Civil Society Organisations,
Actors in the European System
of Research and Innovation

Research Priorities in Europe Scientometric and Budget Analysis of some National European Research Priorities

S T A C S

Science, Technology And Civil Society

- 2009 -

Research priorities in Europe

Scientometric and Budget Analyses of some National and European Research Priorities

by

Eric Gall, Glen Millot & Claudia Neubauer

with advice from

Katrin Grüber

S T A C S

Science, Technology and Civil Society

- 2009 -

Context

The present report is the result of a work conducted by civil society organisations within the framework of the European project STACS.

Science, Technology and Civil Society - Civil Society Organisations, Actors in the European System of Research and Innovation (STACS) was a capacity building project funded by the EU 6th Research Framework Programme, as part of the Science in Society activities aimed at stimulating participation of civil society organisations (CSOs) in research activities. Part of the Specific programme Structuring the European Research Area, the pilot call aimed at increasing the societal relevance of research.

The call underlined that "Civil society organisations show an increasing interest in research activities in domains such as sustainable development, food safety, public health and well-being, renewable energy, discriminations, and conflict resolutions. [...] They can also be sources of knowledge, know-how and innovations, and therefore act as partners in research. [...] The potential of civil society organisations to enrich the research domain remains mostly untapped."

The objective of this exploratory call was therefore "to provide support to civil society organisations: to identify and discuss topics and opportunities for involvement in research activities, or for outsourcing research to research performers; and to explore the possible forms of cooperation with research centres and other research stakeholders in view of more compre- hensive actions in the future Framework Programme."

STACS was conducted by six European CSOs: Fondation Sciences Citoyennes (FSC, France), Institut Mensch, Ethik, Wissenschaft (IMEW, Germany), European Public Health Alliance (EPHA, Belgium), Réseau Semences Paysannes (RSP, France), Free Software Foundation Europe (FSFE, Sweden, Germany), Demos (UK). The main objective of STACS was "to explore the feasibility of future academia-civil society partnerships in different research areas and how to optimise the interaction between science dynamics and the needs and concerns of society". For this purpose, the partners organised capacity building sessions for CSOs on selected scientific issues of high societal relevance, explored the possibilities of drafting common research projects between CSOs and public research laboratories by organising "research project nursery workshops", analysed participatory research experiences in Canada and France and formulated recommendations to the European Commission, published a booklet on "Citizen scientists - reconnecting science with civil society", and redacted a handbook for CSOs aimed at improving the understanding of CSOs of the European research system.

Partners

Legal Notice

Table of Contents

Executive summary 6

Introduction 7

A. Definitions and methodology 8

Definitions 8

The Web of Science and the nomenclature of the Observatory of Science and Technology 8

Specialisation and priority indexes 8

Keywords 9

Limitations and Possible biases 10

B. Results of scientometric studies 12

B.1. Scientometric study of research on organic farming 12

Background 12

Implementation of bibliometric method and key words 14

Results 15

B.2. Scientometric study of research on ecotoxicology, health and environment 17

Background 17

Implementation of bibliometric method and key words 17

Results 18

B.3. Scientometric study on participatory research 23

Background 23

Implementation of bibliometric method and key words 23

Results 24

C. Analysis of budgets and programmes in selected domains of EU research Framework Programmes **27**

1. Approach and methodology 27

Choice of analysed programmes and research domains 27

Methodology for budget analyses 27

2. Funding of research projects on Agriculture and Food in Framework Programmes 29

Funding for projects concerning organic agriculture 29

Funding for projects concerning biotechnological agriculture 29

Comparison of the funding of projects on organic agriculture and on biotechnological agriculture 29

Funding for organic agriculture research under FPs 30

3. Funding of research projects on Energy in Framework Programmes 31

Background 31

D. Conclusions **34**

On the use of scientometric analyses 34

From the scientometric and budget analyses 34

Executive summary

We have conducted quantitative bibliometric analyses of numbers of publications in different scientific domains - organic farming, ecotoxicology, health and environment as well as for participatory research as an approach to research - in different countries of the European Union, in the European Union as a whole and compared to countries such as the USA, Japan, China, Brazil, India. We also conducted budget analyses on agricultural research and research on energy in European Framework Programmes.

The results from the budget and scientometric analysis prove that at the national level, there are huge discrepancies in the support to research on organic farming between different European countries. If, on average, research on organic farming is more of a priority in European countries than in the rest of the world, this is mostly due to the efforts of smaller countries, such as Denmark. The largest countries, with the largest agricultural production capacity, do not prioritise the development of research on organic farming. Given the ecological, energetic and economic challenges faced by agriculture in the XXIst century, it appears that the effort on organic farming research in a region like the EU is still insufficient.
Our results also show that inside EU27, leading countries in research in general do not play a leading role in ecotoxicology, a research domain which should be of utmost importance according to many CSOs, given the increased role which is attributed to pollutants in the occurrence of cancers and other pathologies.
Participatory research is marginal. Interestingly, it is particularly present in research domains linked to sustainable development such as environmental sciences, ecological economics, ecology, multidisciplinary agriculture, public, environmental and occupational health and health care.

The results show that it is relevant to try and build indicators that can inform civil society of the national research efforts in domains they consider as a priority. There are wide disparities between countries, and discourses on research do not always reflect the reality of research efforts in a given domain. But the use of quantitative indicators also highlights the limits of evaluation exercises of scientific activity solely based on publications and patents.

It would be worth developing research partnerships between CSOs and research institutes specialised in this type of analysis (such as the OST in France) to further develop scientometric tools relevant for civil society, and to make the analysis of emerging research domains of particular interest to civil society a routine activity of such institutions.

Introduction

Research priorities often seem far away from the concerns of civil society. Yet there are few tools available to CSOs to assess research efforts in domains of interest for them. Therefore one of the goals of the STACS project was the evaluation of the research efforts in a few domains in the European Union and in other countries. We chose to measure research efforts in Organic Farming, Ecotoxicology, health and environment, and Participatory Research, through the measurement of the number of publications in these domains, a widely used bibliometric indicator. Furthermore we analysed budgets spent for two research domains - agriculture and energy - in Framework programmes.

We will first present definitions and methodologies of the bibliometric analysis in order to clarify the type of information that these tools can provide, as well as the possible biases inducted by this kind of study. We then present results of our scientometric studies on organic farming, ecotoxicology, and participatory research and draft some conclusions on the feasibility, use and interest of scientometric analyses for civil society organisations.

We will also present some elements about research budgets for Agriculture and food and for Energy in Framework programmes. They can inform about the importance given to a certain research domain - in general, and in relation to other domains. Results can be put in relation to other indicators (for instance from scientometric analyses) or to narrative analyses, allowing to draw a broader picture of research policies and of their priorities.

Choice of analysed themes

a) Agriculture, food and energy are thematic research areas of strong priority in European (and national) research programmes. They crosscut with each other and with numerous other domains such as environment, health, transport, urban development, sustainable development.

b) Climate change and food production are issues of common world wide consideration, in the scientific and political as well as the industrial and civil society sphere, ranging from local efforts to international negotiations. They play a vital role for humans, animals, plants and ecosystems and therefore for the life and future of our societies and our planet.

Energy and agriculture are emblematic issues since the compared domains (budget analysis) - organic agriculture versus biotechnological agriculture, nuclear energy versus renewable energies - often stand for different, or even opposite approaches to and visions of socio-technological developments as defended by various actors, notably industry and civil society organisations.

d) Ecotoxicology, participatory research, agriculture and energy are of special interest for CSOs. Numerous CSOs have been engaged in issues related to these domains since decades - soil and air pollution, GMOs, patens on life and biopiracy, farmers seeds and rights of farmers, climate change, security of nuclear power plants, alternative energy sources, energy efficiency.

A. Definitions and methodology

1. Definitions

Bibliometric analysis is based on the presumption that the number of publications is an accurate reflection of scientific activity, in other words that there is an "*equivalence between the concept of science knowledge and scientific writing, which objectively represents its existence*"[1]. If the two terms are often used as synonyms, bibliometric analysis, defined as the application of statistical methods to publications, can be more precisely regarded as a particular tool of scientometry, of which the goal is, in the opinion of Van Raan[2], "*the improvement of knowledge regarding the development of science and technology, including the link with societal and political or policy questions*". Concerning this last point, we could rightfully wonder about the relevance of evaluation based on these type of measurements. Unfortunately, these indicators are the only ones that are currently available to evaluate researchs in terms of execution.

2. The Web of Science and the nomenclature of the Observatory of Science and Technology

The bibliographical database used for this bibliometric analysis is Thomson Scientific's Web of Science. In spite of some limitations which will be explained further below, this database is used as a reference tool by analysts internationally because it examines more than 9.000 scientific journals selected for their editorial operating rules and their level of international visibility. Each journal is attached to one or more of the 180 areas of scientific specialisation ("subject areas") listed in the Web of Science. Because of its generalist character and its disciplinary breadth, this database is the most appropriate for calculation of specialisation indices.

The French Observatory of Sciences and Technology (OST) has itself produced a nomenclature starting from these 180 areas of specialisation, which partitions the areas into eight great disciplines (fundamental biology, medical research, biology and applied ecology, chemistry, physics, earth sciences, engineering science, mathematics), as well as a more detailed classification into 31 sub-disciplines (which do not entirely match that of the eight disciplines). A more specialised database in the field of agriculture, such as CAB Abstract, would be more appropriate to calculate indices to reflect priorisation. But, in addition to our wish to be consistent in calculation of the various indices for the studied field, the OST nomenclature has the advantage of allowing the generation of what we called "Priority indexes" in various fields.

Whereas the nomenclature of the OST regroups articles per discipline and sub-discipline, the nomenclature of the Thomson Scientific's Web of Science is much more detailed and can be integrated into the OST nomenclature. In regard to the needs of our analysis the Thomson Scientific's Web of Science classification is too detailed and we gave thus preference to the one from the OST.

