Ag Input Purchases and Usage: IT-Based vs. Advisory Services

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The Future of Advice on Growers' Ag Input Purchases and Usage
- A Case Study for Germany -

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Introduction

Innovations evolving from digitalization, such as remote sensing, establish potential entry points for new players in the advisory market regarding input usage. Further, the ag industry is considering directly targeting growers with their marketing concepts such as outcome-based pricing models. Additionally, conventional retail channels are challenged by new online retail platforms as well as by private consultancies. Thus, the question is, "Who will shape future decision making of growers regarding the selection and the usage of crop inputs?"

The purpose of this analysis is twofold: First, we want to estimate actual market share of private crop advisory services in Germany. Our underlying hypothesis: The higher the market share of private consulting, the weaker the impact from retailer-based advice on cropping and input use decisions. When high importance of private consulting exists, it will be more difficult for new players to disrupt current marketing concepts and to replace current influencers. The reasoning: If a grower actively searches out a private consultant and pays for that service, he or she most likely will value that individual service and rely on its advice, which usually includes product usage. Therefore, it is assumed that it will be rather difficult to replace this kind of advice – particularly if it is purely based on anonymous algorithms.

Secondly, we want to generate some snapshots of current trends in the role of advisory services: What kind of issues are at stake for growers and what kind of advice they are looking for? Depending on the answers, it will be possible to assess the likelihood that technical and market innovations in input use advisory services can successfully compete with current sources of information and advice.

Due to a diverse advisory landscape and good contacts to several types of advisory companies, we used the case of Germany to analyze these questions. Of course, with the small number of interviews it will not be possible to make general statements about the question at stake; however, we might be able to identify some fundamental factors that will allow us to come up with more specific hypotheses as the basis for more in-depth research.

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Crop Advisory Market Characteristics

In Germany, crop advisory to individual farmers is mainly supplied by three types of institutions – public administration or agricultural chambers, ag retailers, and private consultancies. By and large, the prevailing source in a state is related to the availability of governmental advisory services open to an individual grower: When government-paid services are readily available, private consulting is weak and vice versa.

In western Germany - namely Saarland, Rhineland-Palatine, Hesse and North Rhine-Westphalia - governmental advisory is the dominant form of advice service, providing free general or district-related consultancy. Furthermore, individual growers can access crop advice from these institutions on a fee basis. Local farmer associations exist in addition to advice services of the agricultural chamber and classic private advisory companies. These farmer cooperatives benefit from scaling effects, with all members sharing the costs of an employed advisor – so-called *Beratungsringe*.

Northern Germany is characterized by a mix of all advisory forms, with an increasing share of private advisory in eastern states. Whereas in Brandenburg, the agricultural chamber still is an important additional contact along with private consultancy, crop growers in Mecklenburg, Western Pomerania, Saxony, Saxony-Anhalt, and Thuringia almost exclusively rely on private crop advisory services (PAUL et al. 2014, KNIERIM et al. 2017a). In most of these states, individual, governmental farm consultancy is not available because it was never introduced systemically after German reunion (THOMAS 2007).

Nowadays, in southern Germany, a similar picture is evident: After the regional governments terminated their individual farm advisory services, local advisory associations similar to the Beratungsringe emerged and they now prevail. However, public institutions in Bavaria and Baden-Wuerttemberg still have a strong place with regard to consulting services related to rural development as part of the second pillar in Common Agricultural Policy (KNIERIM et al. 2017a, MINISTERIUM FÜR LÄNDLICHEN RAUM UND VERBRAUCHERSCHUTZ BADEN-WÜRTTEMBERG 2021a, BAYERISCHES STAATSMINISTERIUM FÜR ERNÄHRUNG, LANDWIRTSCHAFT UND FORSTEN 2021).

