Application of web-based information and tele-cooperation in integrated research on livestock production

Marianne Andres & Jan Mark Pohlmann.

German Centre for Documentation and Information in Agriculture (ZADI), Bonn, Germany.
E-Mail: andres@zadi.de, URL: http//www.dainet.de

Summary
Like no other media before, the Internet influences information and communication processes. Thus, it becomes the decisive factor for greater efficiency in all research areas. The Internet changes the information demands of scientists and the possibilities for the use of scientific information. Access to agricultural information is available on the Internet in networks and data catalogues developed by international and national institutions and organisations. They categorise the available information under scientific, organisational and geographical aspects for rapid and goal-oriented access to world-wide Internet sources. New possibilities are given by direct access to information about scientific literature and project information. This use will be exemplified by on-line searchable literature databases which contain full texts or bibliographical details of publications. Information about current or finished research also can be found with help of the Internet via online searchable databases or through publication lists of research institutions. The Internet makes possible modern data management and new forms of research co-operation. Scientists and research institutions that could serve as contacts for answering scientific questions and as partners for joint projects are easily found with the help of address and expert directories, while discussion forums offer a place for immediate exchange of ideas and experiences. Increasingly, telecooperation is used for the solution of common research questions. In this context, several networks provide good examples for combining decentralised holding of data with centralised access and to show new opportunities in international research co-operation in the field of agriculture and animal production.

Introduction

For efficient scientific research, the use of all available information resources is a precondition. Only then it is possible to react in time to new developments, to base research on already existing experiences and research results and to escape the danger of repeating the same work twice. Also, on a global scale, the fast and comprehensive availability of up-to-date high-quality scientific and technical information for the user is the key for efficient scientific and economic acting in industry, science and administration. To secure this type of source availability, the optimal preparation and presentation of all formerly gathered knowledge is necessary.

Changing information needs in the world of the Internet
The changes in the information landscape through the world-wide-operating computer network Internet opened a world of new possibilities. The Internet is increasingly developing into the technical basis for all aspects of integrated research in the agricultural sector. The advantage of having access to research-relevant data by the Internet without any loss of time and directly from the workplace, is a definite improvement for scientific work. Researchers are interested in having their question answered rapidly, questions like "Are there any publications on my scientific problem? Who has published what and where? Is the intended research topic already the subject of another project? Which funding, which research data, which experiences can be used? How can co-operative research work be maximised?"

Changing information access via Internet
For a fast answer to such questions, scientists until now only had a limited number of solutions: most notably, traditionally financed libraries and information institutions as mediators between the producers and the providers of scientific information. Until several years ago, the tasks have remained the same, but today, a fundamental change is happening in basic information technology. In particular, the possibilities of the Internet demand technological adaptations and make possible new forms of information services as well as of co-operation between scientists, publishers, libraries and information services. In the past, the information seeker was dependent on the brokering services of experts in information institutions, when he or she needed special scientific information. These institutions searched, to the order of their clients, in databases of the information hosts like DIALOG, DataStar, DIMDI or STN, which from the beginning of the 1970s had started to hold databases from the agricultural sector. Without knowledge of the specific access methods, retrieval languages and sorting criteria, the information content of the databases was closed for non-professionals. With the development of the Internet, this situation has dramatically changed. Database producers and hosts are now offering their products on the Internet. Interested persons can search for information in these databases and in the world-wide-web in general without any external help. The problem now encountered is to find amongst the multitude of Internet sources, the relevant addresses. The continuously increasing number of web servers and web pages make it near impossible to discover - without an unacceptable expenditure of time - the information of interest.

Differently-structured search catalogues and information networks serve as navigational aids on the Internet. The world-wide distributed information sources are processed in such way that the relevant source can be found under different general headings. Scientists, as well as farmers from animal production and breeding, will find the information of interest to them by these networks and data catalogues in an accumulated form.

Information networks

Information networks and data catalogues allow the centralised access to Internet sources. This information is provided by internationally operating organisations as well as by major national information institutions. Regional scientific institutions are also creating networks and data catalogues for specialised scientific information and they provide in such way for national or even international information needs.

Transnational Networks

One of the large international networks with information on animal production is the *Food and Agriculture Organisation (FAO) (http://www.fao.org/),* another is the *National Agricultural Library (NAL)* in Beltsville, United States. The information at the *World Agriculture Information Centre (WAICENT)* of the FAO covers animal production and all other agricultural topics. Especially valuable are the databases for genetic resources of domestic and useful animals (DAD-IS) and the AGROSTAT databases which provide international statistics on all agricultural subfields. *The Agriculture Network Information Center (AgNic) (http://www.agnic.org/)* that is being developed in co-operation with the NAL provides another comprehensive information network for international agriculture and animal production. AgNic is a decentralised network that gives access to animal-related information, experts and other resources via a special animal science homepage.