3. Specialisation and priority indexes

The Specialisation index (SI) is the relationship between a country's share of global publications for a field of research and its world share of publications in all disciplines. The Priority index (PI, strictly speaking a Sub-Specialisation index) is the relationship between a country's world share of

---

1. Polanco, X, Royaute J, Grivel, L *Infométrie et linguistique informatique, une approche linguistico-infométrique au service de la veille technologique*. Actes des Journées d'étude sur les systèmes d'information élaborés, Ile Rousse, 1995.
2. Verbeek A., Debackere K., Luwel M., Zimmermann E., 2002. *Measuring progress and evolution in science and technology - I: The multiple uses of bibliometric indicators*. International Journal of Management Reviews 4, (2) 179-211.

publications in a field and its world share in the discipline (or sub-discipline) associated with this field. If they are higher than 1, these indexes indicate fields in which research is especially active, and thus supported as priorities by the research policy decision-makers. Conversely, an index of less than 1 indicates neglected fields, while those approaching 0.6 to 0.5 indicate "orphan" fields.

$$SI = \frac{\dfrac{\text{nb public. subject (Country)}}{\text{nb public. subject (World)}}}{\dfrac{\text{total nb public. (Country)}}{\text{total nb public. (World)}}}$$

The PI index indicates the degree to which a given scientific topic is prioritised within its broader associated field. It reflects a country's scientific policy choices within each discipline (for example, the priority accorded to research in environmental health within medical research). But these priorities are generally decided on a level lower than the political level. In France, for example, it is primarily within INRA's (National Institute of Agronomical Research) various scientific departments that grants to support organic farming are decided. The degree of priority thus does not only reflect decisions taken at a high political level (Government, Parliament) but also a large number of smaller decisions, that are not very visible, taken at lower and more opaque levels of the institutions of research and of higher education, affected by the power struggles between actors of a given scientific field. The value of these indices is therefore to make visible these scientific orientations and their effects, and thus to provide data to feed democratic debates.

$$PI = \frac{\dfrac{\text{nb public. subject (Country)}}{\text{nb public. subject (World)}}}{\dfrac{\text{nb public. subjectarea (Country)}}{\text{nb public. subjectarea (World)}}}$$

We named this indicator "Priority index" instead of "Sub-Specialisation index" because it allows to identify real priorities in a given domain from the results in terms of number of publications. But it is necessary to keep in mind that the term "priority" (or "priorisation") generally refers to the activity consisting in deciding the priorities of research, upstream.

4. Keywords

Putting together a list of key words which correspond to the domain to analyse is a crucial and difficult step of the bibliometric analysis. This list must be as complete as possible (within the limit of 50 terms, for technical reasons linked to the interface we used to access Web of Science) while avoiding "false positives" (i.e. terms listing as results articles that do not belong to the analysed domain). For example, acronyms are typical keywords to put aside considering the multiple synonyms that might be found. It is a time consuming process, that consist in gathering the terms that are the most frequent in the articles, in testing them in the database to check their relevance, in excluding false positives, in organizing into a hierarchy these terms according to the number of articles they refer to in the database. The different versions of the list were submitted to experts in the field. Only the number of articles published in journals was taken into account (editorials or congress publications were left out). The present analysis took into account not only the index of keywords selected by the author himself, but also the titles and abstracts of the articles, so as to include as much as possible all the articles relevant to a given domain.

The fact that only 50 keywords can be used simultaneously in a request was not a matter of concern for the present analysis. For instance, in the case of organic farming, we initially took into account a wide range of organic productions such as organic fruits, vegetables and crops for which we found articles. The 50-keywords limit led us to reconsider our list. But actually most of the articles we had to remove could be taken into account by the use of more generic keywords. The situation was similar for our study on ecotoxicology. While this limitation was therefore not a problem for our own studies, in some other research thematics, it might require to put some keywords aside.

5. Limitations and Possible biases

This kind of study is complex for several reasons. The domains we wanted to analyse do not fall into the official classification used in databases, and there is a broad variety of classification of the publications in terms of subject areas. For instance, in two domains we studied, and for which we will present some detailed results, organic farming and ecotoxicology, the articles can be found in many different subject areas (agronomy, plant sciences, food sciences, horticulture, etc. for organic farming; medical research, fondamental biology or more specifically biochemistry, oncology, ecology, environmental sciences, etc. for ecotoxicology). Besides, the analysed research domains are strongly multidisciplinary. There are also limits inherent to the methodology, and to the particularities of the databases used.

The particularities of the database used are the main source of bias. As indicated by the OST in the methodological annex of its 2006 report [3], the Web of Science is biased "*in favour of Anglo-American science, but there also exist opposite bias such as the over-representation of the national literature of certain countries*". The majority and increasing proportion of publications written in English in the Web of Science also reflects the domination of a certain international model of science. If the representativeness of the database is not seriously contested for the most internationalised domains such as physics or fundamental biology, the OST notes that '*The picture is far less accurate for domains characterised by a strong national specificity, an important role given to dissemination channels outside journals, a strong focus on application, or a small size*' [4]. Moreover, the Web of Science is not considered as reliable for social sciences and humanities.

The level of representativeness of languages other than English with the Web of Science is low and seems to vary considerably from a language to another, without the logics for it being very clear. For example, 92% of the articles in organic farming listed in the WoS for the period 2000-2006 are in English, 5.6% in German, 0.6% in French and 0.007% in Italian. Moreover, 16% of the articles mentioning a French author are written in French. A similar study, conducted with the CAB Abstracts over the period 1973-2003, enables to calculate dramatically different proportions for the same languages : 49.% of articles in English, 17% in German, 8.8% in Italian and 4.4% in French. Given the low values obtained for articles not written in English, we have chosen to not take them into account. This linguistic bias in favor of English, inherent to the Web of Science, would affect the relevance of the results of the present study only to the extent that the proportion of articles published in English et in the national language would be noticeably different for the given domain compared to the domain or disciplines used as referents, since we deal with indices. But this remains difficult to estimate, and the results of the present analysis therefore have to be interpreted more precisely as the comparison of researchers publications efforts in English written journals.

As scientific articles are often co-signed by several authors and research institutions, sometimes from different countries, articles can be fractionated according to the number of different addresses indicated by the authors (fractionated counting principle), or counted as one article per author (presence counting principle ; an article co-signed by 8 authors will thus be counted as 8 articles). It is the latter counting principle that was used for the present study.

Another potential limit is that working with keywords lists makes it difficult to take into account more "fundamental" research activities that could be relevant for the analysed domain. But taking into

---

3. Indicateurs de Sciences et de Technologies, 2006. *Rapport 2006 de l'Observatoire des Sciences et Techniques.* http://www.obs-ost.fr/le-savoir-faire/etudes-en-ligne/etudes-2006/rapport-2006.html.

4. ibid. *translated by FSC in english*.

account only the part of publications related to more “finalised” research is not a problem, because it is in general difficult to predict to what extent a piece of fundamental research will be relevant for a sector. Moreover, this bias is the same for all countries studied and does not jeopardizes the relevance of the comparisons and scales, even though certain countries would show a tendency to associate key words related to a given domain to research that would not be exclusively or primarly relevant to this domain. If this were the case, this difference of practice would itself be the sign of a difference in approach and priorisation on the part of scientific authorities of a country for this type of research. This problem appears for the study of any emerging domain.

Another technical limitation, which was more problematic, is the maximal number of answers that the Web of Science is able to display. This maximum number is 100,000, which means that when one request gives more than 100,000 results, only 100,000 answers are available, and the real number of answers remains unknown. Web of Science only indicates that there are more than 100,000 articles. Unfortunately, in order to calculate Specialisation and Priority Indexes (SI and PI), it is necessary to know the world share in overall articles or in the articles of a given discipline or sub-discipline, for every countries we want to study. Thus, we needed to know precisely the number of published articles for each country during a given period of time. The number of articles for the following countries during the period 2000-2006 (time interval we chose to cover) is greater than 100,000.

USA (1,799,740); Japan (500,665); Germany (420,237); England (374,547); China (315,161); France (301,782); Italy (240,071); Canada (231,512); Spain (168,714); India (145,039); Netherlands (132,242) and Sweden (104,557).

The first solution to this problem could be to count the number of articles year by year but, in the case of the USA, each yearly number of articles is superior to 100,000. We found a way around this obstacle thanks to data published by the Observatory of Sciences and Technology (OST) in their annual reports, and we were able to proceed with our scientometric analysis of the “organic farming” domain.

We faced another serious problem when we started to study other domains such as ecotoxicology. The Web of Science modified their own counting principles without detailing the nature of the changes. We noticed discrepancies of 10 to 30% compared to the values we previously obtained, with the exact same requests. Since we could not include the USA anymore in our calculation, we decided to focus the ecotoxicology study on the European Union, which provided relevant information from another standpoint.

Any bibliometric analysis displays biases, linked to several factors. However, the importance of these biases is limited in the present study because the indicators used are quotients of values presenting the same potential biases.

B. Results of scientometric studies

B.1. Scientometric study of research on organic farming

Background

We chose organic farming because it is a rapidly growing economic sector, and because its development also enjoys a strong support from civil society. Moreover, we conducted a similar study in 2004 that showed that some countries (including major agricultural producers like France) suffer from a large research deficit in most areas related to sustainable development.[5] We found that research on organic farming, within the framework of the broader sector of agronomic research, constitutes a largely under-investigated field.

Sales of organic products are in rapid growth in most European countries and, since the early 1990s, organic farming has rapidly developed in almost all European countries.

At the end of 2006, there were more than 6.8 million hectares under organic management in the European Union, and almost 180'000 organic farms. This represents 4% of the total agricultural area. 24% of the world's organic land is situated in Europe.

The countries with the largest organic area are Italy (1'148'162 hectares), Spain (926'390 hectares) and Germany (825'539 hectares). The highest percentage is in Austria (13%). The highest market shares of organic products of the total market (with around 5%) are in Austria and Denmark. Some countries are currently experiencing a shortage of supply.

Support for organic farming in the European Union includes grants under the European Union's rural development programmes, legal protection under the recently revised EU regulation on organic faming (initially adopted in 1992) and the launch of the European Action Plan on Organic Food and Farming in June 2004. Countries that are not EU members have a similar support. Furthermore, research in organic agriculture is supported both at a national as well as at the EU level, reaching around 65 million Euros in 2006.[6]

---

5. Fondation Sciences Citoyennes, *Quelle politique scientifique pour entrer dans le 21e siècle ? Vers un nouveau contrat entre recherche et société*, Note n°2 de la Fondation Sciences Citoyennes, 2004.

