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# Collective Scientific Expertise at INRA : a Tool for Decision Making and Dialogue between Science and Society

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## Abstract

Since 2002, French National Institute for Agricultural Research (INRA) undertakes to supply collective scientific expertise (ESCO) to answer questions raised by French government authorities in relation to agriculture and society. A final report and an executive summary are published in order to be integrated in a decision-making process.

The ESCo process consists in analysing international scientific publications by an experts' group in order to establish knowledge, highlight uncertainties and consider controversis, transparently and impartially. A charter institutionalises this method and determines its rules.

For each ESCo, a group of experts from different disciplines and research organisations in France and other countries is constituted. These experts are scientists with relevant expertise and a scientific excellence. A declaration of interests will always be requested of each expert in order to guarantee his or her impartiality, which is crucial to the credibility of such exercises.

INRA information professionals are involved in ESCO to collect international scientific publications from different information sources (WoS, PubMed, specialized databases). Numerous rounds of interactions between information professional and experts are used to define keywords and refine searches. In a second time, grey literature are provided to experts. An Endnote database is created and shared by the group. Information professionals provided support for experts by providing documents and formatting the bibliographies in the final report.

Experts analyze all the publications furnished in order extract, discuss and assemble relevant elements to provide information on the issues raised by French government authorities.

The Scientific Expert Report is posted on the INRA web in open access whereas the Executive summary is published by Quae.

## Résumé

Depuis 2002, l'Institut National pour la Recherche agronomique (INRA) réalise des expertises scientifiques collectives (ESCO), en appui à la décision publique. L'exercice consiste à répondre à une question complexe posée par un commanditaire public en établissant, sur la base de la bibliographie mondiale, un état des connaissances scientifiques pluridisciplinaires qui fait la part des acquis, des incertitudes, des lacunes et des controverses. L'analyse est réalisée par un groupe d'experts dans une démarche de transparence et d'impartialité. Une charte précise la méthode, l'éthique et les règles de l'exercice.

Pour chaque ESCo, un groupe d'experts de différentes disciplines et institutions est constitué. Ils sont tous choisis pour leur expertise et leur excellence scientifique. Une déclaration d'intérêt doit être signée par les experts pour garantir leur impartialité, ce qui est fondamental pour ce genre d'exercice.

Des documentalistes spécialistes de l'information scientifique sont mobilisées dans l'exercice d'ESCO afin de rechercher et collecter des publications dans différentes sources internationales (WOS, PubMed, bases spécialisées). De nombreuses interactions sont nécessaires entre les experts et les documentalistes afin de définir les mots-clés et valider les équations de recherche. Dans un 2<sup>ème</sup> temps, de la littérature grise est communiquée aux experts. Les références scientifiques sont rassemblées dans une base Endnote qui est mise à la disposition des experts. Les documentalistes

apportent un appui aux experts pour la fourniture des documents et la mise en forme de la bibliographie dans le rapport final.

Les experts doivent analyser l'ensemble des publications scientifiques afin de dégager les points pertinents sur le sujet et construire un document apportant une approche multi-disciplinaire sur la question posée.

Le rapport d'expertise est diffusé en libre accès sur le site web de l'INRA tandis que la synthèse, destinée à un public plus large, fait l'objet d'une publication par les Editions Quae.

## Introduction

Society's attitudes toward science and research are changing. On the one hand, citizens are directly affected by science and technology and refuse to simply be passive recipients of new products and technologies, however innovative they may be. People extrapolate from past experience and from consequences that were improperly assessed or unforeseeable. Furthermore, the scientific progress is not blindly accepted as beneficial to society. On the other one, many questions are asked to the researchers to provide clear, objective and not ambiguous assessments, for general public and wide audience.

All these questions are relayed or supported by political and administrative authorities, economic actors or civil society which need information and arguments to justify, contest or oppose decisions. They request institutions to carry out scientific assessments on many societal debates in light of current scientific knowledge. So, expert assessments play a major role in mediating between knowledge producers and technologies' users, bringing evident benefits for decision-making and renewing dialogue between science and society.

The scope of this paper is to describe the activity of collective scientific expertise as it is conducted by the French National Institute for Agricultural Research (INRA). First, we placed this activity in a general context of scientific assessment in response to societal demand. Second, we described the actors involved in the collective scientific expertise process at INRA. Third, the different steps of the collective scientific expertise process are described with a particular attention with the information professionals' role.

