network of organizations, enterprises, and individuals focused on bringing new products, new processes, and new forms of organization into economic use, together with the institutions and policies that affect their behaviour and performance” (World Bank 2012).

- Support systems (all the organizations providing funding, inputs and producers' associations, etc.)

In such a model the four sets of actors will act upon existing knowledge of beekeepers and bee breeders and generate innovations in response to challenges and new opportunities, desired outcomes (from individuals to society), system drivers and regulative policies and institutions (figure 1).

A B-KIS is almost always composed of research, extension and some kind of educational or training organizations. Furthermore it is structured and governed by the government through a sector policy for agriculture in general or sometimes apiculture specifically. As for the agricultural sector in general, the main aim has historically been to make beekeepers more professional (in the meaning of efficient and competent production). The structure of this system, its organization and governance (e.g. under a public or private structure) differs greatly between countries, as does the level of centralization or decentralization. Diversity can also be found within different regions and federal states in the same country.

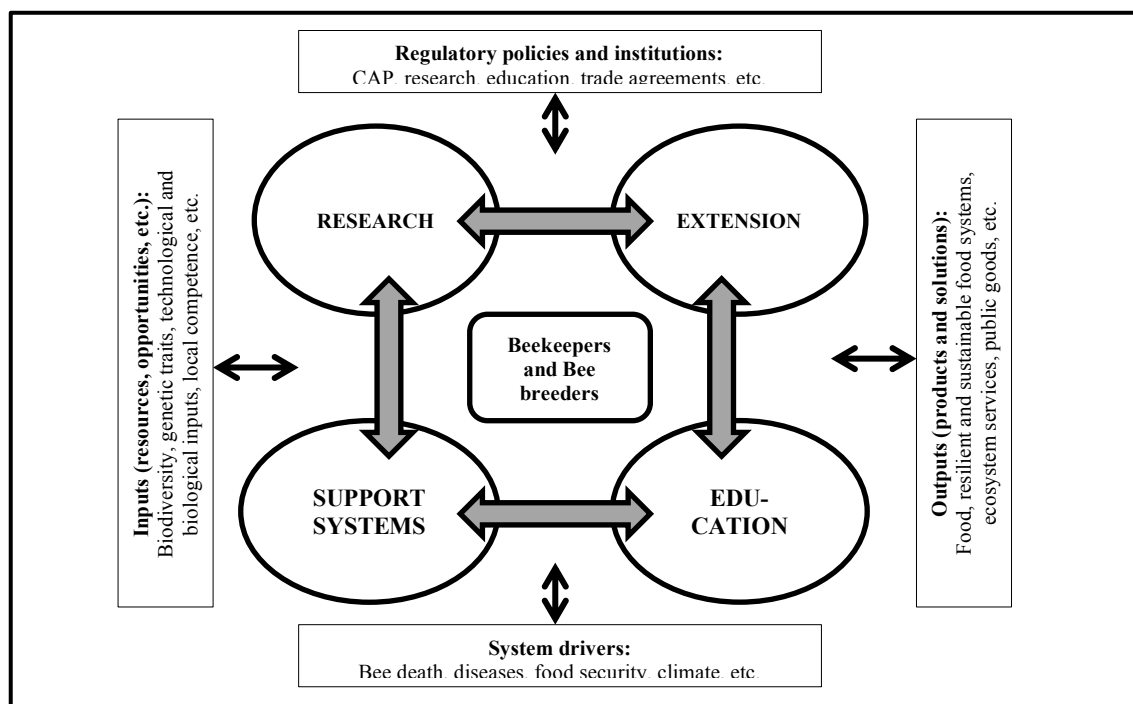


Figure 1. A conceptual model of the Beekeeping Knowledge and Innovation System, B-KIS, which consist of actors constantly acting on changes in their context (adapted from Rivera et al, 2005).

The AKIS in Europe has been described as highly fragmented and subject to a dynamic process of emerging new structures and actors (EU SCAR, 2012). Although being much narrower in focus, the same processes take place within the beekeeping sector in Europe, due to changes in funding, level of privatization or regionalization, emerging co-learning approaches such as EIP Agri, and the general role of government in supporting the development of the sector. Regardless of these trends a functioning B-KIS requires various forms of knowledge brokerage (e.g. the dissemination of applied research, farmers' magazines, specialized websites, posters, seminars etc.).

There are universal trends in the ways in which learning and change can be achieved within rural development, agriculture and probably also apiculture. In general, more emphasis is put on networking, trans- and interdisciplinary research and other forms of cooperation between academia and practice (from beekeepers to trainers, advisors, industry, and other knowledge brokers etc.). In

most countries there are challenges in transferring results from research into practice - and vice versa – channeling practitioners’ demand for knowledge into research and advisory agendas.