6. H. Willer, M. Yussefi-Menzler, N. Sorensen, *The World of Organic Agriculture - Statistics & Emrging Trends*, 2008.

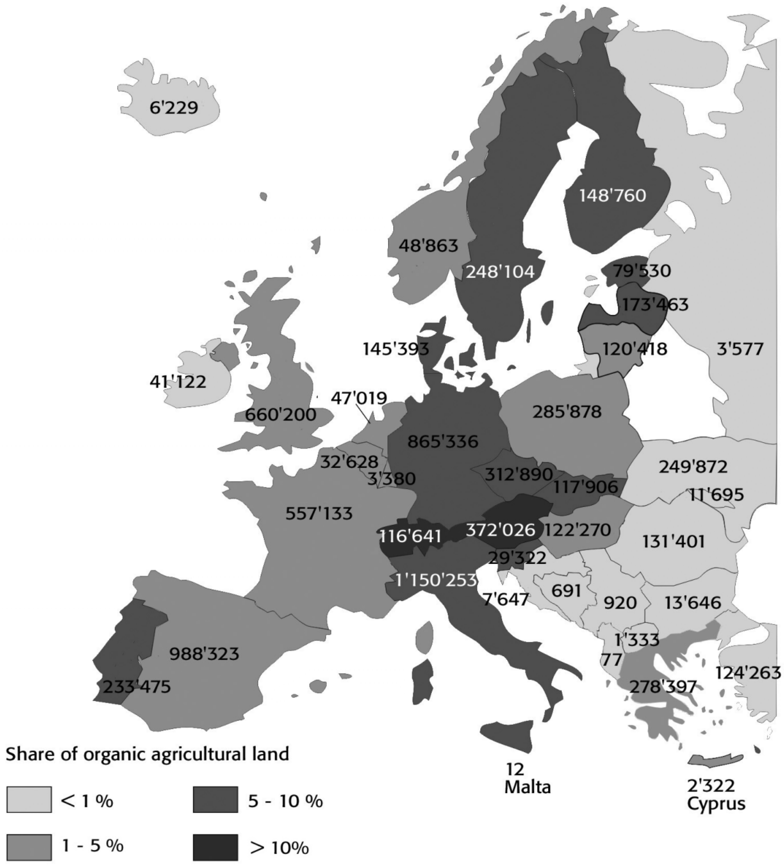

Figure 1 shows the number of hectares of land under organic management in Europe in 2007[7]

Organic Farming	Share in overall food sales (%)	Organic land area in % of total area
Country	**2003 ***	**2004 ****
USA	1.5 - 2.0	0.2
Japan	< 0.5	0.6
Germany	1.7 - 2.2	4.5
UK	1.5 - 2.0	4.4
France	1.0 - 1.5	1.8
Italy	1.0 - 1.5	6.2
Netherlands	1.0 - 1.5	2.5
Sweden	1.5 - 2.0	6.8
Denmark	2.2 - 2.7	5.8

Table 4 gathers shares of organic products in overall food sales and percentage of organic land area compared to total agricultural land area[8].

---

7. FiBL in cooperation with ZMP 2009 - http://www.organic-world.net/maps-2009.html

8. H. Willer, M. Yussefi-Menzler, *The World of Organic Agriculture - Statistics & Emrging Trends*, 2006.

More recent data show different trends. For example, the share of the total agricultural area in the UK decreased to 3.8% in 2006 (4.4% in 2004) whereas this share increased in Germany, France, and more significantly in Italy to respectively reach 4.8%, 2.0% and 9.0% in 2006 (respectively 4.5%, 1.8% and 6.2% in 2004).

It is relevant to study research specifically on organic farming, rather than research on “sustainable agriculture” or on “low-input”, for two reasons. First of all, in many European countries the development of organic farming is an objective endorsed at the political level, and it is the only label that enjoys worldwide recognition.

Moreover, research institutions now acknowledge that organic farming is a relevant model for research, “*a prototype of system the scientific knowledge and the technical mastery of which will help operators active in this supply channel, but will also irrigate other forms of agriculture.*”[9] In contrast, if a lot of agriculture research nowadays is geared towards a reduction of inputs or of the impact of agriculture on the environment, the applicability of this research to organic farming is debated. A number of scientists argue that research on low-input systems can hardly be transferred to organic farming, that considers agricultural systems in their globality, and does not look only at the reduction of the use of a given pesticide or fertiliser.

Implementation of bibliometric method and key words

A bibliometric analysis based on keywords from scientific publications (in English only) taken from Thomson Scientific’s ISI Web of Science reference database made it possible to determine sufficiently relevant indicators for a comparison of national research efforts from 2000-2006, and to therefore assess actual research efforts in the area of organic farming. Beyond traditional specialisation analyses, the ratio between the world share of publications of a given country in organic farming and its world share of publications in specific disciplines and sub-disciplines (according to the nomenclature of the French Observatory for Sciences and Techniques) allowed us to obtain relative Specialisation indexes that act as policy and priority indicators for research institutions involved in the concerned area.

Here is the final list of keywords we used for our requests (including only the terms giving more than 4 articles in the 1991-2008 years range, thus more than 0.2% of the total number of articles):

“organic farm” OR “organic production*” OR “organic agr*” OR “organic food*” OR “organic crop*” OR “organic dairy” OR “organic management” OR “organic feed*” OR “organic cultiv*” OR “organic apple*” OR “organic vegetable*” OR “organic cropping system*” OR “organic pig” OR “organic milk” OR “organic wheat*” OR “organic fruit*” OR “organic livestock*” OR “organic certification” OR “organic meat” OR “organic coffee*” OR “organic egg*” OR “organic corn*” OR “organic seed*” OR “organic cereal*” OR “organic and conventional cropping system*” OR “organic rice*” OR “organic cotton*” OR “organic pigs” OR “organic chicken*” OR “organic strawber*” OR “organic plum*” OR “organic vine*” OR “organic wine” OR “organic lettuce*” OR “organic husbandry*” OR “organic banana*” OR “organic pear*” OR “organic tomatoe*” OR “organic barley*” OR “organic cow*” OR “organic tea” OR “organic onion*” OR “organic soy*” OR “organic grape*” OR “organic marketing” OR “organic potatoe*” OR “organic aquaculture”*

9. S. Bellon, Y. Gautronneau, G. Riba, I.Savini, B. Sylvander, B. Hervieu, 2000. L’agriculture biologique et l’INRA : vers un programme de recherche, INRA Mensuel, 104, 1-25. (*Translation ours*)

Results

For the period 2000-2006, the European Union obtained a specialisation index of 1.52 in the area of organic farming, compared to 0.68 for the US, 0.98 for Brazil and 0.18 for China. However, this seemingly satisfactory average for Europe as a whole hides important disparities between European countries. Moreover, important agronomic actors, such as France or Spain, are at the very end of the European classification for all indexes with only 0.47 and 0.67 respectively for specialisation, compared to Germany with 1.19, Italy with 1.39, Austria with 2.78, Sweden with 3.99, Finland with 4.46 and Denmark with 12.19 (see Figure 2 below).

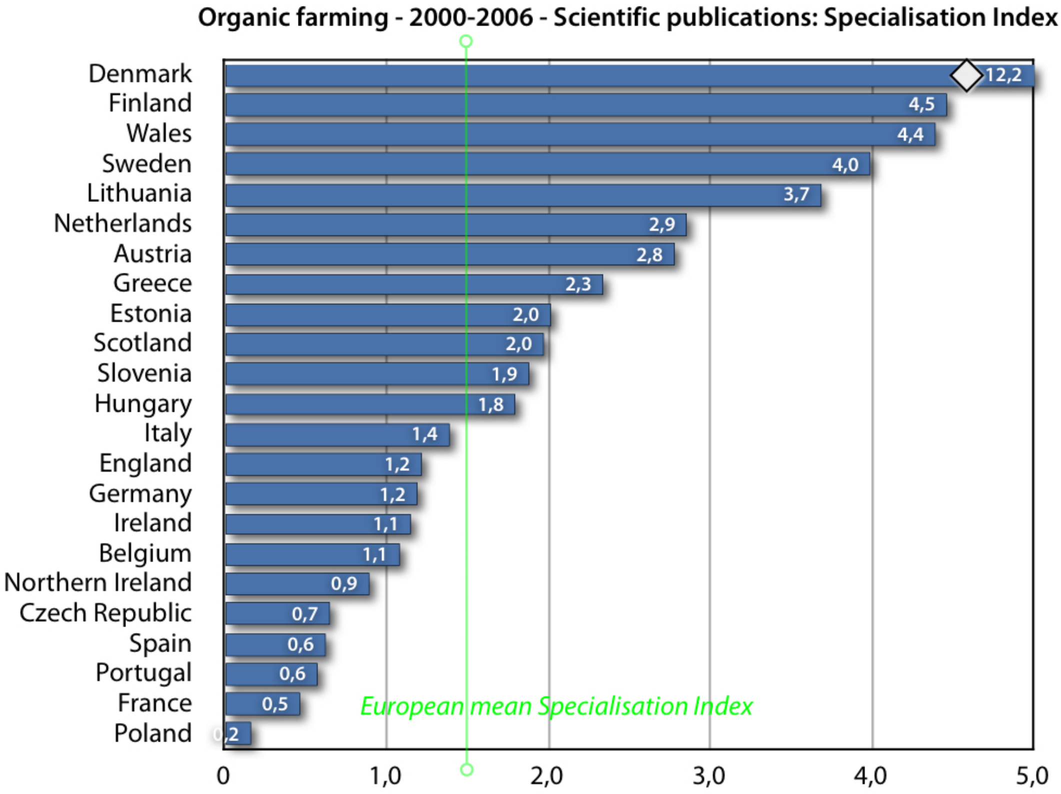

Figure 2. Scientometrics Analysis Worldwide
Organic Farming: Specialisation Index for European countries

In our study, we also constructed a Priority index (PI), built on the comparison of several disciplines and sub-disciplines. We kept the most relevant of them in terms of numbers of articles.