National Networks

In different countries, information institutions have undertaken to provide central entry points for agriculture-related Internet sources. They include not only the sources from their own countries, but also those from other regions. Examples of these type of systems are the Scandinavian network *NOVAGate (http://novagate.nova-university.org/)* with classified Internet sources from the agricultural sector of the five Scandinavian countries as well as the Belgian network, *AGRIS (http://www.agris.be/agris/),* with extensive breed descriptions of Belgian and French cattle and pigs, and the Danish information system *DINA (http://www.dina.dk)* that has been installed as a network for research activities of universities and research institutions.

The German Internet service for the field of food, agriculture and forestry is the *German Agricultural Information Network (DAINet) (http://www.dainet.de).* With its broad range of topics and more than 8,000 described Internet sources, the DAINet is regarded as the world-wide largest Internet search catalogue in agriculture. The DAINet is an information service maintained by the German Centre for Documentation and Information in Agriculture (ZADI), an information institution financed by the German Federal Ministry of Food, Agriculture and Forestry.

The structure of this system directs users with different information needs, such as scientists and farmers, to the relevant information sources. From a German or an English homepage, information forums for agriculture, horticulture, forestry and fisheries can be reached, which provide direct access to Internet sources on plant and animal production, ecological agriculture, economics and technology. There also exist central entry points to search for publications, statistics, research information, addresses, events, software and discussion lists.

The entry point, "Animal Production" gives rapid access to Internet sources covering aspects such as the individual varieties of domestic animals, animal breeding, genetics, biotechnology and market and trade information. The basis of the offered sources is a database which collects the details about Internet sources in a way that allows them to be searched from all imaginable aspects. The service FIZ-AGRAR gives free access to more than 130 different databases for on-line searches of literature, factual data or project information. Increasingly, these databases contain full texts and factual data.

Specialised Subject-Related Information Networks

More complex information services for animal production can be found in specialised subject-related networks, such as, for example, the *Information System Genetic Resources (GENRES) (http://www.dainet.de/genres/),* which is maintained by ZADI. It offers texts, data and pictures on the conservation of animal genetic material which allow breeders and livestock farmers to find information about old, rare or endangered domestic animals for different geographic areas.

Regarding individual animal species, specialised networks are also available, like for example the *Goat Information System (http://www.wiz.uni-kassel.de/ntier/goatweb.html),* a network of Internet sources about goat production that is being developed at the Witzenhausen division of the University of Kassel. It gives access to specialised publications, addresses and possible contacts for goat breeding and husbandry.

Specialised literature on the Internet

Specialised literature and project information are of special relevance for research. They are used during all stages of research planning, discussions of results and result dissemination so that the scientists are able to react to new developments in their fields and avoid the repetition of research. The Internet provides completely new ways of accessing such data.

Access to Specialised Literature

Access to specialised literature until recently was provided by information hosts, libraries and specialised publishers. As more and more on-line databases become available, these new access possibilities for users have completely changed the tasks of these information providers.

On-line Databases

Nearly all information hosts, for example DIMDI, STN, DIALOG by now are present on the Internet with their databases. Simple query forms allow on-line searches (liable for payment) for scientific literature. However, increasingly data-producing institutions themselves are presenting information in their own databases.

These databases offered on the servers of the institutions themselves in most cases can be searched without payment. This is also true for major databases with international agricultural literature like AGRIS of the FAO and AGRICOLA of the NAL's AgNic service. Each of them has two million bibliographical references to scientific literature (journals, books, other publications) and is now searchable on-line. A high percentage of this literature refers to research topics from animal production and breeding.

FIZ-AGRAR of the DAINet provides 73 literature databases, which can be searched free of charge for specific topics, authors or publishing institutions. One of them is the German ELFIS database with about 300,000 literature references,

50,000 of them on animal husbandry and breeding. All references contain the necessary bibliographical information and descriptions of contents based on descriptors and abstracts. Direct reference to source and full text version have a special interest for people looking for literature because the texts can then be downloaded or printed. The Internet with its hypertext configuration is especially able to provide such services. Also in ELFIS and other databases of FIZ-AGRAR this service is offered. Here in several agricultural journals and series, it is already possible to access the full text versions of contributions. Research reports and other publications from agricultural research institutions are also available in full text from FIZ-AGRAR.

Libraries, Publishers and Publication Lists from Institutions
A number of large libraries is already offering their catalogues for on-line searches, in most cases combined with an ordering service. As an example, the catalogue of the German Central Library for Agricultural Sciences (ZBL) in Bonn can be searched in the database AGROKAT (http://www.dainet.de/zbl/agrokat.htm). Book and journal holdings of the library from 1986 onwards are searchable. The document ordering system connected with this catalogue is part of a joint project (SUBITO) of several large German libraries.