Another universal challenge in competence development is how to support small-scale beekeepers or hobbyists. Due to the limited financial turnover among such actors, there is a need to develop affordable and local services. State support is often necessary to reach out to these groups. In addition, they often have no tradition of continuous education and competence development, why specific measures must be taken to get them to join courses, seminars and other activities.

Some difference between an AKIS and a B-KIS

Looking at the apicultural sector there seems to be some important differences between the traditional AKIS and existing B-KIS in Europe. The first relates to the size and organization of businesses, where the beekeepers although being many do not run big agricultural businesses. This has implications for the relative economic and political power of beekeepers in relation to policy and political priorities. Secondly, there are less formal educational actors within apiculture compared to other sectors of agriculture. Thirdly, the advisory system looks quite different from other sectors, which in many countries means that there are just a few advisors although the sector have thousands and thousands of producers.

The reasons behind the above mentioned and general differences between AKIS and B-KIS have not been the scope for this study. Undoubtedly it is connected to the economic and political power of the sector, and its historical lack of full-time beekeepers (having an effect on the sector’s importance in creating employments in rural areas, etc.). For many beekeepers, producing honey has been something you do on-the-side of a main farming activity.

A consequence of the abovementioned is also that there is not as strong tradition of formal education and buying advisory services among beekeepers compared to farmers in general. There is a tradition of informal, adult learning within the sector, but it is often organized locally and without the intensity and/or continuity in order to really enabling learning for innovation and change. In a situation where there is an immediate need for competence development, for instance regarding Varroa-management, this might become a bottle-neck in itself – just to get beekeepers to ‘the table’ can be hard enough.

In conclusion, one can argue that there are important differences between the European AKIS and existing B-KIS, although there also are many general similarities.

The role of B-KIS in meeting challenges within Apiculture and European Bee-keeping

Over the last decades there have been increased criticism regarding the knowledge and innovation systems’ ability to support sustainable development of agriculture. SCAR, the Standing Committee on Agricultural Research, describes the current state of Agricultural Knowledge Systems in Europe, as “*currently unable to absorb and internalize the fundamental structural and systemic shifts that have occurred. The remaining publicly funded AKIS appear to be locked into old paradigms based on linear approaches and conventional assumptions*” (EU SCAR, 2012). There is a need for renewed political attention to the effectiveness, relevance and scale of Europe’s AKIS and for a redefinition of AKIS. Is this also the case for European apiculture?

There have not been that many reviews of the European apicultural sector. One of the most important was done by Deloitte in 2013 for the DG Agri on “Evaluations of measures for the apicultural sector” (EC DG Agri, 2013). The aim of the evaluation was to how the different measures within the Common Agricultural Policy, CAP, have affected the competitiveness and sustainability of the

European apicultural sector. It is important to note that measures that have an effect on beekeeping can be taken in many policy areas as shown in figure 2 below.