Due to a limited availability of official business registers at federal state level a web research was used to estimate the market share of private consulting businesses. Accordingly, we listed all officially registered and online detectable private advisories, including respective indicators for their reach (e.g., number of consultants and/or number of hectares consulted), if available. The result is a list of 41 conventional private crop production advisory companies and an additional seven companies focusing on organic farming. Five of the conventional consultancies have clients in all German states and other European countries. The serviced acreage was either adopted from the official websites of the companies or calculated by the mean farm size of the respective state and the average number of farms per consultant. In total, approximately 25,600 farmers cultivating 3.3 – 3.4 million hectares pay for private consultation. This equals 20% of the total agricultural land (arable plus grassland) or 28% of the total arable land in Germany. On average,

one consultant serves about 9,700 – 9,800 hectares owned by 71 clients[2] (STATISTISCHES BUNDESAMT 2021).

These findings are fairly in line with comparable research conducted for the "Prospect for Famers' Support Agricultural Knowledge and Information System" (AKIS) project funded by the EU. Researchers surveyed varying advisory institutions and found a client consultant ratio of 60:1 in private advisory services with an average farm size of 328 ha over all consulting institutions (PAUL et al. 2014 KNIERIM et al. 2015). As stated above, we found a ratio of 71:1 with an average farm size of approximately 140 ha. Possible reasons for the differences were not evaluated in more detail. Generally, we make no claim to completeness – covering the whole range of single freelancers to international advisory companies. Small advisory offices, in particular, may not show up online and often do not provide detailed numbers about clients and acreage (KNIERIM et al. 2017a, AUFSICHTS- UND DIENSTLEISTUNGSDIREKTION 2021, LANDESAMT FÜR LÄNDLICHE ENTWICKLUNG, LANDWIRTSCHAFT UND FLURNEUORDNUNG 2021, LAND MECKLENBURG-VORPOMMERN 2021, MINISTERIUM FÜR LÄNDLICHEN RAUM UND VERBRAUCHERSCHUTZ BADEN-WÜRTTEMBERG 2021b, Pro AKIS Inventory 2021).

When interpreting our findings, one must keep in mind the farm structure in Germany. About 30% of arable land is farmed by farms (sole proprietorships) that are smaller than 50 ha; in total, the share of part-time farms is 52%, cultivating 27.5% of the total arable land (STATISTISCHES BUNDESAMT 2017). Since investing in private consultancy has a fixed-cost component and presupposes special interest in crop production, it can be hypothesized that the bulk of farms paying for private consultancy services will be larger and more professional farms than the average German 60 ha farm (IBID 2017). That would imply that the market share for private consultancy among more advanced growers with more sophisticated needs regarding the quality of advice is probably higher than the 28% mentioned above. Accordingly, market share increases to 38% if statistical averages per state are replaced by the average of our sample per region.

The comparison of our findings to the consultancy landscape described by THOMAS (2007), PAUL et al. (2014), KNIERIM et al. (2017a) and KNIERIM et al. (2017b) gives evidence that the political promotion and reinforcement of private agricultural advice services over the past years shows an effect – notably in Saxony, Bavaria and Baden-Wuerttemberg. Especially in the southern part of Germany, governmental institutions have withdrawn from individual farm operation consultation: Consultancy in plant production now is mainly offered by certified private advisories whose services are subsidized by the agricultural ministries and chambers (KNIERIM et al. 2017a, BAYRISCHES STAATSMINISTERIUM FÜR ERNÄHRUNG, LANDWIRTSCHAFT UND FORSTEN 2021, MINISTERIUM FÜR LÄNDLICHEN RAUM UND VERBRAUCHERSCHUTZ BADEN-WÜRTTEMBERG 2021a). Strengthening of AKIS and farm advisory services will increasingly influence farmers' decision making and in turn, their license to produce throughout the next years (EU SCAR AKIS 2019).

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[2] Numbers do not include a farmer association in the south of Bavaria where nine consultants manage 21,442 clients covering 890,000 ha with a client advisor ratio of 2,382:1. This extremely wide ration indicates that the advice generated is predominantly generic and very little in a 1 to 1 format and therefore hard to compare with the private advisory services analyzed before.

Estimation of actual market size, number and geographic location of identified competitors allows a first conclusion on the introductory hypothesis:

The share of arable land that is being privately advised as well as the number of growers relying on private crop advice have reached a level where significant influence of private advisory services on ag input purchase and usage of German producers is to be assumed.

