ADVISORY GROUP

FP7 – THEME 2
“Food, Agriculture and Fisheries, and Biotechnology”

Brussels, 10 June 2009

MEETING REPORT

Introduction and Background

This was the 8th meeting of the FP7 Advisory Group (AG) for Theme 2, “Food, Agriculture and Fisheries, and Biotechnology”. It was the second time the AG met after a 50% turnover of its members that has taken place last year, the first time being on 24-25 November 2008. The meeting was attended by 18 out of the total 27 AG members.¹

The agenda of this AG8 meeting was structured around two strategic topics for the European “Knowledge-Based Bio-Economy” (KBBE) research, as identified in the previous AG meeting (AG7), i.e.

-Bio-Waste, and
-International Cooperation.

By its timing, AG8 could generate vital inputs to the AG’s mission of providing advice to the European Commission, specifically with respect to the preparation of the 2011 Work Programme (WP2011) of this FP7 Theme. In particular, we can distinguish three sources of AG’s potential recommendations:

- The main points of the AG’s feedback on the KBBE Reflection Paper, tabled at AG7 meeting, as summarised in the respective Meeting Report;

- The results of the recent KBBE Call-for-Proposals (Call 3), as presented in AG8 by the responsible Commission services; and

- The material of the 16 contributions on the two strategic topics addressed in the meeting (see Table 1), and the fertile debates that followed them.

¹ This level of attendance can be partly explained by the focus of the discussions at the July 2009 meeting on two specific topics, as agreed after the November 2008 AG meeting. On the other hand, as shown by the large number of presentations (see the following Table), the participants of the 8th AG meeting were characterized by a high degree of active involvement.
Table 1: Number of structured presentations in AG8

<table>
<thead>
<tr>
<th>Strategic Topic</th>
<th>EC</th>
<th>AG</th>
<th>Total</th>
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<tbody>
<tr>
<td>Bio-Waste</td>
<td>3</td>
<td>6*</td>
<td>9</td>
</tr>
<tr>
<td>International Cooperation</td>
<td>3</td>
<td>4*</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>6</td>
<td>10</td>
<td>16</td>
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* Including the ones by the AG Chair and Vice-Chair.

The present report is based on the presentations and discussions during the meeting, and incorporates some relevant written comments submitted by AG members after the meeting. The following report parts correspond to the main sources for AG’s advice, as defined above, followed by the resulting AG recommendations. As for the reporting style employed in this document, the AG Chairpersons who put it together have decided to act as creative Rapporteurs, focusing on the essential and potentially useful to the AG work elements that came up during the whole-day meeting.

Main Critical Points from Prior AG Work

During the November 2008 meeting, several AG members expressed a number of critical remarks on the KBBE research activities and plans, as included in the Reflection Paper material tabled at the particular meeting. The main points of such feedback are the following (see the AG7 Meeting Report, pp. 3 and 6):

- KBBE research should be more closely linked to that within other EU-funded RTD fields, which are related to the KBBE objectives, such as the environment, energy and health ones;
- Social and economic aspects are not well represented;
- (Eco)systems thinking should be enhanced, especially with respect to better understanding of complex, crisis-like phenomena, as well as sustainability considerations;
- The need for an interdisciplinary approach in some mainlines must be made more clear;
• Certain strategic research topics and aspects were found to deserve a closed examination (e.g., in the AG8 agenda); major examples given include (a) bio-waste as a biomass resource, and (b) a more strategic view of international collaboration (linked to growth economics); and finally,

• More emphasis is needed on the targeted development of appropriate tools, especially in fast growing fields like bio-informatics.

The above list, which was presented at the start of the meeting by the Chair, will serve as the frame for the formulation of the AG8 recommendations.

Results of the KBBE Call 3

Based on the detailed presentation of the Call 3 results by the Commission services, the Advisory Group has noted the significant increase of the proposal success rate, compared to previous Call levels; the figures show an overall average of 15% (or 1 proposal selected from 7 submitted), which becomes 18% for the Member States (i.e., 1 proposal selected from 6 submitted). This indicator reflects a better “fit” between the research “supply” and “demand” forces.