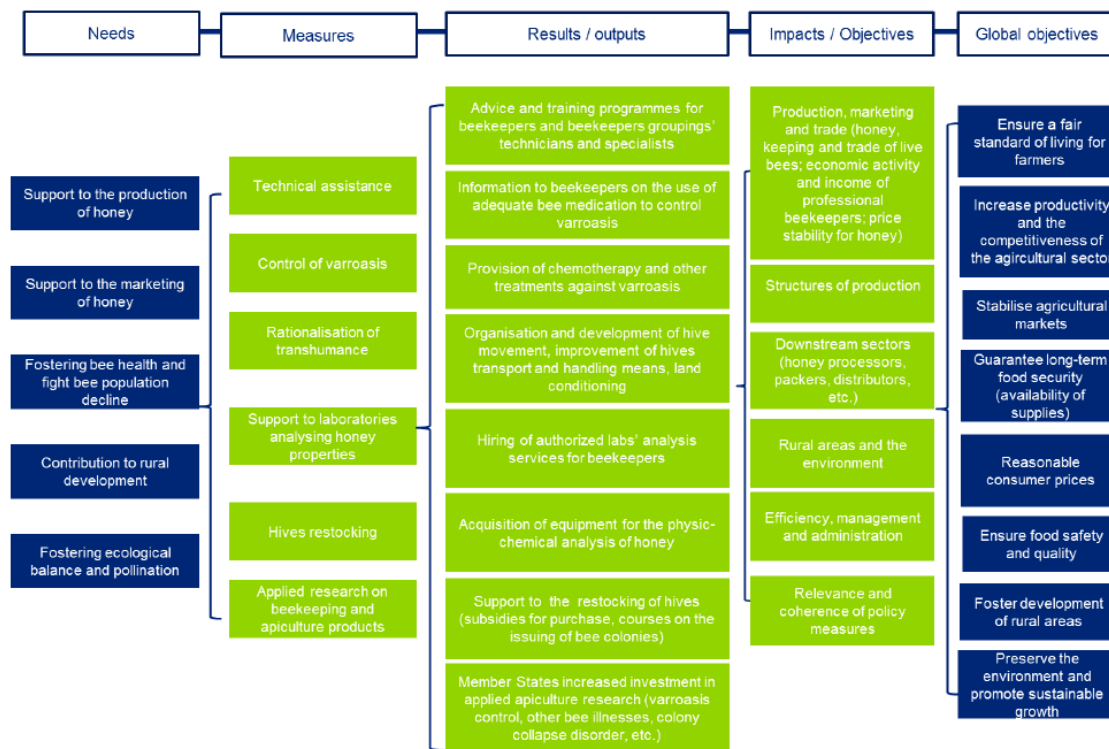


Figure 2. Intervention logic of bee measures (EC DG Agri, 2013, p. 15).

One important conclusion from the abovementioned evaluation was that the measures taken on EU level have induced structural improvements in the sector, notably by encouraging and enabling beekeepers to produce more efficiently (technical assistance, investments support, competence development, supporting laboratories, implementation of applied research activities, etc).

Nevertheless, a B-KIS is much more than the international policy level and the forms of state support that are linked to this level. How does an ideal B-KIS function?

Ideally a well-functioning B-KIS support a high quality and ongoing process of learning among actors involved in the knowledge development. In such a situation new findings in research finds it way quickly to the end-users, is implemented and deliver benefits both for the individual beekeeper as well as for society. But it could also work the other way around, when new issues and challenges are transformed into research questions which then later on helps beekeepers manage the challenges they identified as crucial. This is example of co-learning or multi-stakeholder approaches in research and development.

A well-functioning B-KIS also support the sector with educated people, coming from both training programs and higher education. The B-KIS support the sector with the competences needed to be competitive and sustainable. No chain is stronger than its weakest link, why all parts of the B-KIS must reach minimum level of competence to make the whole system function.

Furthermore, a B-KIS should ideally be able to innovate. This is not only a question of new inventions or management solutions it is also about developing new business models and markets. Today's increased interest for bees (and beekeepers) as ecosystem service providers will create new opportunities for the sector. But for these potentials to be realised the B-KIS must support much more issues and processes than what traditional might have been the main focus. The B-KIS must of course continue to support technological and management innovations, but also markets and products

innovations. In order to do so there is a need for social and institutional innovations. In a well-functioning B-KIS all parts are integrated and the knowledge and innovation system is seen as a whole. An analysis of a national or regional B-KIS makes it possible for us to discuss which limitations exist and what is needed to change.

Acknowledging the diversity of B-KIS across Europe

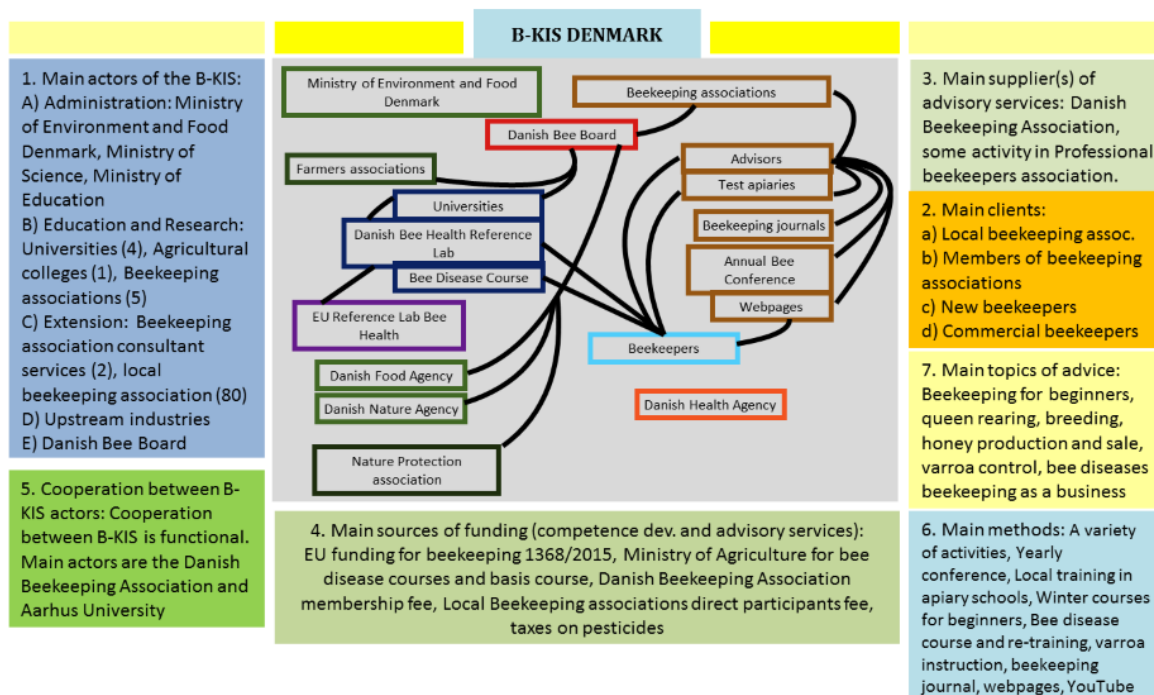
It has earlier been argued that there is a great variety of B-KIS across Europe. This has to be acknowledged, but also be seen as a future possibility for the sector as a whole. Diversity reflects local and historical adaptation and enables resilience. Nonetheless, we certainly have a lot to learn from each other. Having different solutions to more or less the same challenges might give us insights on how to do things a bit differently.