For example, within the discipline "Applied biology and ecology", the mean Priority Index (PI) is 1.65 for the EU27, compared to 0.69 for the US. Inside the EU27, here are some of the most interesting results : 1.7 for Germany, 3.98 for Austria, 3.84 for Finland, 9.45 for Denmark and 0.49 for France.
Within the sub-discipline "Agriculture, plant biology" the mean Priority Index (PI) is 1.5 for the EU27, compared to 0.98 for the US. Inside EU27, 1.61 for Germany, 3.28 for Austria, 1.52 for Finland, 9.79 for Denmark, and 0.41 for France. Finally, for the sub-discipline, "Agro-food", the mean PI is 1.86 for the EU27, 0.73 for the US. And Inside EU27: 1.98 for Germany, 6.92 for Austria, 7.39 for Finland, 9.39 for Denmark and 0.58 for France.

The high Priority indexes of certain countries can be misleading. Therefore, in Table 5, we presented the number of articles in Applied Biology, the discipline where approximately 80% of the total number of articles in organic farming can be found, in order to compare these numbers to the very low amount of publications in organic farming. Overall, there are still relatively few publications on organic farming research, which confirms that more efforst have to be done to allow the European organic farming sector to meet the demand from European consumers.
It is hardly surprising that the EU has a Specialisation index above average, given that the size of its agro-food sector and the high social and consumer demand for organic products. The very concept of organic farming originated in countries like Germany or the UK.

2000-2006	Applied Biology	Organic Farming inside Applied Biology	
Country	Nb of publications	Nb of publications	% / Applied Biology
USA	151863	217	0,14 %
Japan	38075	10	0,03 %
Germany	31297	77	0,25 %
England	30599	98	0,32 %
France	25419	23	0,09 %
Italy	16135	65	0,40 %
Spain	25485	19	0,07 %
Netherlands	12605	69	0,55 %
Sweden	10455	65	0,62 %
Belgium	7537	13	0,17 %
Denmark	7578	134	1,77 %
Finland	6134	49	0,80 %
Austria	3932	31	0,79 %
Canada	32039	38	0,12 %
China	21849	7	0,03 %
India	20335	15	0,07 %
Brazil	14307	15	0,10 %

Table 5. Organic farming vs Applied biology
Respective number of articles (years 2000-2006) and comparisons

These results must be interpreted with caution. They would need to be put in context, and crossed with the analysis of other domains, and of other factors, such as budgets. As such, they show that if research in organic farming appears as a relative specialisation in the EU on average, there are high disparities between countries. The relatively good average seems to be due to the strong effort of countries such as Denmark, Finland, Sweden, Lithuania, the Netherlands or Austria. The largest countries, with the largest agricultural production capacity, do not prioritise the development of research on organic farming, even though it could also benefit other types of agriculture. The case of France is of particular concern. More detailed results and analysis can be found in our peer-reviewed publication about research efforts in France[10].

10. E. Gall, G. Millot, C. Neubauer, *Faiblesse de l'effort français pour la recherche dans le domaine de l'Agriculture Biologique : approche scientométrique*. Innovations Agronomiques (2009) 4, 363-375

B.2. Scientometric study of research on ecotoxicology, health and environment

Background

At latest since the adoption of the European directive REACH, the need for ecotoxicological research has been confirmed at the European level. Ecotoxicology can be defined as "the branch of toxicology concerned with the study of toxic effects, caused by natural or synthetic pollutants, to the constituents of ecosystems, animal (including human), vegetable and microbial, in an integral context"[11]. It can also be seen as « ecology in the presence of toxicants » while integrating aspects of physiology, analytical chemistry and other disciplines. However, after exchanges with professionals and scientists, it became obvious that there are not enough scientists (e.g. toxicologists) to do the work and that ecotoxicology is more of an "orphan" research domain. We did the scientometric analysis to prove this hypothesis.

Implementation of bibliometric method and key words

For the analysis of research efforts on ecotoxicology, we decided to adopt a different approach. Instead of comparing EU countries to the rest of the world, we conducted an intra-European study to find which EU countries were leaders in this domain crucial for the study on environmental impacts on health. The reference point is therefore not the world, but the EU27. In consequence, the Specialisation and Priority indexes for the EU27 are equal to 1.0 in this study.

We focused our research on the seven following countries, which gather the highest number of publications: Germany, England, France, Italy, Spain, the Netherlands and Sweden. The three first countries of this list produce almost half of the total of publications in the EU (*see Table 7, below*). And these seven countries represent together 75% of publications in the EU. Our aim was to find out whether these countries, leaders in terms of the quantity of research outputs, were also leaders in ecotoxicology.

Below is the list of keywords with which we submitted our requests in the database:

xenobiotic or ecotoxic* or ((environmental exposure or biomagnification or bioaccumulat* or bioconcentration or chemical stress* or metallothionein or sentinel spec* or sensitive biomark* or effect biomark* or environmental risk assessment or LC50 or LD50 or biomonit* or bioindic*) and (biomarker* OR pollut* OR xenobiotic*)) or organic pollutant* or dioxin-like or inorganic pollutant* or emerging pollutant* or EROD or ethoxyresorufin-O-deethylase or ECOD or ethoxycoumarin-O-deethylase or endocrine disrupt* or multixenobiotic resistance or microtox or Algal Growth Inhibition or Daphnia Acute Immobilization or Fish Acute Toxicity*

---

11. Truhaut, R. 1977, "Eco-Toxicology - Objectives, Principles and Perspectives", Ecotoxicology and Environmental Safety, vol. 1, no. 2, pp. 151–173.

Results

First we calculated the Specialisation index (SI) for all EU countries for two sub-disciplines: Environment and Public Health (respectively ENVIR and HEALTH in table 6, below, where we can find the lists of the subject areas that these subdisciplines contain).

Environnement	**Health**	**Pharmacology/Toxicology**
Engineering, Environmental; Environmental Sciences; Limnology; Water Resources	Geriatrics & Gerontology; Integrative & Complementary Medicine; Medical Ethics; Medicine, Legal; Nursing; Orthopedics; Parasitology; Pediatrics; Public, Environmental & Occupational Health; Rehabilitation; Sport Sciences; Substance Abuse; Tropical Medicine	Chemistry, Medicinal; Pharmacology & Pharmacy; Toxicology

Table 6. *List of the subject areas contained in our studied subdisciplines (Environment; Public Health and Pharmacology/Toxicology)*

For both these sub-disciplines, the Specialisation Index (SI) is below 1, which shows the relatively low importance given to these domains, even though many research needs have been identified by civil society in these areas.

A higher specialisation in Public Health (HEALTH in Table 7) in England, the Netherlands or Sweden, or in Environment (ENVIR in Table 7) for Spain, the Netherlands and Sweden, are not sufficient to counter-balance the weak research effort of the other European countries, even if we consider the top3, top4, top 5 or even top7, in which the good score of Sweden is not enough. None of the seven EU countries which publish the most give a high enough priority to these two sub-disciplines.

The first results for ecotoxicology in terms of specialisation, still in Table 7, confirm the weak role of these countries. Specialisation Indexes for the top3 countries are low : 0.86. These three countries, that publish more than 46% of the European scientific articles, only publish 40% of the articles in ecotoxicology.

2000-2006	ALL SUBJETCS		Environment		Health		Ecotoxicology		
Country	Nb of publications	% / UE27	Specialisation Index		Specialisation Index		Nb of publications	% / UE27	SI
Germany	349631	17,33 %	0,72		0,66		1753	15,66 %	0,90
England	332439	16,48 %	0,96		1,51		1467	13,11 %	0,80
France	255087	12,64 %	0,76		0,69		1265	11,30 %	0,89
Italy	201266	9,97 %	0,95		0,77		1161	10,37 %	1,04
Spain	147215	7,30 %	1,33		0,67		971	8,68 %	1,19
Netherlands	115171	5,71 %	1,14		1,44		636	5,68 %	1,00
Sweden	92196	4,57 %	1,32		1,59		684	6,11 %	1,34
	top3	46,44 %	top3	0,82	top3	0,97		top3	0,86
	top4	56,42 %	top4	0,84	top4	0,93		top4	0,89
	top5	63,71 %	top5	0,90	top5	0,90		top5	0,93
	top7	73,99 %	top7	0,94	top7	0,99		top7	0,96

Table 7. Scientometrics Analysis inside EU27: All subjects, Environment, Health and Ecotoxicology

On the basis of these first results, we examined in which disciplines and sub-disciplines the priority given to ecotoxicology was the lowest. We calculated the Priority indexes for ecotoxicology in disciplines and sub-disciplines in which we found the highest number of ecotoxicology articles.

Fondamental Biology	**Medical Research**
Anatomy & Morphology; Behavioral Sciences; Biochemical Research Methods; Biochemistry & Molecular Biology; Biophysics; Biotechnology & Applied Microbiology; Cell Biology; Developmental Biology; Engineering, Biomedical; Evolutionary Biology; Genetics & Heredity; Materials Science, Biomaterials; Mathematical & Computational Biology; Medical Informatics; Medical Laboratory Technology; Microbiology; Microscopy; Neuroimaging; Neurosciences; Nutrition & Dietetics; Parasitology; Physiology; Psychology; Reproductive Biology; Virology	Allergy; Andrology; Anesthesiology; Cardiac & Cardiovascular Systems; Chemistry, Medicinal; Clinical Neurology; Critical Care Medicine; Dentistry, Oral Surgery & Medicine; Dermatology; Emergency Medicine; Endocrinology & Metabolism; Gastroenterology & Hepatology; Geriatrics & Gerontology; Health Care Sciences & Services; Hematology; Immunology; Infectious Diseases; Integrative & Complementary Medicine; Medical Ethics; Medicine, General & Internal; Medicine, Legal; Medicine, Research & Experimental; Nursing; Obstetrics & Gynecology; Oncology; Ophthalmology; Orthopedics; Otorhinolaryngology; Pathology; Pediatrics; Peripheral Vascular Disease; Pharmacology & Pharmacy; Psychiatry; Public, Environmental & Occupational Health; Radiology, Nuclear Medicine & Medical Imaging; Rehabilitation; Respiratory System; Rheumatology; Sport Sciences; Substance Abuse; Surgery; Toxicology; Transplantation; Tropical Medicine; Urology & Nephrology; Veterinary Sciences

Table 8. List of the subject areas contained in our studied disciplines (Fondamental Biology, Medical Research).