Changes in Crop Advisory Services

The expert interviews are meant to help understand the motivations of growers to request consultancy in crop production. Further, the statements can contribute toward answering the question whether foreseeable innovations such as remote sensing or outcome-based pricing meet current and future requirements of crop producers. To reflect the heterogeneity of crop production in Germany, advisors and growers were chosen from different regions. The contacted farms are in the west of Germany (500 ha) and the southern center of Germany (340 ha); both are mixed farms. Both farms receive crop production advice, not by a private company but from retail, industry, and unpaid as well as paid services of the agricultural chamber.

The two interviewed crop advisors work for private companies, one in the northeast of Germany and one in the west up to the northwest Germany. Clients of the advisor in eastern Germany are arable farmers with an average farm size of 1,200 ha. The focus of the consultancy is on economics and crop production. The consultant in western Germany services all farm types, averaging 80-90 ha. The focus of this advisory service is on crop production and groundwater protection.

A main goal is to assess the change in advisory service demand over time: Can we identify any trends that have an impact on the competitiveness of digital or otherwise innovative crop input and use advice? Therefore, all participants were asked to indicate what topics have been high on their agenda over the past five years, what matters to them nowadays, and what they expect to be relevant over the next five years. Answers imply a growing need in advice services over the past years, caused by three drivers: political restrictions and obligations, the political debate about long-term goals in agriculture and climate change. Whereas, in the past, the crop consultant served as a specialist for detailed crop production questions, nowadays very often a holistic, production systems approach is needed: First, the grower needs support to design a crop rotation that is in line with legal, economic and agronomic framework conditions. In the next step, advanced technical guidance is needed regarding product choice, dosage, and timing of applications, as well as a way to measure the impact. These decisions become even more complex because of (a) more frequent extreme weather events, (b) resistances of plants and pathogens against crop protection products and (c) a decline in the choices of approved crop protection products.

Finally, growers have to adhere to ever-changing legal rules regarding nutrient management and nutrient surpluses. In the end, growers and advisors are faced with serious mid- and long-term planning uncertainties and a growing complexity of decision making.

To sum it up: Questions put to consultants very often are related to aggregated structural issues and overall profitability of arable farming, whereas more detailed agronomical issues play a relatively minor role. Because of the far-reaching implications of the issues at stake, honesty, independence, specificity and expertise are considered to be key characteristics of an "ideal" advisor.

Furthermore, consultants reported that, in general, growers increasingly are asking for advice on legal rules. In fact, this task has become a major part of their work. Growers and advisors identified the sheer amount of regulation and unclear political directions as key reasons for rather difficult and complex decision making. For example, the legislation on fertilizer application is very specific to different types of landscapes, which are legally defined by certain environmental parameters such as the amount of nitrate that has been identified in aquifers. Depending on the legal status of a particular field, different rules regarding the permitted fertilization apply; it is even possible that four neighboring fields fall into four different zones.

To manage previously mentioned challenges, all participants are involved in locally adapted trials and experiments to widen crop rotations as a major potential solution to a lot of legal and agronomic challenges. Further, growers and advisors interviewed see significant potential in precision farming – namely site-specific crop management – and digitization to meet legal and political constraints. They also believe that site-specific crop management will be important to manage expectations from the society regarding crop production and its environmental performance. However, they are of the opinion that, as of now, there is still a steep learning curve to manage; the current benefits realized at the farm level are rather limited, even though two of the four experts already use remote imagery to monitor their own or clients' fields as a tool to identify issues in crop production. This challenge in itself causes growers to ask for more and better advice, too.

In addition, all experts expect that in the future growers will be obliged to document field activities in more detail than today. Both the political will to tighten control as well as the increasing technological possibilities to do so are considered as the key drivers for that trend. The respective obligations will create new complexity at the operational level because proper documentation will not be done automatically. Therefore, all participants, especially crop advisors, referred to the relevance of integrated documentation systems and communication channels involving all stakeholders. This does not mean they are just asking for IT systems that take over responsibilities. Rather, they are looking for an IT infrastructure that allows them to manage complex processes of modern agriculture. It was assumed that higher standards in information gathering, processing and data distribution to various stakeholders will also increase demand for advisory services.