This overview of national B-KIS also gives us a baseline for the next step of WP5 in the Smartbees project. When identifying relevant communications strategies and extension tools to increase the sustainability of the beekeeping sector, these have to be adopted to and built on existing B-KIS. Only then will they be possible to scale up and out.

Examples of national B-KIS in Europe

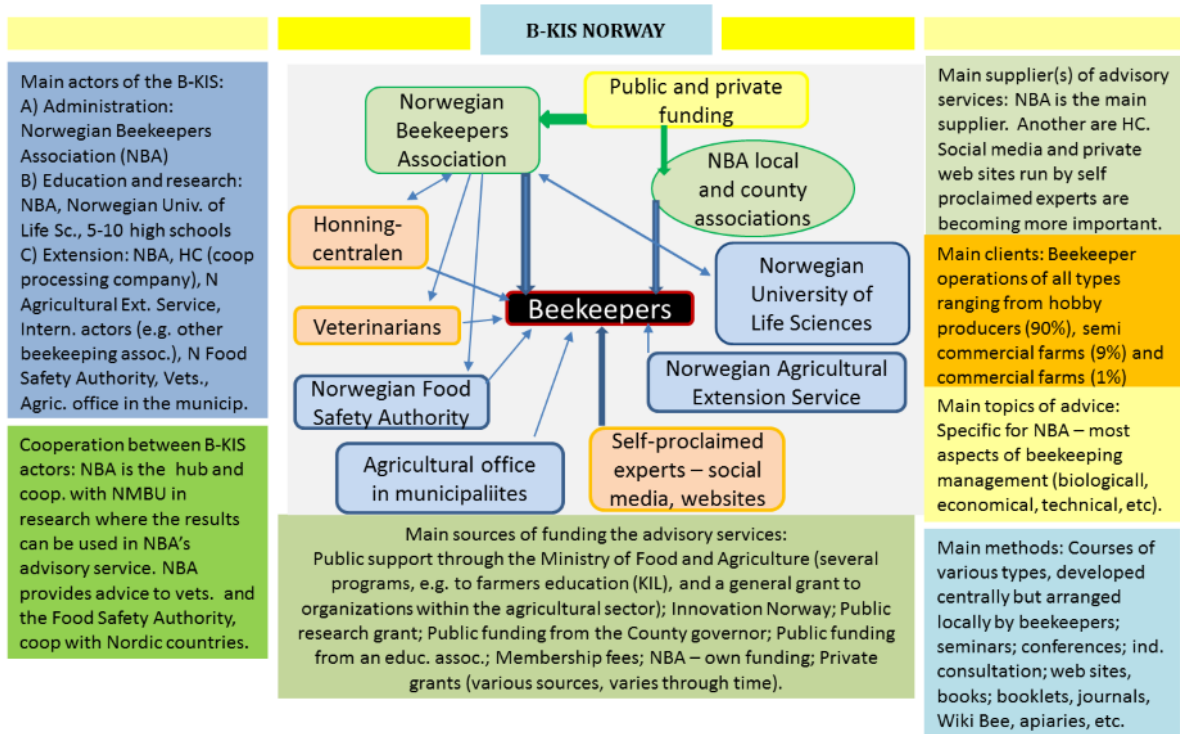
Denmark

The Danish B-KIS is characterised by strong beekeeping associations having an important role in supply advisory services, and using its local organisation to develop competence within the sector. The Danish beekeepers association is the hub in the whole structure, their employees and advisors, making their journal, running their test apiary, organising the yearly conference, etc. There is an ongoing and well established cooperation between these associations and the university level. The role of the state is mainly funding of activities to support the sector.