The number of articles in the disciplines Fundamental Biology and Medical Research represent respectively 20% and 42% of all articles in ecotoxicology (62% for both of them). Table 8 lists the subject areas contained in these two disciplines.

Table 9 (for Fundamental Biology, see below) and table 10 (for Medical Research, see below) show that the low results observed for ecotoxicology in general are reflected for Fundamental Biology and Medical Research. The differences observed with this "zoom" are not significant enough to reverse the tendency.

2000-2006	Fondamental Biology		Ecotoxicology within FONDAMENTAL BIOLOGY		
Country	Nb of publications	% / UE 27	Nb of publications	% / UE 27	Priority Index / Fondament. Biology
Germany	111127	18,21 %	351	15,85 %	0,87
England	101680	16,66 %	272	12,28 %	0,74
France	80974	13,27 %	304	13,72 %	1,03
Italy	57337	9,39 %	237	10,70 %	1,14
Spain	42406	6,95 %	202	9,12 %	1,31
Netherlands	35800	5,87 %	93	4,20 %	0,72
Sweden	30496	5,00 %	127	5,73 %	1,15
	top3	48,14 %		top3	0,87
	top4	57,53 %		top4	0,91
	top5	64,48 %		top5	0,96
	top7	75,34 %		top7	0,95

Table 9. Scientometrics Analysis inside EU27: Ecotoxicology within Fondamental Biology

2000-2006	Mecical Research		Ecotoxicology within MEDICAL RESEARCH		
Country	Nb of publications	% / UE 27	Nb of publications	% / UE 27	Priority Index / Medical Research
Germany	134314	15,99 %	746	15,89 %	0,99
England	161747	19,26 %	668	14,22 %	0,74
France	81184	9,67 %	529	11,26 %	1,17
Italy	95116	11,33 %	474	10,09 %	0,89
Spain	46797	5,57 %	266	5,66 %	1,02
Netherlands	65156	7,76 %	325	6,92 %	0,89
Sweden	47816	5,69 %	348	7,41 %	1,3
	top3	44,92 %		top3	0,92
	top4	56,25 %		top4	0,92
	top5	61,82 %		top5	0,92
	top7	75,27 %		top7	0,95

Table 10. Scientometrics Analysis inside EU27: Ecotoxicology within Medical Research

For England, which represent almost 20% of the publications in Medical Research, the Priority Index, that was already low taking all disciplines into account (0.80), is even lower when analysing the number of articles in these two disciplines (0.74 in both disciplines). The 0.80 value is obtained with the help of Applied Biology, in which England's PI is above 1. But Applied Biology, not represented here, does not gather more than 10% of all articles in ecotoxicology.

Sweden, ranked 7 in Europe, displays the best results among this selection of countries. We can also notice that no regional trend seems to appear, as the best and worst results are randomly spread in Europe, Slovakia (2.2), Czech Republic (1.89), Portugal (1.81) and Greece (1.49) having the highest PI for ecotoxicology within Fundamental Biology and Portugal (3.41), Czech Republic (3.32), Slovakia (2.78), Bulgaria (1.96) and Poland (1.83) having the highest PI for ecotoxicology within Medical Research.

If we do not take into account the very small countries, whose smaller amount of articles published induce important statistical biases, the worst PI appear for Latvia (0.25), Estonia (0.53), Austria (0.72), Scotland (0.74) and Hungary (0.78) in Fundamental Biology and for Austria (0.44), Ireland (0.51), Northern Ireland (0.53), Greece (0.62), Wales (0.73) and Hungary (0.74) for Medical Research.

We also examined the number of ecotoxicology articles in the sub-disciplines Environment, Public Health and Pharmacology/Toxicology (respectively ENVIR, HEALTH and PHARM/TOXICO in the tables). These three sub-disciplines gather 75% of all articles in ecotoxicology, Public Health being the least important of these sub-disciplines with – surprinsingly - only 7% of the articles. 41% of the articles are found in the sub-discipline Environment, and 27% in the sub-discipline Pharmacology/Toxicology. The list of subject areas in these sub-disciplines can be found in Table 6.

Table 11, 12 and 13 (*see below*) respectively show the results for these sub-disciplines. These results are more nuanced, even though in general Priority indexes remain below 1.0, and are therefore the sign of a low prioritisation of ecotoxicology within these restricted domains.

2000-2006	ENVIR		Ecotoxicology within ENVIR		
Country	Nb of publications	% / UE 27	Nb of publications	% / UE 27	Priority Index / ENVIR
Germany	8734	12,48 %	638	13,94 %	1,12
England	11030	15,76 %	576	12,58 %	0,8
France	6753	9,65 %	438	9,57 %	0,99
Italy	6615	9,45 %	502	10,97 %	1,16
Spain	6816	9,74 %	436	9,53 %	0,98
Netherlands	4548	6,50 %	282	6,16 %	0,95
Sweden	4233	6,05 %	279	6,10 %	1,01
	top3	37,89 %		top3	0,95
	top4	47,34 %		top4	0,99
	top5	57,08 %		top5	0,99
	top7	69,62 %		top7	0,99

Table 11. Scientometrics Analysis inside EU27: Ecotoxicology within Environnement

2000-2006	HEALTH		Ecotoxicology within HEALTH		
Country	Nb of publications	% / UE 27	Nb of publications	% / UE 27	Priority Index / HEALTH
Germany	11447	11,37 %	134	16,30 %	1,43
England	25102	24,93 %	117	14,23 %	0,57
France	8811	8,75 %	65	7,91 %	0,9
Italy	7733	7,68 %	109	13,26 %	1,73
Spain	4886	4,85 %	41	4,99 %	1,03
Netherlands	8279	8,22 %	50	6,08 %	0,74
Sweden	7293	7,24 %	81	9,85 %	1,36
	top3	45,05 %		top3	0,85
	top4	52,73 %		top4	0,98
	top5	57,58 %		top5	0,98
	top7	73,05 %		top7	0,99

Table 12. Scientometrics Analysis inside EU27: Ecotoxicology within Health

2000-2006	PHARM/TOXICO		Ecotoxicology within PHARM/TOXICO		
Country	Nb of publications	% / UE 27	Nb of publications	% / UE 27	Priority Index/ PHARM/TOXICO
Germany	14236	15,91 %	466	15,68 %	0,99
England	13473	15,06 %	410	13,80 %	0,92
France	10656	11,91 %	376	12,66 %	1,06
Italy	11128	12,44 %	248	8,35 %	0,67
Spain	7009	7,83 %	183	6,16 %	0,79
Netherlands	5007	5,60 %	232	7,81 %	1,4
Sweden	4272	4,77 %	207	6,97 %	1,46
	top3	42,88 %		top3	0,98
	top4	55,32 %		top4	0,91
	top5	63,15 %		top5	0,9
	top7	73,53 %		top7	0,97

Table 13. Scientometrics Analysis inside EU27: Ecotoxicology within Pharmacology/Toxicology

Disparities within sub-disciplines are nonetheless more apparent. For example, Germany has a relatively good Priority Index (1.43) within the sub-discipline Public Health, but slightly below 1 (0.99) for Pharmacology/Toxicology. The contrast is even sharper in Italy, whose indexes are respectively 1.73 et 0.67 for these two sub-disciplines. Sweden remains the only one of this selection of countries for which all PI are higher than 1.0. But even this country shows a certain weakness in ecotoxicology research within the sub-discipline Environment. England is the only one of the seven that has all its PI below 1.0. And France, Spain and the Netherlands have two out of the three indexes below 1. Here as well, it is not possible to see a regional grouping of the European countries as the best and worst PI are again randomly spread across the EU27.

As far as the other EU countries are concerned, here are the most relevant results. For the Priority indexes for ecotoxicology within the discipline Environment (*see table 11 for top 7 countries*), the highest scoring countries are Portugal (1.82), Belgium (1.47), Czech Republic (1.40), Lithuania (1.28) Denmark (1.25) and Slovakia (1.23). The other values are lower than 1.16 (PI for Italy). Theses values, although above 1, cannot be considered as very good. The worst PI are found for Scotland (0.57), Northern Ireland (0.61), Latvia (0.64), Estonia (0.77), Finland (0.78) and Bulgaria (0.79), the other low values being higher than 0.80 (PI for England).

For the Priority indexes in Public Health (see table 12 for top 7 countries), , the highest scoring country is Romania (4.65), but its very low production prevents us from taking this value into account. The other best publishing countries in ecotoxicology are Slovakia (3.31), Poland (2.11) and Czech Republic (2.01). The other values are lower than 1.73 (PI for Italy in this sub-discipline). The lowest scoring countries are Slovenia (0.0), Ireland (0.13), Scotland (0.47), Bulgaria (0.48) and Portugal (0.53), the other low values being higher than 0.57 (PI for England). (data not shown)

Finally, the Priority indexes in Pharmacology/Toxicology (see table 13 for top 7 countries), the highest scoring countries are Portugal (2.35), Czech Republic (2.06) and Denmark (1.63). The other values are lower than 1.46 (PI for Sweden). And the worst countries are Latvia (0.0), Northern Ireland (0.09), Hungary (0.31), Austria (0.41), Lithuania (0.52) and Bulgaria (0.67). The PI for Romania is 0.33, but for the same reason as mentioned above, we cannot take it into account. The other values are higher than 0.67 (PI for Italy).(data not shown)

B.3. Scientometric study on participatory research

Background

The term "Participatory Research" is used to describe the involvement of citizens or civil society organisations in research processes. In general terms it refers to research conducted in partnership between traditionally trained experts (usually academics) and members of a community or a CSO. It is an approach, a guiding principle to research and is valuable for social sciences and humanities as well as for natural sciences. As Participatory Research leads to adopting a problem-based and trans-disciplinary approach, it is particularly adapted to issues linked to sustainable development and to tackling problems which are transversal and have multiple dimensions. It is notably demanded and used by a civil society which has become a major location for knowledge, innovation and expertise but remains marginal in the current research system.