All experts expect that, over the coming five years, the challenges mentioned are going to become even more important. The relevance of a systematic approach in advice will grow, especially in terms of defining a farm strategy and preprocess legal information. Changing political framework conditions and climate change are identified as the main influencing variables for the next years. The farm to fork strategy and the Common Agricultural Policy after 2023 already indicate the need for growers to develop new concepts in plant production (BUNDESMINISTERIUM FÜR ERNÄHRUNG UND LANDWIRTSCHAFT 2021). Of course, this need is associated with a high uncertainty which, in return, requires even more intensive interaction with advisors. To some degree, the growing need is met by digitization, enabling new ways of delivering advice, which were accelerated by the Covid-19 pandemic. Messenger services and e-newspapers were already part of pre-pandemic crop consultancy, but it can be assumed that web conferences and webinars will stay as an element in the advice service toolbox.

Previous paragraphs illustrate different characteristics of crop production in which information systems can and most probably will change crop consultancy – this raises the question whether it might be possible to – at least partially – replace the services of an advisor by artificial intelligence (AI). The concept: If it were possible to gather, link, and compile a huge number of detailed pieces of information on all activities and natural framework conditions of crop production, computer programs might be able to identify patterns for the most successful cropping methods. A picture that might illustrate the concept: Each and every field of growers participating in such an analysis would become a trial plot with all its related data. Using these "trial plots" as a reference database would allow one to assign a probability for success to each individual activity and input use at a given set of natural framework conditions. The algorithm would then suggest to the grower the activity and input usage that has the highest probability of a high return in a given environment. This scenario is based on the goals of the ValiProg project about decision support and prognosis in crop protection and a considerable amount of research that has lately been conducted regarding the use of AI in crop production (BARBOSA et al. 2020, BESTELMEYER et al. 2020, PETERS et al. 2020, SUDDUTH et al. 2020, JUNG et al. 2021, VITALI et al. 2021, ZENTRALSTELLE DER LÄNDER FÜR EDV-GESTÜTZTE ENTSCHEIDUNGSHILFEN UND PROGRAMME IM PFLANZENSCHUTZ 2021).

Regardless of the speed of technological innovations, no expert expects the human being to be replaced by AI in the near future. The complexity of the tasks - for example, regarding legal aspects - and the granularity in which decisions must be made are assumed to be beyond today's level of AI. Furthermore, for the interviewed farmers, social interaction and trust, aspects that can only be assigned to humans, are fundamentals of good advice. Additionally, the consultant is, through bidirectional communication, a counterpart the farmer can grow on – AI only provides one-way communication. Nevertheless, digital tools and AI are identified and valued as additional information sources and supporting tools. Digital communication, real-time information gathering, prognosis and possibilities evolving from various information sources (RÖSCH 2018, HATFIELD et al. 2020, BITKOM 2020) are perceived to be efficient extensions but not alternatives to conventional consultancy in crop production.

Conclusions

(1) When reviewing the outcomes from the expert interviews, we need to consider the small sample size. Hence, it would be desirable to broaden the coverage in terms of region and types of institutions as far as the consultants are concerned. However, it seems that a lot of statements refer to tangible and measurable developments such as the number of restrictive political regulations or changing weather conditions in recent years. We therefore hypothesize that most of the challenges mentioned will pop up again if more growers and advisors are interviewed.

(2) The framing of the challenges indicates the complexity of growers' needs. Reflection of the two different perspectives outlines the relevance of availability and ongoing development of advice services for future crop production. Climate and policy are fundamentally reshaping the agricultural landscape in Germany. It appears that growers are primarily facing the challenge to retain their license to produce, rather than deciding whether to use product A or product B.