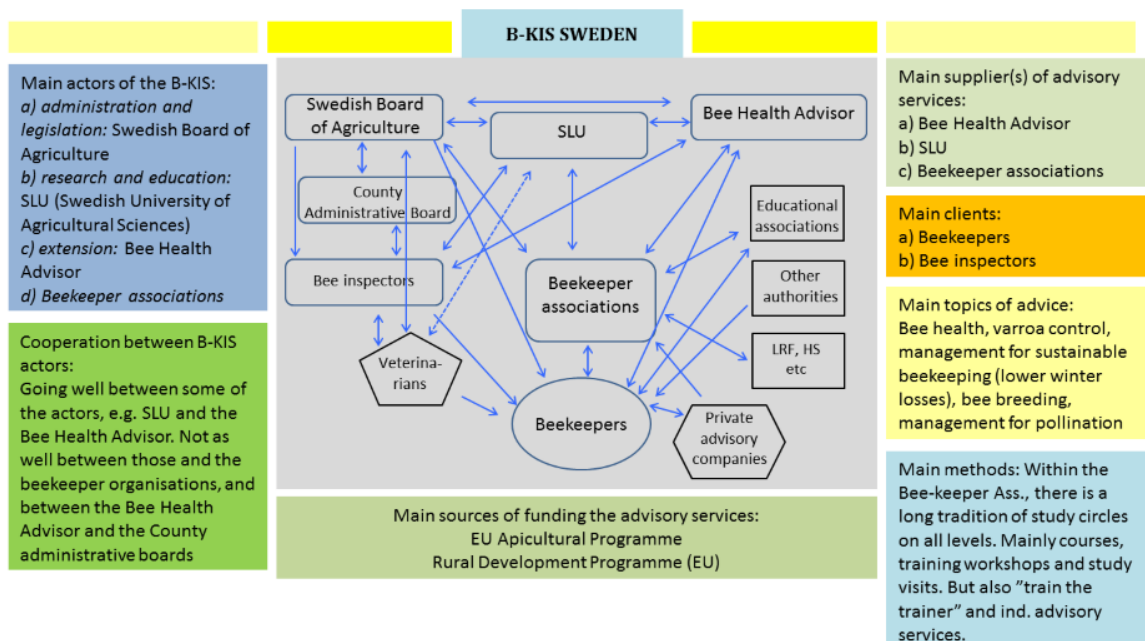
Norway

In Norway it is NBA, the Norwegian Beekeepers Association, which is the hub of the national B-KIS structure. They work in a network structure, collaborating with universities and other actors within the system. The knowledge development which takes place in for instance research projects are disseminated by NBA through close cooperation with other actors, both private and public, enabling them to reach out through many different channels.