Implementation of bibliometric method and key words

In most cases, scientometric analyses consist in the making of Specialisation indexes aimed at comparing the scientific production of certain countries to scientific production worldwide. We tried to apply a similar logic to make visible the priorities of a country in a domain relative to the related disciplines and sub-disciplines. But other approaches are also possible.

Their use depends on the object of the analysis. With organic farming and ecotoxicology, we conducted studies based on the use of quantitative indicators built through the number of published articles and their ratios, through Specialisation indexes or Priority indexes. In both cases we had to elaborate an adequate lists of keywords and submit them to scientists in the field to check their validity and make adjustments. But, as we will see, it is possible to obtain interesting results with very simple requests in the database, in domains which use terms that are not “false positives”.

A very simple request with the term “participatory”, submitted for the last decade (1999-2008), which corresponds to the rise of those practices, gives interesting results. Figure 2 shows the evolution of the number of articles linked to this request. In this precise case, because of the low number of articles, the identification of false positives was easy. A closer examination revealed that there was none, the term “participatory” being hardly used outside this set of practices.

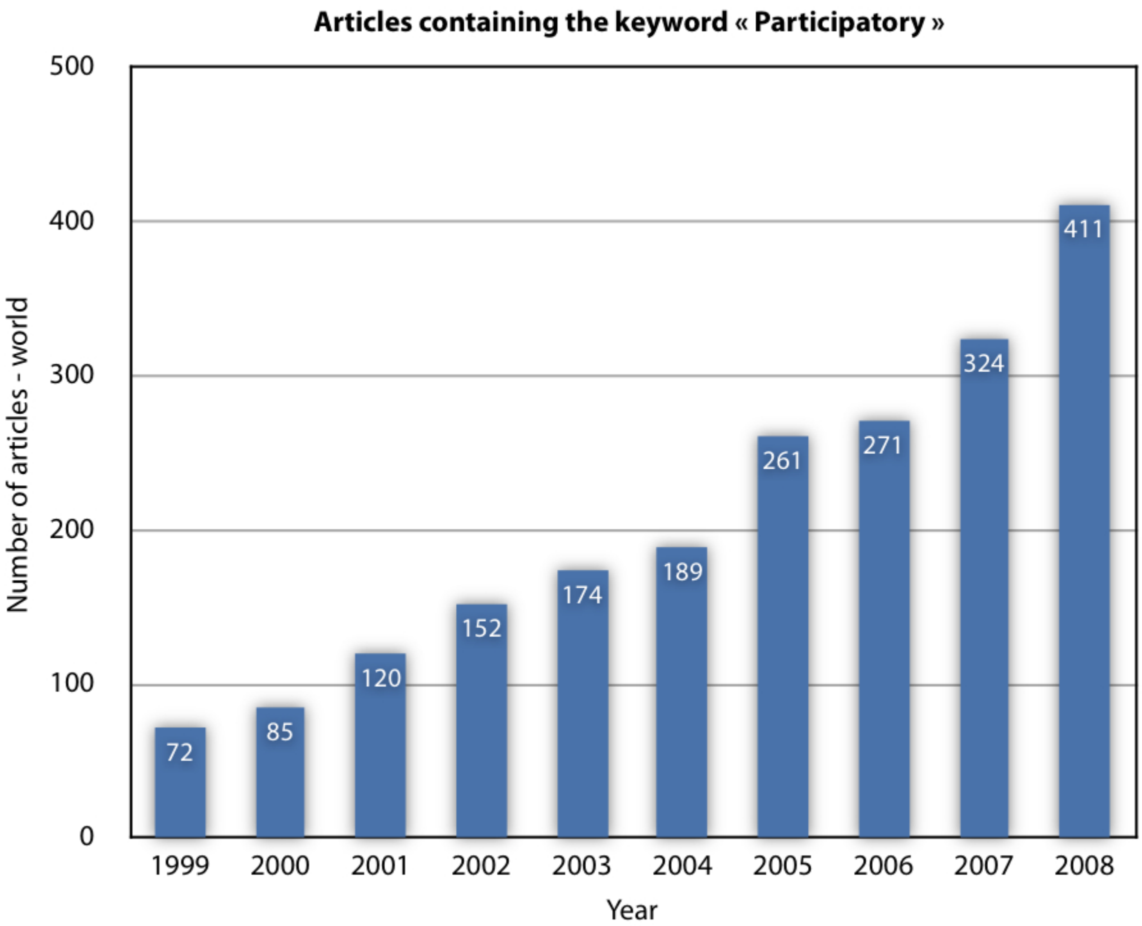

Figure 2. Scientometrics Analysis Worldwide
“Participatory” keyword: Number of publications

Results

We can observe a constant increasing trend in the number of yearly publications in this field, and even an acceleration in the last years, that correspond to the increase in the number of international meetings (e.g. Living Knowledge conferences, Community-University Expo in Victoria in 2008, etc.), in their attendance, in the densification of networks and the increase of funding opportunities for this type of research projects.

Tables 14 and 15 and Figures 3 and 4 (see below) show the countries publishing the most, and the main subject subject areas for articles that use participatory approaches in research. We can observe that these kinds of thematics are more frequent in English-speaking countries (even in Africa). But it tends to increase in more and more countries (even if not many EU countries appear on the list). Concerning the subject areas, most of them are contained in environment or health sub-disciplines, which seems logical, as these themes are the ones that concerns the greatest numbers of civil society organisations. Nevertheless, some subject areas such as “Engineering, industrial” or “Geography, physical” cannot be neglected.

Country	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
USA	23	27	40	46	63	61	86	96	100	125	667
England	10	13	15	16	14	20	22	31	45	44	230
Canada	2	2	8	11	8	18	21	27	23	31	151
Netherlands	1	4	8	14	12	13	23	23	22	30	150
Australia	7	4	6	10	8	18	13	12	23	28	129
India	6	7	8	9	8	7	14	7	9	24	99
Germany	1	5	1	7	3	6	7	10	17	18	75
Kenya	3	1	2	8	4	9	15	7	8	11	68
Sweden	2	3	4	6	2	12	7	8	10	11	65
South Africa	1	3	5	2	8	6	6	9	7	9	56
Italy	1	3	3	2	3	0	7	5	9	11	44
China	0	0	1	4	3	9	3	6	6	8	40
Japan	1	1	2	3	2	1	3	6	6	10	35
France	0	2	2	1	3	2	2	6	4	9	31
Spain	0	2	0	1	1	1	3	1	4	11	24

Table 14. Scientometrics Analysis Worldwide
“Participatory” keyword: Number of publications by country

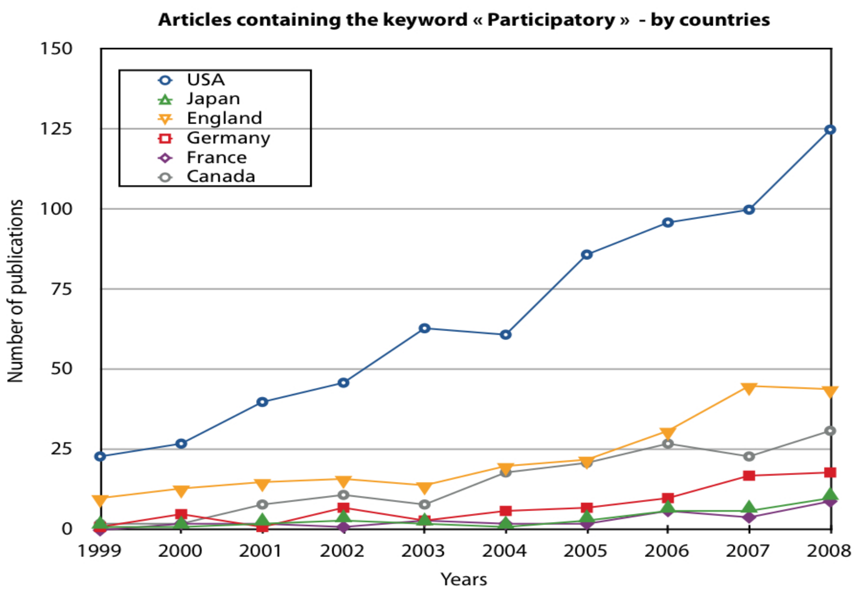

Figure 3. Scientometrics Analysis Worldwide - “Participatory” keyword: Main countries

Subject Area	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
Environmental sciences	18	25	32	25	28	31	58	53	68	70	408
Public, env. & occupat. health	10	6	20	21	28	34	43	45	60	45	312
Ecology	2	8	14	16	17	16	27	31	33	32	196
Agriculture, multidisciplinary	6	8	15	16	18	15	35	19	26	19	177
Agronomy	4	13	6	27	14	12	14	13	26	28	157
Medicine, General & Internal	4	5	7	5	15	7	15	16	25	17	116
Water resources	7	4	2	5	10	13	9	12	23	25	110
Health Care sciences & serv.	2	3	3	11	11	13	12	12	17	17	101
Environmental studies	1	5	9	5	8	5	5	12	23	27	100
Nursing	0	0	0	1	7	10	16	18	20	23	95
Forestry	1	11	5	6	13	6	16	7	9	13	87
Plant sciences	1	5	1	17	8	4	5	9	10	20	80
Engineering, environmental	10	2	4	1	3	3	4	9	11	12	59
Geography, physical	1	3	7	4	8	9	6	9	9	3	59
Veterinary Sciences	1	2	2	4	4	8	8	5	7	16	57
Health Policy & services	1	3	2	6	10	9	6	6	7	4	54
ergonomics	0	5	7	4	5	7	4	7	5	7	52
Horticulture	0	3	0	16	7	2	2	3	6	9	48
Engineering, industrial	2	4	5	3	5	4	5	8	3	7	46

Table 15. Scientometrics Analysis Worldwide
"Participatory" keyword: Number of publications by Subject Area