(3) With regard to the initial question about who will influence growers' decision making in the future, our analysis suggests the following: Since
    (a) it seems likely that the market share for private consultants – who are considered to be rather influential - will increase and
    (b) the number of issues on which the individual producer is looking for advice will rise as well,
    we question whether it will be possible to disrupt these relationships and establish new influencers. With regard to the role of advisory services delivered by retailers, it seems likely that their impact will be reduced – and so will their ability to influence growers' decisions regarding input purchases and usage.

(4) Provided these conclusions can be confirmed by further research and broader empirical evidence, targeting private consultancies as key influencers for input purchase decisions would be a reasonable conclusion for manufacturers and even service providers of digital tools.

Bibliography

Aufsichts- und Dienstleistungsdirektion (Ed.) (2021): Beratung in der Landwirtschaft. Available online at https://add.rlp.de/fileadmin/add/Abteilung_4/Foerderungen_Abteilung_4/41_Beratung_in_der_Landwirtschaft/Liste_anerkannte_Beratungsanbieter.xls, accessed 25.02.2021.

Barbosa, Alexandre; Trevisan, Rodrigo; Hovakimyan, Naira; Martin, Nicolas F. (2020): Modeling yield response to crop management using convolutional neural networks. In: Computers and Electronics in Agriculture 170, p. 1–8. DOI: 10.1016/j.compag.2019.105197.

Bayrisches Staatsministerium für Ernährung, Landwirtschaft und Forsten (Ed.) (2021): Beratung in der Land- und Forstwirtschaft. Available online at https://www.stmelf.bayern.de/cms01/landwirtschaft/unternehmensfuehrung/003303/index.php, accessed 25.02.2021.

Bestelmeyer, Brandon T.; Marcillo, Guillermo; McCord, Sarah E.; Mirsky, Steven; Moglen, Glenn; Neven, Lisa G. et al. (2020): Scaling Up Agricultural Research With Artificial Intelligence. In: IT Prof. 22 (3), p. 33–38. DOI: 10.1109/MITP.2020.2986062.

Bitkom (Ed.) (2020): Schon 8 von 10 Landwirten setzen auf digitale Technologien. Berlin. Available online at https://www.bitkom.org/Presse/Presseinformation/Schon-8-von-10-Landwirten-setzen-auf-digitale-Technologien, accessed 18.03.2021.

Bundesministerium für Ernährung und Landwirtschaft (Ed.) (2021): Stärkere Förderung kleinerer Betriebe – Honorierung von Umweltleistungen – bessere Unterstützung von Junglandwirten. Bundesministerin Julia Klöckner legt Entwurf für nationale Umsetzung der Gemeinsamen Agrarpolitik Europas vor. Available online at https://www.bmel.de/SharedDocs/Pressemitteilungen/DE/2021/29-gap.html, accessed 18.03.2021.

EU SCAR AKIS (Ed.) (2019): Preparing for Future AKIS in Europe. Brussels, European Commission. Available online at: https://library.wur.nl/WebQuery/wurpubs/fulltext/522240, accessed 30.03.2021.

Hatfield, Jerry L.; Cryder, Michelle; Basso, Bruno (2020): Remote Sensing: Advancing the Science and the Applications to Transform Agriculture. In: IT Prof. 22 (3), p. 42–45. DOI: 10.1109/MITP.2020.2986102.

Jung, Jinha; Maeda, Murilo; Chang, Anjin; Bhandari, Mahendra; Ashapure, Akash; Landivar-Bowles, Juan (2020): The potential of remote sensing and artificial intelligence as tools to improve the resilience of agriculture production systems. In: Current opinion in biotechnology 70, p. 15–22. DOI: 10.1016/j.copbio.2020.09.003.

Knierim, A.; Boenning, K.; Caggiano, M.; Cristóvão, A.; Dirimanova, V.; Koehnen, T. et al. (2015): The AKIS Concept and its Relevance in Selected EU Member States. In: Outlook Agric 44 (1), S. 29–36. DOI: 10.5367/oa.2015.0194.

Knierim, Andrea; Thomas, Angelika; Schmitt, Sebastian (2017a): Beratungsangebote in den Bundesländern. In: B&B Agrar (4), p. 1–26.