## General context of expert assessments

### Some definitions

Expert assessment, also called scientific expertise, is the whole set of activities required to analyse a complex problem, based on the current state of knowledge, on demonstrations and on the experience of the experts. The assessment can be requested by the public or private sector.

Expert assessments can concern a wide range of topics from authentication assessment to legal or psychiatric assessment. By involving social and human aspects, assessments can be useful to analyse natural or human disasters which have occurred in the past. Prospective assessment can concern the forecast of a new technology or a new research field (genome science, nanotechnology).

At the request of public sector as government ministry, research institutions can be requested on a complex societal problem and they have to manage a group of expert in order to analyse the world scientific literature and identify the main point of views. The outcome of collective expertise is intended to be integrated in a decision-making process.

Collective expertise is based on the "published knowledge" and is very different of "expert opinion" based on personal advices of one individual expert, selected for his competence.

### Collective scientific expertise at INRA, France

The French National Institute for Agricultural Research (INRA) conducts collective expertise as several other French institutions like INSERM, IRD, Cemagref. Since the French Research Law n°2006-450,

scientific expertise is a part of researchers' missions. Since 2006, French research institutions had to formalize this activity through a charter of good practices.

Since 2002, INRA carried out several collective expertise mainly at the request of the Ministries for Agriculture and Ecology. They dealt with various topics as "the challenges and determinants of fruit and vegetable consumption", "carbon stockage", "agriculture and biodiversity", "pesticides, agriculture and environment" and "drought and agriculture".

The last ESCo, published in 2009 (LE NEINDRE et al., 2009), concerns "farm animal pain" and has been compiled at the request of the French Ministries of Agriculture and Research. This request is the result of recent debates in France, about the relationship between humans and animals, in particular while the meetings entitled "Rencontres Animal et Société" organized in 2008 at the initiative of the President of the French Republic. These meetings pointed out the need to clarify the key notion of pain in animals and led to an action plan calling for a multidisciplinary scientific assessment on animal pain.

## Collective scientific expertise's actors

### ESCo Unit

When a Ministry commissioned INRA to carry out a scientific assessment, INRA has the responsibility to choose the experts and organize the study itself.

It is the Scientific Collective Expertise Service (ESCo Unit) which has to coordinate the scientific assessment for INRA. For each scientific assessment, ESCo Unit must gather scientific experts and information professionals and has to manage the project in the respect of the deadlines, i.e. 12 months.

### The experts' group

The experts are chosen on the basis of their areas of expertise and the absence of conflicts of interest. They cover all required disciplines concerning the subject and human sciences are always involved in order to bring a societal lighting on scientific data. Experts must belong to a range of research agencies what allows the confrontation of different opinions and schools of thought.

For example, for ESCo "farm animal pain", the experts' group covered a wide range of disciplines in the life sciences (neurophysiology, human clinical medicine, veterinary medicine, genetics, ethology), and human, economic and social sciences (history, anthropology, philosophy, ethics, law, economics). This scientific assessment gathered around twenty experts from INRA and other research establishments (Assistance publique-Hôpitaux de Paris, Collège de France, CNRS, Veterinary Schools), both in France and abroad.

### The information professionals

Several information professionals are involved in the ESCo in order to guarantee the quality of this ESCo process mainly based on scientific information (LEFEBVRE et al., 2010a). At least, one of them insures the information methodological process and one is specialized on the subject of the expertise and knows perfectly the specialized information sources.

For example, for ESCo "farm animal pain", two information professionals were involved. One of them was specialized in animal welfare and the other one has already participated in the two previous ESCo.

## The ESCo process

All the stages of the process are described in the Tab.1.

Tab. 1 Steps to conducting to collective scientific expertise (ESCo)

Rank	Steps	Expected outputs	Actors
1	Formulating the question	Terms of reference Guideline	Government ministry ESCo Unit
2	Constitution of Experts' group	Expert data form	ESCo Unit Information professionals
3	Information searching	Search strategies, keywords	Information professionals Experts
4	Information collecting	ESCo Endnote® database	Information professionals
5	Collective work, literature analysis and report writing	Report and executive summary	Experts
6	Bibliography formatting	Report's bibliography Cited references	Information professionals
7	Quantitative analysis of cited references	Bibliometric analysis	Information professionals
8	Dessimination of ESCo's outcomes	Scientific meeting Report posted on the internet Executive summary published by Editions Quae	ESCo Unit Experts Government ministry

## 1 – Formulation of the question addressed to INRA

Government Ministry formulates questions in a letter outlining the terms of reference and addresses it to INRA. The boundaries of the assessment must be clearly set out and corresponding terms of reference precisely defined. Numerous exchanges between ESCo and Ministry are necessary to write the guideline of the request. The outputs of the expertise must be clearly defined (report, executive summary), in particular, information delivery to the media and public (meeting).