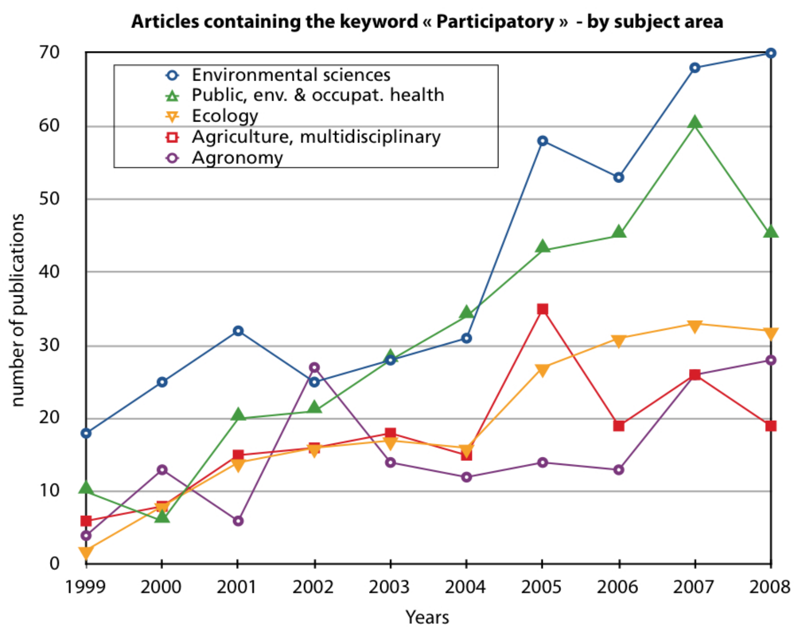

Figure 4. Scientometrics Analysis Worldwide - "Participatory" keyword: by main Subject areas

C. Analysis of budgets and programmes in selected domains of EU research Framework Programmes

The analysis of budgets and programmes aims at delivering insights into the financial support of the European Commission to different research domains. It can inform about the importance given to a certain research domain - in general, and in relation to other domains. Results can be put in relation to other indicators (for instance from scientometric analyses) or to narrative analyses, allowing to draw a broader picture of research policies and of their priorities.

1. Approach and methodology

Choice of analysed programmes and research domains

This analysis focuses on Framework Programme 6 since it is the most recent and at the same time an almost totally executed FP. Some projects are still under way up to 2011 but the financial distribution is closed.

FP6 had seven priority thematic areas: Life sciences, Genomics and biotechnology for health; Information society technologies; Nanotechnologies and nanosciences, Knowledge based multifunctional materials and new production processes and devices; Aeronautics and space; Food quality and safety; Sustainable development, Global change and ecosystems; Citizens and governance in a knowledge based society.

Comparisons of budgets from FP3 to FP7, and from Euratom programmes, were also conducted.

The analysis concentrates on two comparative exercises:

- On Agriculture and food, through the analysis, project by project, of research efforts on organic agriculture on the one hand, and on biotechnology on the other hand.
- On Energy, through the analysis of published numbers concerning research for nuclear and renewable energies.

Methodology for budget analyses

Budget analysis have been conducted by using primary and secondary sources. Budget analyses are very time consuming for several reasons:

- Complete overviews of all funded projects in a given domain do not exist.
- Key word screening does not always reveal all related projects.
- Key word analysis in titles and abstracts can deliver false positive and false negative results.
- Abstracts have therefore to be analysed.
- Sometimes project websites have to be analysed.
- Sometimes project partners have to be checked.

Technical approach to budget analyses

Several approaches have been used in a combined manner in order to examine funded projects and programmes.
For the analysis of projects on organic and biotechnological agriculture, the « Advanced search » function of the Cordis database, with a timescale covering the entire FP6 financial period (from January 2003 to December 2011), was used. To cover projects of a given field, a search with key words was used. Key words had to appear either in the title, in the abstract or in the partners descriptions. Abstracts and description of objectives of the projects have been analysed to ensure the importance of the search terms for the given projects and to exclude false positives (ex. “organic” and “organic waste”). For some projects, websites were analysed or they were sent to external experts to

gather complementary views.
The "Simple research" function of the Cordis database was also used since this function revealed to be sometimes more efficient than the advanced research one. Furthermore we used websites of the European Commission, such as the website on research projects on organic agriculture, on automated data collection of FP6 projects, on international cooperation in FP6-Food. Publications from other organisations were also included such as from FIBL (Swiss Research Institute on Organic Farming), Friends of the Earth Europe, IFOAM (International Federation of Organic Agriculture Movements) and other civil society organisations in order to gather complementary information.[12]

For the research on energy research budgets, numerous documents and websites from the European Commission, EUREC (European Renewable Energies Research Centres Agency) and other organisations were used.[13]

The project search was undertaken in the field of agricultural research, and two domains were analysed more specifically - research for organic agriculture (OA) and research for biotechnological agriculture (BT).

Keywords were used to find the relevant projects.

Keywords for organic agriculture: Organic farming, organic agriculture, organic production, organic *, low input *
Keywords for biotechnological agriculture: biotechnolog*, GMO, genetic engineering, genetic improvement, transgenic products, marker-assisted selection

Search borders: Only projects were counted in which the research had a clear main focus on organic or biotechnological agriculture. Other projects which can eventually serve organic or biotechnological agriculture but which were not mainly focused on these issues, were excluded[14].

Problems encountered

Technical problems occurred regularly on the Cordis websites and several search options did not exist

---

12 http://cordis.europa.eu/home_fr.html
http://ec.europa.eu/agriculture/organic/eu-policy/research-projects_fr
http://www.ist-world.org
http://cordis.europa.eu/food/int_coop_bro.htm
http://www.fibl.org/
http://www.foeeurope.org/
http://www.ifoam.org/

13 http://ec.europa.eu/research/fp6/index_en.cfm?p=e_euratom
http://cordis.europa.eu/fp5/src/budget.htm
http://209.85.229.132/search?q=cache:wFWmvjKHarsJ:www.eurosfaire.prd.fr/euratom/documents/pdf/fp6-euratombrief_v01_fr.pdf+FP6+-+Euratom+Programme&cd=3&hl=fr&ct=clnk&gl=fr&client=firefox-a
http://ec.europa.eu/research/fp6/index_en.cfm
http://cordis.europa.eu/fp5/src/budget4.htm
http://www.eurec.be/content/view/45/34/
http://ec.europa.eu/research/joule/joule3.html
http://cordis.europa.eu/sustdev/energy/
http://www.europeanenergyforum.eu/

14 . *e.g.* three projects were indicated as on organic agriculture by the EC website but since the issue of organic agriculture was marginal, these projects were not taken into account. The advanced search function of Cordis showed a total of 61 projects on biotechnological agriculture in FP6, however, the projects where biotechnological agriculture did not seem to be the main focus, were not counted.

or functioned properly. Even with the help of the Cordis helpdesk these problems could not be solved and necessitated a more extensive search on the web in general.
One of the most difficult points in the search was to identify false positive and false negative projects. We tried to examine projects as carefully as possible but errors can not be excluded.
None of the sources we used is apparently shaped to give an exhaustive overview over EC funded research projects in specific domains

2. Funding of research projects on Agriculture and Food in Framework Programmes

Funding for projects concerning organic agriculture

Projects concerning organic agriculture were found to be financed under five priorities of FP6 - Food quality and safety, Research for policy support, Marie-Curie Actions - Human resources and mobility, Coordination of research activities, and Specific SME activities.

A total of 16 projects was found with an overall budget of 41,140,666€.

Funding for projects concerning biotechnological agriculture

Projects concerning biotechnological agriculture were found to be financed under three priorities of FP6 - Food (Food quality and safety), JRC (Joint Research Centre), INCO (International Cooperation).

A total of 32 projects was found with an overall budget of 133,922,321€.

Comparison of the funding of projects on organic agriculture and on biotechnological agriculture

Projects on organic agriculture received a total funding of 41,141,000€ in FP6 whereas projects on biotechnological agriculture received a total support of 133,922,000€. The funding of OA projects is thus less than one third of those for BT projects: OA/BT = 0.307. In other words, support to projects for biotechnological agriculture was more than three times as high as support to those on organic agriculture: BT/OA = 3.25.

Since FP6-Food was the programme which gathered the largest number of projects and subsidies both for organic agriculture and biotechnological agriculture, we compared the budgets spent on respective projects within this programme.

Seven projects on organic agriculture were financed under the FP6 Food programme.
They amount to a budget of 32,293,347€ (see annex I) which corresponds to 78% of the total budget spent on OA projects.

Total amount of FP6-Food programme: 685,000,000€
All projects on organic farming in FP6 Food: 32,293,347€
Percentage projects on OA/FP6-Food: 4.71% of the budget of FP6-Food.

26 projects with a focus on biotechnological agriculture were financed under FP6-Food. They amount to a budget of 126,767,218€ which corresponds to 94% of the total budget spent on BT projects under FP6.

Total amount of FP6-Food programme: 685,000,000€.
All projects on biotechnology in FP6 Food: 126,767,218€
Percentage projects on BT/FP6-Food: 18.51% of the budget of FP6-Food.

=> In FP6-Food, project funding on BT projects was 3,9 as high as funding on OA projects.

	Organic agriculture in €	Biotechnological agriculture in €
FP6	41.141.000	133.922.000
FP6-Food	32.293.000	126.767.000
% of FP6-Food budget	4,71	18,51

Table 1: Comparison of support to research for organic agriculture and biotechnological agriculture under FP6

Funding for organic agriculture research under FPs

Under FP3, research for organic agriculture counts for less than 0,1% of the total budget. Since then, European funding in total amount of money for organic agriculture research is constantly growing. However, since total FP budgets raised constantly as well, the relative support of the European Commission to research for organic agriculture did not grow since 1994 and stays stable at a very low level under FP4, 5 and 6.