Increasingly, agricultural publishers are presenting on-line readable tables of contents of their current journals. Also, other editors of publications and journals provide tables of contents and full texts on the net.

Project information on the Internet
Publications about current or concluded research projects are another important information resource. They direct scientists to answers for questions about research institutions or current research topics as well as about institutions and scientists which are doing or funding specific research. Apart from international project information, such as, for example, that published by the European Union, a number of national services inform about their local projects.

Project information by the European Union
CORDIS (http://www.cordis.lu/en/home.html), the research and development service of the European Union, represents a complex service for project information. The FAIR homepage at CORDIS (http://www.cordis.lu/fair/home.html) has detailed project information on agriculture and fisheries. Special services relating to research projects can be used through ERGO, the European Research Gateways On-line intended as a one-stop shop for European R&D project information (http://www.cordis.lu/ergo/home.html). The project information of the EUREKA database is also the result of co-operation and important for animal production. EUREKA promotes pan-European, market-oriented research and development across almost 30 European countries.

Project information in individual countries
Information institutions of different countries give information on research projects conducted in their national research institutions. The German database "Forschungsprojekte" ("research projects", http://www.dainet.de:8080/AGFSTW/SF) contains about 30,000 projects from German agricultural research. This database can be searched for topics or for projects of either institutions or scientists.

Other forms of on-line availability of research project information are overviews which research institutions or universities put on their Internet pages, where they can be found rapidly.

Integrated Agricultural Research
The Internet has decisive advantages for research management and telecooperation. Here, large resources for more efficient research are found. The Internet creates the conditions for co-operation on certain research topics that cross national boundaries. Telecooperation is promising a solution for research tasks beyond the boundaries of individual countries and institutions.

Exchange and discussion
Modern telecooperation exploits the new communication forms offered by the Internet. Scientists encounter directly from their workplace contact addresses and people to get in touch with for participation in joint projects or for an uncomplicated exchange of scientific information and knowledge. Discussion forums, newsgroups and mailing lists are the media more suitable for this. E-mail and address directories available in data catalogues and information systems, allow rapid communication with experts in a specific field.

Efficient data management
The possibilities of the world-wide computer networks facilitates the development and use of jointly kept databases. Redundant holding and maintenance of data is no longer necessary. These networks that connect participants from different locations in the world are today the prerequisite for efficient research co-operation and for the co-operative creation of products. There exists a number of different methods to achieve this, which, however, are always based on joint usage of decentralised or centralised data holdings.

Data holdings, consisting of decentralised inputs, can be maintained centrally, but it is also possible to keep them locally when a central user interface provides the necessary connection and access paths. Institutions which participate in the input of centrally-held databases have access to the data provided by them as a sub-pool of the database, with individual page layouts and database functionality. This principle, for example, is applied in all co-operatively developed databases of the German on-line service FIZ-AGRAR. The publications, annual reports and projects of the German Federal Research Centres are administered in joint databases on the ZADI server, but presented as individual data holdings on these institutes' homepages.

Internet technology is increasingly resorted to for the development of national and international research networks. A number of co-operatively working networks for animal production are already in existence.

Co-operative Networks in the European Union
Databases, publications, discussion forums and events are collected as part of the Non-Food Agro-Industrial Research Information Dissemination Network *(NF-2000 Network) (http://www.nf-2000.org/index.html)*. The NF-2000 database contains more than 500 items describing EC-funded, national

and international activities relating to the non-food use of crops. These items link to more than 1200 contacts including researchers, manufacturers, consultants, national and international organisations.

The advantages of the world-wide nets are also the basis for the development of the *European Initiative for Agricultural Research for Development (EIARD) (http://www.dainet.de/eiard/homepage/).* EIARD is a policy instrument to promote co-ordination among its 18 European partners at various levels (information exchange, concertation, activities, common strategy/vision), and partnerships between all stakeholders in Europe and the developing countries. The participating countries enter information about their research-relevant sources on the basis of standardised input criteria into the central database which is being developed in the ZADI. The homepage of the system available on the Internet give access to all resources of the individual countries, and also to a cross-section of information about all available discussion forums, calendars of events and papers on the general principles. An on-line input form used by all participants is the basis for an uncomplicated data supply from any location.

Telecooperation in Regional Projects
Rapid access to specific research data or documentation is increasingly the guiding principle in the development of major regional networks. For example, the State research institutions in Germany are developing an archive of research reports, *Research Reports on the Internet Project* (VIP), as a database, that is kept and searchable on the ZADI server. The institutions supply via on-line forms numerical values and texts from research reports to the central VIP database. The same principle is the basis of a project intending to provide a centralised reference system for official documents for German agricultural administration and research (Agri-Doc). A number of Federal States are participating in the data supply for a central database and in its use. This data management is a crucial factor in the improvement of research and in making financial savings.

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