In parallel, an exploratory search in bibliographic databases is realized by information professionals in order to estimate the number of scientific references on the subject and the main scientific disciplines which are concerned. Major institutions are also identified and the rank of INRA among them is important to note because it gives legitimacy to INRA to conduct the scientific assessment. This ranking is based on the number of articles published by INRA and indexed in international bibliographic databases as Web of Science® (Thomson Reuters).

## 2 - Constitution of experts' group

The experts are chosen on the basis of their scientific excellence and research activities.

Information professionals bring a considerable help for the identification of the experts. Specific informations are searched in order to identify the most important authors according the number of published articles. The Web of Science® is useful for this step but it cannot allow to identify young researchers. Other databases as institutional publication databases, repositories are used. Because experts' participation in international research programs could be a good experience, Cordis (gateway to European research and development) is used to search profiles of researchers, programmes or running projects.

Information professionals produce an initial list of potential experts and the ESCo Unit gets in touch with those experts or their research teams.

Because the legitimacy of INRA to conduct the assessment was based on scientific activities on the subject, it is normal to find INRA researchers among the main authors in the world. However, because the experts' group must represent several institutions, some experts are chosen in other research institutions or universities, from France or foreign countries. However, even if scientific papers are written in English, french-speaking authors (from France, Belgium or Switzerland) are preferred to facilitate exchanges within the experts' group and to reduce travel costs.

Before experts' group validation, all of the experts are qualified with quantitative and qualitative criteria to attest their scientific excellence (Tab. 2). A declaration of interests is always requested of each experts to guarantee his (or her) impartiality, which is crucial to the credibility of such exercises.

According to their speciality, the experts are distributed in one or two sub-group(s) corresponding to the report chapters.

### **3 – Information searching**

Information professionals play a key role in the retrieval and the selection of the available data on the subject. According to the subject and the discipline, they identify appropriate information sources, multidisciplinary or specialized.

The terms of reference and chapters' topics are formalized into keywords, ideas and concepts. Experts propose a list of keywords and information professionals consider possible synonyms, related terms, as well as broader and narrower terms. Information professionals construct advanced search strategies such as Boolean logic (and / or / not) and truncation (Tab. 3). Search strategies are designed and entered into appropriate information sources. Numerous rounds of interactions between information professionals and experts are used to define keywords, evaluate results and refine searches.

For the expertise to be unbiased, attempts should be made to search all literature, published and unpublished, and no language restrictions should be applied, but in order to have a acceptable number of publications, searches are first limited by using publication type (review article or meta-analyses). Searches are conducted principally in international bibliographic databases, in order to collect mainly scientific papers published in peer reviewed journals: Web of Science®, PubMed / Medline, Cab Abstracts, Econlit... Separate search strategies are after developed for each chapter of the ESCo report. In a second time, "grey literature" which includes technical reports from government agencies (EFSA, AFFSA, European Commission, ...) or scientific research groups, working papers from research groups or committees, are provided to experts.

### **4 – Information collecting into ESCo database**

Information professionals create an Endnote® database of these references, named "ESCo database". They store the full-text articles (pdf) or link the bibliographic records to full text articles when it is possible in order to facilitate experts' work. Information professionals manage references and create reference groups "smart groups" to identify a specific subset of a database. For example, they create a smart group for each chapter and for each database update.

This Endnote database is shared by the experts' group and each expert downloads it on his personal computer. Every month, experts have to download updates with new and complementary references. Even if Endnote® software is not suitable for collaborative working, it is one of the most flexible and powerful way for experts to cite references within their word processor and format bibliographies.

### **5 - The collective work, literature analysis and report writing**

A collaborative workspace is created with Silverpeas® platform, in order to share different resources, including calendars, participant lists, announcements, document libraries, links to other relevant sites. It allows document management and sharing with versioning.