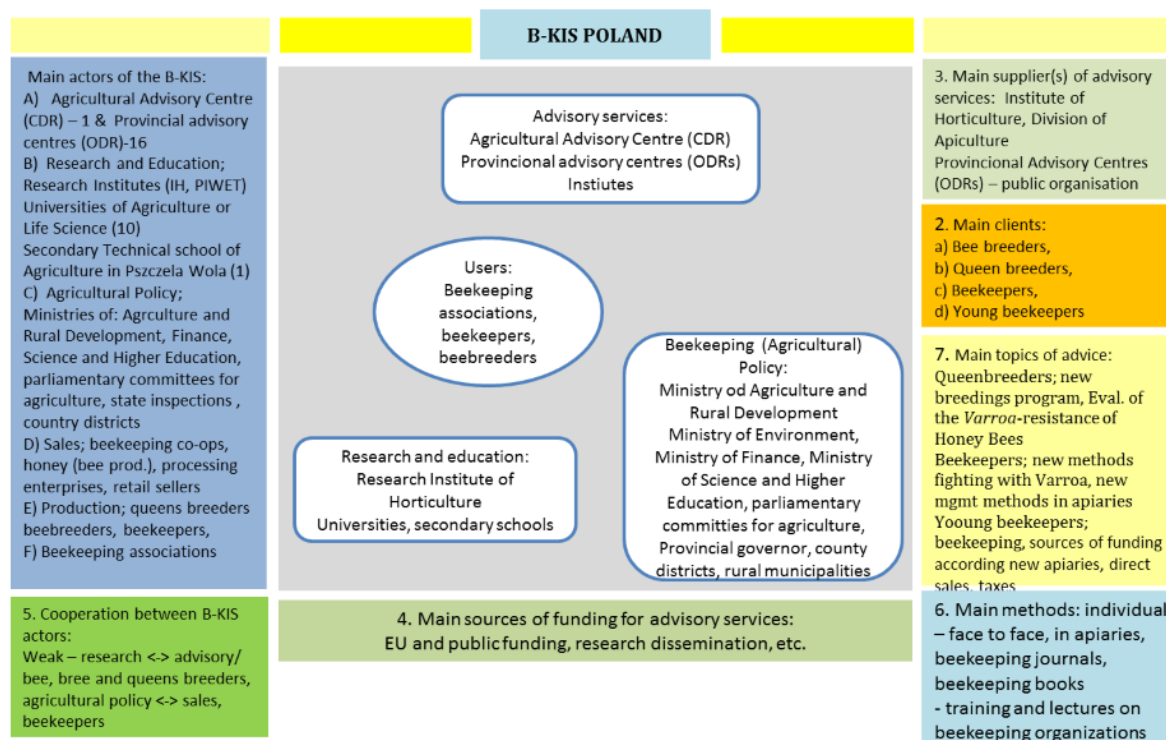
Sweden

The Swedish Beekeeping Association (SBR) is central to the Swedish B-KIS. Two main approaches to reach out are applied; firstly the long tradition of informal, adult learning through the study circle tradition used by the associations to reach out to beekeepers in the whole country especially on basic level, and secondly the Bee Health Advisors, which becomes a knowledge hub bridging between actors within the whole B-KIS. Big efforts are today put on finding new channels and methods to reach out and engage beekeepers and bee breeders in learning activities.



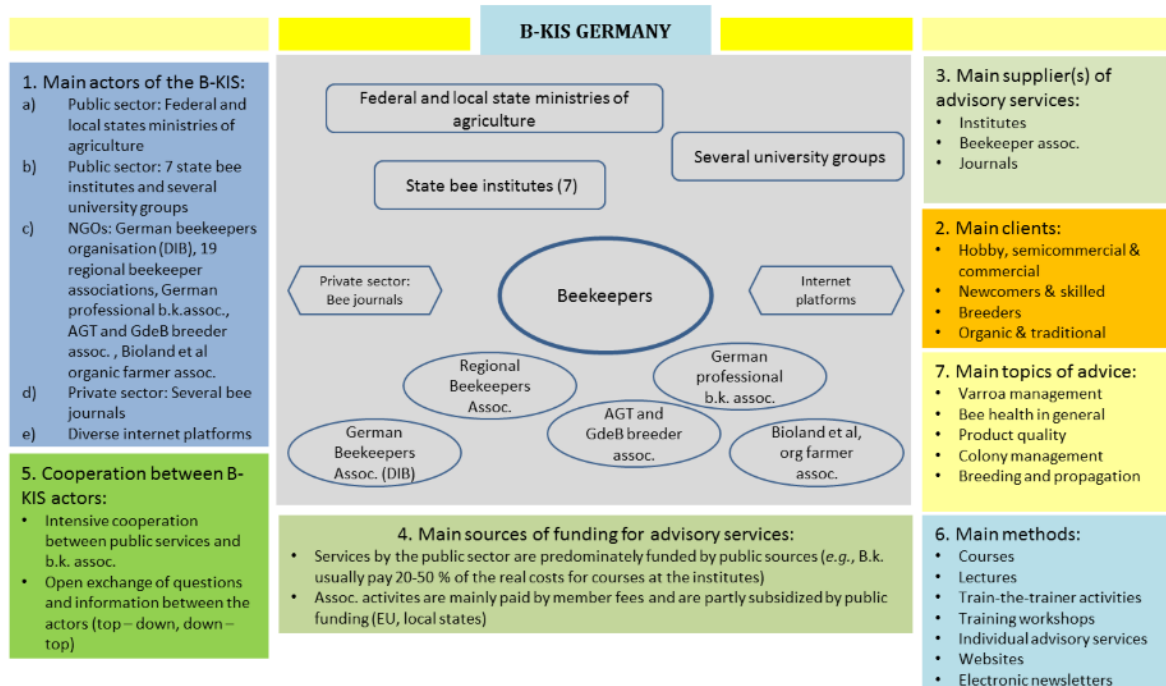
Poland

Poland has a well-developed national and regional structure for supporting beekeepers. The provincial advisory services, together with academic institutions, create a potential for a strong B-KIS. As compared to the Nordic countries the relative importance of the Beekeeping associations are less obvious, although used as a platform to reach out. As in many countries the cooperation among actors in the B-KIS could be better.