Framework programme	Budget for research on OA in M€	Total budget of FPs in M€	% of budget spent on OA research
FP3 (1990-1994)	5*	6600	0.08
FP4 (1994-1998)	11*	13215	0.22
FP5 (1998-2002)	33*	14960	0.20
FP6 (2002-2006)	41	17500	0.23

* data from IFOAM, briefing note, September 2006, Organic farming research in the 7th research framework programme

Table 2: Funding of research projects for organic agriculture under different framework programmes [15]

15 All budgets in this document are given in € (1 ECU = 1€).

3. Funding of research projects on Energy in Framework Programmes

Background

Research on energy at the European level is assured by Framework Programmes and Euratom, the European Atomic Energy Community. The treaty of Rome on Euratom came into force in 1958 for an "unlimited period" and is today under the responsibility of the European Community. Euratom aims at developing a strong nuclear research and industry and at coordinating the efforts between EU member states.

The Euratom assures thus the research on nuclear energy, the Framework programmes the research on all other issues concerning energy.

Eurobarometer on Energy

In March 2003, the EC published the Eurobarometer on "Energy: Issues, Options and Technologies" commissioned by DG Research.[16] About 16,000 citizens of the European Union (aged 15 and over) were interviewed. "The aim was to obtain a clearer picture of public opinion on energy-related issues, including their scientific, technological aspects and prospects for the future: hence the number of questions concerning perceptions of the future."

The summary of the report states:

=> "Renewable sources of energy are perceived by a majority of those polled as being the least expensive, the best for the environment, and to a lesser extent, the most efficient. The view which Europeans have of energy options 20 and 50 years from now is clearly influenced by their expressed preferences for renewable energy sources, although the majority of those questioned consider that it will still be necessary to use a variety of energy sources. [...] As far as energy-related research is concerned, EU citizens expect to see significant consequences for environmental protection and want more action with regard to renewable energy sources and cleaner means of transport."

=> on Energy-related research: The citizens had to answer to the question "In which of the following areas would you like to see more energy-related research in the European Union".
"When it comes to energy-related research, Europeans would firstly like to see the European Union do more in two areas: renewable energy sources (69%) and cleaner means of transport (51%). Nuclear fusion comes next (21%). Conventional energy sources trail far behind, with natural gas scoring 13%, nuclear fission 10%, oil 6%, and coal 5%."[...] The main reason for continuing nuclear research is increased power station safety (48%), followed by improved waste disposal (43%)."

Energy in FP7

After long and intense discussions between the Council, the Parliament and interested actors on FP7's provisions for funding renewable energy, the legislative text of the programme was enlarged to the sentence: "Recognising their important contribution to future sustainable energy systems, renewables and energy end-use efficiency will be the major part of this Theme." ('This theme' refers to the research proposed in the area of non-nuclear energy.) On behalf of the renewable energy research community, the European Renewable Energy Centres Agency EUREC therefore expects that "... this sentence can only mean one thing: that the two sets of technologies will receive over half of the

16 http://europa.eu/rapid/pressReleasesAction.do?reference=IP/03/336&format=HTML&aged=0&language=EN&guiLanguage=en
http://ec.europa.eu/geninfo/query/resultaction.jsp?Page=1&userinput=
Eurobarometer *Energy: Issues, Options and Technologies.* Science and Society. European Commission, 2002

budget for non-nuclear research, meaning at least 1175 M EUR over the seven years of FP7,". This figure represents an increase in real terms of the order of 40% compared to the average amount spent per year on these technologies during FP6."[17]

Financial efforts were analysed for research for nuclear or renewable energies under different Framework Programmes.

17 EUREC, press release 30.11.2006, http://www.eurec.be/component/option,com_docman/task,cat_view/gid,75/Itemid,79/

FP	Euratom budget in M€	Energy budget in M€	% FP Energy/ Euratom budgets	Renewable energies budget in M€	% renewable energies/FP energy budgets	% renewable energies/ Euratom budgets
FP4 (1994-1998)	1235	1030	83.4	400-450	38.8 -43.7	32.4-36.4
FP5 (1998-2002)	1260	1042	82.7	400-450	38.4-43.2	31.7-35.7
FP6 (2002-2006	1350	890	65,9	380-410	42.7-46.1	28.1-30.4
FP7 (2007-2013)	2750 (2007-2011) (550/year)	2350 (336/year)	85.4 (61.0/year)	?	?	?

Table 3: Funding for research in energy under different framework programmes

In comparison to FP4 to FP7 budgets, the research budget for the Euratom programme has been significantly more important than the total budget for all other research issues concerning energy, such as energy efficiency, sustainable energy systems, hydrogen storage, clean energy systems, renewable energies, etc. Research funding for renewable energies is almost only one third of the support attributed to nuclear energy research, and with the tendency from FP4 to FP6 to decrease from around 34% to 29%.

D. Conclusions

On the use of scientometric analyses

Scientometric indicators can provide useful tools for the analysis of research priorities by civil society. But there is a lack of public and open access databases. The non public character of scientific databases (ex. access via payment) renders difficult the access to data, and therefore the carrying out of bibliometric analyses. Moreover, the level of expertise necessary to conduct such analyses demands a high investment. It would be worth **developing research partnerships between CSOs and research institutes** specialised in this type of analysis (such as the OST in France) to **further develop scientometric tools relevant for civil society**, and to make the analysis of emerging research domains of particular interest to civil society a routine activity of such institutions.

From the scientometric and budget analyses

On agriculture

Organic products may only represent a small fraction of the market for now (around 5%), but it is rapidly growing and the European demand for organic products is already largely superior to what Europe is able to supply. Besides, organic agriculture has proven environmental benefits. On the other hand, not only is the specific demand for agri-biotech products (such as genetically modified organisms) by farmers and citizens very limited, but there is a strong and steady consumers opposition all across Europe. Several Member States have banned the cultivation of genetically modified maize (up to recently - before the authorisation of the Amflora potato from BASF - the only genetically modified crop allowed to be grown in the EU) on their territory. EU research priorities on agriculture therefore seem to reflect the interests of a few industrial players and scientific institutions rather than European citizens' views.

The results from the budget and scientometric analysis prove that at the national level, there are huge discrepancies in the support to research on organic farming between different European countries. If, on average, research on organic farming is more of a priority in European countries than in the rest of the world, this is mostly due to the efforts of smaller countries, such as Denmark. The largest countries, with the largest agricultural production capacity, do not prioritise the development of research on organic farming, even though it could also benefit other types of agriculture. The case of France is of particular concern. "Given the current problems such as food security, the unsustainable exploitation of natural resources, land degradation and biodiversity loss and climate change, International experts call for a change of strategy: it is about to move towards a truly sustainable science, an agriculture respecting nature and valorising not only technological knowledge but also knowledge of farmers. Under the impetus of these recommendations, it is undoubtedly urgent to examine the potential of organic agriculture in a perspective of sustainability and autonomy, especially toward energy consuming inputs."[18]

Thus, given the ecological, energetic and economic challenges faced by agriculture in the 21st century, it appears that the effort on organic farming research in a region like the EU is still insufficient. The necessity of important changes in the priorities of agricultural research globally in favour of organic farming were highlighted in the report of the IAASTD from April 2008. This international panel of scientists called for a re-orientation of agriculture around local knowledge, so as to allow a majority of regions to become again self-sufficient in terms of food production. The report also recommends the development of agro-ecology and organic farming to reduce poverty, improve food security and the environmental sustainability of agriculture.

---

18 Niggli, Urs, *Comment les recherches en agriculture biologique peuvent contribuer à répondre à des enjeux agricoles et environnementaux contemporains ?* Colloque DinABio, Montpellier, France, May 2008 (traduction CN)

The co-production of knowledge between farmers and researchers, through participatory research mechanisms, could be a good way to foster the development of organic farming. But, in the present state, such research would be unlikely to have an impact of such bibliometrical indicators.

On ecotoxicology

In regard to ecotoxicology, globally there are significant discrepancies in the distribution of scientometric values, as several countries can have one of the best Priority indexes for ecotoxicology within a sub-discipline, as well as one the worst in another sub-discipline, Portugal and Italy being the most relevant examples of these discrepancies. A first and easy explanation can be that trends can be different in different countries, due to the way research institutions are organised. The results may also illustrate the case of a discipline which has not yet found a stable place in the research landscape. Nevertheless, the results of this study show that inside EU27, leading countries in research in general do not play a leading role in ecotoxicology, a research domain which should be of utmost importance according to many CSOs, given the increased role which is attributed to pollutants in the occurrence of cancers and other pathologies.

On participatory research

Participatory research is marginal. However, it is particularly present in research domains linked to sustainable development such as environmental sciences, ecological economics, ecology, multidisciplinary agriculture, public, environmental and occupational health and health care. EU Research Framework Programmes have the merit of being leaders in promoting this type of research and in opening possibilities for CSOs to participate to research projects, in comparison to most national research policies in Europe. But even if FP7 integrated a new financial scheme to facilitate partnerships between research organisations and civil society organisations that is also open to CSOs ((Research for the Benefit of specific groups - BSG-CSO), the use of this instrument is still rare, and its use should be mainstreamed and adapted to CSOs' needs. Most Member States still have to develop the same type of innovative activities that the EU "Science in Society" programme initiated, at a modest level.

On energy

At the EU level, since FP4 support for research on renewable energies has been only around one third of the financial resources dedicated to research on nuclear energy. This is mainly due to historical reasons and to the Euratom Treaty, that earmarks more than half of the money available for energy research to nuclear energy. The historical context that has led to the adoption of the Euratom Treaty in 1957 has changed, and the challenges of the XXIst century are different from the challenges the world faced in the 1950s. Whether nuclear energy should continue to enjoy such a high level of funding through public money should at least be debated.

In general

There seems to be a shift from FP5 via FP6 to FP7 with respect to the importance that is given to competitiveness and business in European research and technological development. Research in Europe seems more and more focused on supporting high technological innovation and competitiveness of enterprises. This pervasive objective offers a very narrow framing of the role of public funded research. The narratives that underpin EU Research Framework Programmes should probably reflect more the diversity of aspirations and hopes in society – as well as in the scientific community.

Sustainable development is fully integrated in the language used in Research Framework Programmes, but essential domains of sustainable development such as renewable energies and organic agriculture have not been prioritised enough. There are contending accounts of what sustainable development means and implies in terms of action, and the visions of sustainable development conveyed by civil society do not appear very well reflected in FPs, despite the pervasive use of the term. It would be useful to develop indicators and other tools to ensure that the views of civil society are better reflected in EU research agendas.