The experts have to analyze all the available published data on the subject in order to determine the established knowledge, highlight uncertainties. They have to consider any controversis and must work transparently and impartially. To facilitate their work, information professionals collect references into an Endnote® database (ESCo database) and references are grouped by chapter.

Experts screen titles and abstracts for relevancy and select references for which they have to read the full-text article. Information professionals provide support for experts by full-text documents delivering. They have to identify studies that specifically address the research question.

From the scientific papers, experts have to identify useful elements and compile them into a bibliographic note and in the chapter of the report.

Throughout the collective scientific expertise project, several meetings are organised so that the experts can provide their analysis and confront main points of view based on available international data.

## Dissemination of collective scientific expertise outcomes

Different outputs are planned as different ways to disseminate the results of the collective scientific expertise.

### Symposium

The main outputs of the collective scientific expertise are presented and discussed with the public during a meeting organised by INRA and the Ministry who raised the question.

For example, ESCo “farm animal pain” meeting was organized at the headquarters of OIE (World Organization for Animal Health) situated in Paris. Nearly 250 persons were present at this meeting. Presentations were filmed and are available on the internet.

[http://www.inra.fr/audiovisuel/web\\_tv/colloques/douleurs\\_animales](http://www.inra.fr/audiovisuel/web_tv/colloques/douleurs_animales)

### A final collective scientific expertise report

Experts write a final report which includes a state of art with a pluridisciplinary point of view and a critical analysis of knowledge. This report outlines what is known or unknown, identifies gaps in knowledge and controversies.

The collective scientific expertise report does not provide specific advice or recommendations nor formally attempts to analyze future trends. The report may point out main points and needed researches. Full report is published on INRA website.

Information professionals provide support in formatting report’s bibliography. The list of all cited references is available in the collective scientific expertise report.

For example, ESCo “farm animal pain” report has 339 pages. The assessment provided a new perspective on the biotechnical and societal components of the animal pain issue and practical information on how it can be minimised. It also identified gaps and scientific controversies and pinpointed areas requiring further research. The ESCo began with the premise that animal production and its purpose are legitimate. The assessment thus excluded extreme positions held, on the one hand, by those who reject any exploitation of domestic animals for the benefit of mankind and, on the other hand, those who refuse to accept that any animals can feel pain. Before starting to examine the neurophysiological phenomenon of pain, it was deemed necessary to take a fresh look at the currently debated question and place it in its historical context, tracing how it has evolved, identifying the various ethical, legal, economic and cultural components and seeing in what terms the question is framed today. To study the notion of pain we compared the knowledge acquired from both human and veterinary medicines. The capacity to measure pain in animals using criteria that are reliable and preferably applicable in routine practice is clearly a central question for the ESCo, since it means that pain can be identified and characterised, thus demonstrating that it exists and enabling ways of treating it to be envisaged. Two chapters deal more specifically with pain in livestock production. Rather than attempting to be exhaustive in its analysis of practices considered to be painful, the ESCo concentrated on several situations on-farm or at slaughter that are likely to involve pain, seeking wherever possible alternatives or solutions designed to reduce or even suppress pain.

### Executive summary

The executive summary is published by Quae Publisher and also posted on the web in French and English languages.

The ESCo “farm animal pain” executive summary has 98 pages. It will be published by Quae in Expertises collectives Series (ISSN = 1962-1477).

### Quantitative analysis of cited references

With “traveling library” Endnote ® feature, it is possible for information professionals to identify which references are cited in the report.

Quantitative analysis of cited references is performed by information professionals in order to describe the data selected by experts as base of their scientific assessment.

Different point of views are given as the date of publication, the major information and the main journal. Main subject categories and keywords are identified and compared with the terms of reference, in order to a posteriori verify that selected references match with the request demand.

For ESCo “farm animal pain”, near than 1400 references were selected by the experts and integrated into the report (FOURNIER et al. 2009). The experts primarily used recent publications, with 30% of the references being published in the last 5 years.

They also principally cited articles published in international scientific journals (69 %), in agreement with the definition of the exercise as a scientific assessment. The experts also made reference to books or book chapters (23 %) published by the major scientific editors. They also made use of what is referred to as “grey literature” in the form of scientific reports edited by international institutions (2%), conference proceedings (4%), theses (1%) and articles published in technical journals (3%). In order to represent the most frequently words used in the ESCo bibliography, tools as Wordle.net are used for generating “word clouds” from titles of selected references of the report (Fig. 1). The “word clouds” give greater prominence to words that appear more frequently in the bibliography.