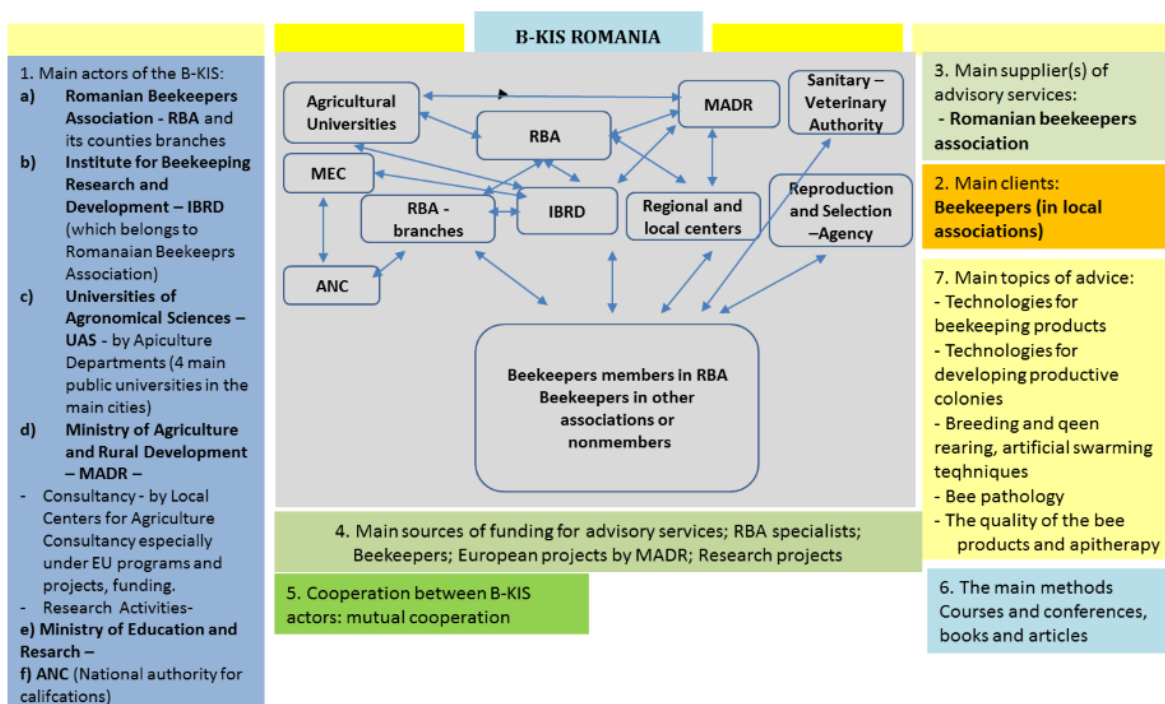
Germany

The German B-KIS is well developed on all levels. There is both a federal and a regional level, including seven state bee institutes and several university groups supporting knowledge development and dissemination. Together with the German beekeeping associations – from national to local level – the cooperation is intense and in general well-functioning. As for most countries there is an ongoing struggle to get funding for new initiatives, but also to develop and implement adapted methods for beekeepers in the whole country.



Romania

The Romanian Beekeeper Association has a central role as a supplier of advisory services and as a bridging institution between different actors within the B-KIS in Romania. There is a well-developed structure from ministry and university to institutes and beekeeping associations. The methods used for competence development is based on traditional methods such as courses, conferences and books/articles.



Institutional arrangements

It is clear that the B-KIS described reflects the cultural and historical differences in Europe. These have clearly influenced the development of national B-KIS, as much as they have for other dimensions of the AKIS and competence development in society. One obvious example is the relative importance of Beekeeping associations and systematic methods for informal, adult learning within the Nordic countries. Another example is the regional state institutes in Germany and the provincial advisory centres in Poland.

In all B-KIS the role of the state or federal level is clear. State support, mainly by funding instruments, is crucial for both continuous competence development as well as for enabling innovations (products, markets, social and institutional). Private funding, through payments for educational activities or fees, is not possible to carry the many efforts made to develop the sector. As EC DG Agri (2013) showed in their evaluation of EU-measures for the apicultural sector, it is clear that such measures are and will be important for a long time forward.