Knierim, Andrea; Thomas, Angelika; Schmitt, Sebastian (2017b): Agrarberatung im Wandel. In: B&B Agrar (4), p. 27–32.

Land Mecklenburg-Vorpommern (Ed.) (2021): Beratungsleistungen im Bereich der Landwirtschaft des Landes Mecklenburg-Vorpommern. Available online at https://www.regierung-mv.de/serviceassistent/_php/download.php?datei_id=1568346, accessed 25.02.2021.

Landesamt für Ländliche Entwicklung, Landwirtschaft und Flurneuordnung (Ed.) (2021): Berateranerkennung. Available online at https://service.brandenburg.de/lis/detail.php?id=422450&template=lis_adressen_tab&_sortfolge=sortierer,title&_ariadne=&_ariadne=;422450, accessed 25.02.2021.

Ministerium für Ländlichen Raum und Verbraucherschutz Baden-Württemberg (Ed.) (2021a): Beratung.Zukunft.Land. Wissen in die Praxis bringen. Available online at https://bzl.landwirtschaft-bw.de/,Lde/Startseite, accessed 25.02.2021.

Ministerium für Ländlichen Raum und Verbraucherschutz Baden-Württemberg (Ed.) (2021b): Beratungsorganisationen. Available online at https://bzl.landwirtschaft-bw.de/site/pbs-bw-mlr-root/get/documents_E920481812/MLR.Beratung/Dokumente-Beratung/PDF-Datei_BOs/2021-02-02_Beratungsorganisationen.pdf, accessed 25.02.2021.

Paul, C., Knuth, U., Knierim, A., Ndah, H.T. and M. Klein (2014): AKIS and advisory services in Germany. Report for the AKIS inventory (WP3) of the PRO AKIS project. Available online at www.proakis.eu/publicationsandevents/pubs, accessed 25.02.2021.

Peters, Debra P. C.; Rivers, Adam; Hatfield, Jerry L.; Lemay, Danielle G.; Liu, Simon; Basso, Bruno (2020): Harnessing AI to Transform Agriculture and Inform Agricultural Research. In: IT Prof. 22 (3), p. 16–21. DOI: 10.1109/MITP.2020.2986124.

Pro AKIS Inventory (Ed.) (2021): Searchable database. Available online at https://proakisinventory.eu/searchabledatabase, accessed 26.04.2021.

Rösch, Martina (2018): Beratung wird digitaler. In: B&B Agrar, p. 32.

Statistisches Bundesamt (Ed.) (2017): Land- und Forstwirtschaft, Fischerei. Rechtsformen und Erwerbscharakter Agrarstrukturerhebung.

Statistisches Bundesamt (Ed.) (2021): Feldfrüchte und Grünland. Landwirtschaftliche Bodennutzung nach ausgewählten Hauptnutzungsarten. Available online at Landwirtschaftliche Bodennutzung nach ausgewählten Hauptnutzungsarten - Statistisches Bundesamt (destatis.de), accessed 04.08.2021.

Sudduth, Kenneth A.; Woodward-Greene, M. Jennifer; Penning, Bryan W.; Locke, Martin A.; Rivers, Adam R.; Veum, Kristen S. (2020): AI Down on the Farm. In: IT Prof. 22 (3), p. 22–26. DOI: 10.1109/MITP.2020.2986104.

Thomas, Angelika (2007): Landwirtschaftliche Beratung in der Bundesrepublik Deutschland – eine Übersicht. In: *B&B Agrar*, p. 1–20.

Vitali, Giuliano; Francia, Matteo; Golfarelli, Matteo; Canavari, Maurizio (2021): Crop Management with the IoT: An Interdisciplinary Survey. In: Agronomy 11 (1), p. 181. DOI: 10.3390/agronomy11010181.

Zentralstelle der Länder für EDV-gestützte Entscheidungshilfen und Programme im Pflanzenschutz (Ed.) (2021): Verbundvorhaben „ValiProg". Available online at http://www.zepp.info/proj/lp/229-valiprog, accessed 11.05.2021.