Fig. 1. Word cloud from titles of selected references of the ESCo report “farm animal pain” (according to FOURNIER et al., 2009) <http://www.wordle.net/>.

## Conclusion

Collective scientific expertise is an emergent activity conducted at INRA. It contributes to renew dialogue and society. This activity asks for many human resources which is gathered during the project time.

ESCo Unit continually develops guides and methods to enhance the collective scientifique expertise process. The ESCo Charter is one of those outputs, but a lot of methods which were used for previous assessments are also formalized in order to be used for the next assessments (LEFEBVRE et al., 2010b). However, it should be useful to implement components of “systematic review process” in this ESCo process, not only because it will facilitate experts’ work in refining the number of available data but also because it will strengthen the quality of experts’ analysis. Indeed, systematic review process uses explicit methods to perform a thorough literature search and critical appraisal of individual studies to identify the valid and applicable evidence.

An additional step should be added in the ESCo process, between the information retrieval and the experts’ analysis. This step should be assigned by a reviewers’ team who screen the available literature and identify relevant studies to be included in the database and be analyzed by the experts’ group. These reviewers must refer to a checklist so their choice can be clarified and justified.



Tab. 2 Expert's data form used to qualify the ESCo experts (according to LEFEBVRE et al., 2010b)

ESCo Expert Data Form			
Expert's name	Expert's institution	Expert's adress	Expert's research field (according to his research topics)
<b>Name of information sources (database, search engine)</b>	<b>Quantitative measurement</b>	<b>Name of qualitative criteria</b>	<b>Qualitative information</b>
<b>Web of Science</b>	Number of publications	<b>Subject category</b>	Main subject categories of expert's publication
<b>MedLINE (1949- )</b>	Number of publications	<b>MeSH Headings</b>	Main MeSH Headings of expert's publication
		<b>MeSH Qualifiers</b>	Main MeSH Qualifiers of expert's publication
<b>CAB Abstracts (1973- )</b>	Number of publications	<b>CAB descriptors</b>	Main CAB descriptors of expert's publication
		<b>CABICODES</b>	Main Cabicodes of expert's publication
<b>Francis (1972- )</b>	Number of publications	<b>Name of information sources (database, search engine)</b>	<b>Quantitative measurement</b>
<b>Revues.org</b>	Number of publications	<b>Econlit (1969 - )</b>	Number of publications
<b>ProdInra</b>	Number of publications	<b>Cairn (2001- )</b>	Number of publications
<b>Google Scholar</b>	Number of documents indexed by Google Scholar	<b>Google Books</b>	Number of books
<b>Scirus</b>	Number of Journal Sources	Number of referred web	
<b>Other informations</b>	Curriculum vitae, participation to international projects, other specific informations		

Tab. 3. Examples of search strategies used for ESCo "farm animal pain" (according to LEFEBVRE et al., 2010b)

Name of database	Example of search strategies
CAB Abstracts	Cabicodes = DD500 (= Laws and Regulations) and LL810 (=Animal Welfare) Limits : Type of documents = « reviews »
EconLit	consumer, citizen, willingness to pay, animal welfare (ou animal dolor ou suffering), regulation, legislation, world trade organisation
PubMed	((("Animals"[Majr] OR "Animals, Domestic"[Majr] OR "Fishes"[Majr] OR "Birds"[Majr] OR "Ruminants"[Majr] OR "Swine"[Majr] OR "Cattle"[Majr] OR "Rabbits"[Majr] OR "Horses"[Majr] OR "Goats"[Majr] OR "Sheep"[Majr] OR "Sheep, Domestic"[Majr] OR "Sheep, Bighorn"[Majr] OR "Chickens"[Majr] OR "Quail"[Majr] OR "Coturnix"[Majr] OR "Poultry"[Majr]) AND ("Pain"[Majr] OR "Nociceptors"[Majr] OR "Inflammation"[Majr] OR "Pain Measurement"[Majr] OR "Pleasure-Pain Principle"[Majr] OR "Pain Threshold"[Majr] OR "Pain, Postoperative"[Majr])OR "Nociceptors"[Majr]))

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