The formal educational system is not strong within the B-KIS. There are quite few actors involved in formal educational activities, ranging from lower grades to higher education. There are different challenges moving from becoming a beekeeper to being a full-time, professional beekeeper. Nevertheless, none of the studied B-KIS have a clear educational strategy for supporting such a development trait among beekeepers. One might describe competence development within the B-KIS as quite ad hoc.

Another critical issue for many of the B-KIS is the reliance of very few people, advisors and experts which makes the B-KIS sensitive. In some countries there are only a few persons taking responsibility for many issues, many beekeepers, and covering a large geographical area. This of course is problematic. The B-KIS is not resilient and sustainable. This is a major difference from other AKIS, for instance in cereals, milk production, horticulture, etc., where the knowledge infrastructure, including all actors involved, creates resilience.

One way of supporting the national B-KIS is by international cooperation. EU-funded research projects such as Smartbees and other initiatives are important, but also networks such as COLOSS and conferences such as EURBEES. These platforms and programs in order for best practice to quicker be spread and to enable cross-fertilization.

Some of the described B-KIS reflects existing knowledge gaps. These arise when different actors in the B-KIS does not co-operate as much as needed. A typical gap is that between academia and advisors. The German model of seven state bee institutes function as bridging institutions, but this is more an exception than a general rule. In the Nordic countries the Beekeeping associations have to take a very big responsibility for disseminating research results, while there are very few advisors due to lack of funding. Furthermore, there is a gap between beekeepers and advisors, due to the fact that many beekeepers have no tradition of participating in training programs or other educational activities. They keep bees for personal use, and do not perceive a need to develop their competence. Such a target group can only be reached by untraditional means and methods. But in the described B-KIS it is clear that most channels used are directed towards the so called early adopters among beekeepers.

Diversity of methods and approaches

As for the institutional arrangements the methods and approaches used for reaching out with new knowledge is diverse within Europe. The methods described range from formal educational programs,

courses and trainings connected to legislative demands (for instance food safety) to study circles, individual consultations, study visits and web based training activities. The approaches used reflect the different traditions within the European B-KIS, but there seems to be an attempt across countries to learn from good examples and across borders.

One challenge for most B-KIS is to avoid a situation where different methods and approaches are used ad hoc, that is, without an overall communication strategy telling the providers which methods to use and how to combine them for best, long-term result. Existing institutional arrangements and lack of sustained funding (partly by lack of economic resources for competence development among beekeepers) is a real problem in this respect. Nevertheless, the awareness of how the knowledge and innovation system can be modified in order to enable learning processes among beekeepers and bee breeders, aiming to implement better Varroa-management and conserving local bee breeds, is often lacking. This is not strange, why most actors involved in competence development within each B-KIS is experts in specific subject fields, and have no specific training in planning, organising and developing communication strategies for competence development for such a diverse group as beekeepers are.

The good thing is that most relevant methods, as well as the educational infrastructure, are in place. No obvious channel is missing within most B-KIS. It is therefore more an issue of being able to combine them strategically so that the potential can be realised. The last part of WP5 in the Smartbees project will be to support such a development.

Conclusions

The knowledge and innovation systems within the beekeeping sector (B-KIS) in Europe are unique for each country. There are many similarities on a more structural level, such as the presence of universities and research institutes, demonstration apiaries, beekeeping associations, and advisors of different kind. The content of the advices given are quite similar across Europe – we face the same challenges. On the other side there are many differences, based on beekeeping traditions, governance structures, the relative power of actors, and of course different funding mechanisms and production volumes. There are some similarities, but also a lot of differences.

In the B-KIS there is a potential to develop the systems efficiency in supporting beekeepers to become more sustainable and to make apiculture reach its full potential in society. But there is no “one-size-fits-all”. The measures taken must be different in each B-KIS, why the communication strategies and the extension tools, methods and approaches will vary.

There is a need for a best fit perspective where capacity is built among actors in all parts of the B-KIS (from policy makers, researchers, advisors etc.) in order to develop and implement advisory services that best fit the conditions as well as political priorities in each country. At the same time it is important to stress that we have a lot to learn from each other across Europe. The description and analysis of different B-KIS shows that there is a lot of experimentation using new approaches and tools in competence development for beekeepers. Good examples could be found all over Europe. The regional training centers in Germany are one example, and the informal system of adult learning through study circles in the Nordic countries another. The next step of WP5 will be to identify these examples of best practice, present them in an extension tool box, and suggest how these can be combined with existing activities to create regionally adapted communication strategies in European countries.

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