On the negative side, the AG is concerned with the fact that 6 topics out of the total 70 of the Call (i.e., 9% or 1 out of 11) could not be finally covered by successful proposals. Taking a closer look at their titles:

- globalization, and sustainable aquaculture in Area 2.1,
- sustainable eating, and prospects for novel foods in Area 2.2,
- nano-biotech, and abiotic stress tolerance biotech in Area 2.3,

We observe that almost all of them refer to more strategic, “softer” and “horizontal” aspects of the KBBE agenda, such as those listed above as part of the AG feedback. This can be considered as an indication of a potential RTD supply/demand “misfit” and/or of a particular communication weakness. This is also a warning of similar risks threatening the incorporation of some of the above suggested by the AG elements into WP2011.

An obvious possible solution is that of the integration of such “horizontal” elements (e.g. socio-economic acceptance) into the usual, “vertical” research topics (e.g., novel foods), rather than their presentation as separate research mainlines.
The approach of the AG8 meeting towards each strategic topic followed the very first of the AG critical points listed above. In the case of Bio-Waste, representatives of the EC’s Environment and Energy Directorates of DG Research were invited to present how the topic is placed within their respective activities.

In the framework of *environmental research*, bio-waste is typically part of the solid (and sometimes liquid) waste categories. This field is increasingly dominated by Life Cycle (LC) thinking, in conjunction with a zero-waste vision, and not the least by the vision of generating higher value products from what was earlier recognized as a waste. These trends are accompanied by a shift from disposal/cleanup to prevention, and from research on waste-treatment processes to that on decision-support tools and various “maps”. As far as science and technology are concerned, the identification of critical knowledge “gaps” opens the way to novel opportunities, linked with

- high value-added, waste-derived products;
- sustainable solutions; and
- integrated systems and networks.
Bio-, info- and nano-tools are being considered for the development of joint solutions on such, fast-growing interfaces, a key example being biorefineries (see the recent Joint Call).

In the framework of energy research, bio-waste is just another type of potentially available biomass feedstock, required for the EU to meet its strategic energy goals, as far as renewables, specifically bioenergy. Specifically, for biomass to satisfy the 2020 EU energy targets, an additional 100 Mtoe/year of bioenergy, including 35 Mtoe/year of transport biofuels, should be generated, thus representing a huge pressure on bioresources. Bio-wastes of all kinds constitute a large reservoir of bio-organic matter, which has to be “unlocked” for energy and higher value-added uses, thus substituting fossil resources, by appropriate technologies; this is especially the case of lignocellulosic biomass (crop, forest, agro-food and other bio-wastes), where the development of biological solutions is long overdue.

The strategic dimensions of such a biowaste-to-energy pathway, where KBBE has a key role to play, reveal a new emerging RTD landscape, including

- mapping of the potential and its availability;
- optimizing the technical quality of feedstocks (standards);
- maximizing economic efficiency, as well as socio-economic value;
- covering sustainability aspects, among which security of supply, as well as soil fertility;
- managing and governing complex, multi-actor systems.

From the presentation of the biowaste-related activities within the FP7’s Theme 2, it is clear that the 15 projects surveyed cover only the “tip” of the iceberg of the challenges and opportunities illustrated by the other research fields. The problem is not so much that “bio-waste” as such is not explicitly on the KBBE agenda (this is also the case of energy research). It is that, quantitatively, the waste-related activities are rather minimal (1-2% of the Theme’s budget), and that qualitatively these projects follow an approach focusing on just a few of the several emerging opportunities, i.e., re-use/recycle in the primary production and the food areas, and feedstock utilization on the nonfood biotech area.

At the same time, the risks from an EU’s delay in developing biological tools, solutions and systems for energy, industry and the environment are high; what is at stake here is the future of European food industries, rural areas and green industries, as well as EU’s S&T leadership. Is there a way out?
A number of contributions by AG members have indicated some significant possibilities, as well as some potential “traps”. What follows is a tentative synthesis:

- **AGRO-ECOSYSTEMS**: Integrated biomass/waste management could be based upon a new set of bio-tools and solutions putting together knowledge from various fields; examples include modeling of soil systems as large bioreactors; managing natural (N, P, C) cycles as huge recycles; developing biomimetic tools for complex ecological functions.

- **FOOD CHAINS**: They represent a highly strategic type of bio-system, characterized by a logistically wasteful operation: more than 50% of the potential food value end-up as wastes at various stages; at the same time, their energy, water- and nutrients-using efficiency is very low; on the other hand, drawing-up a research agenda needs new tools, e.g., foresight.

- **AQUATIC SYSTEMS**: Their high versatility and adaptability makes them an ideal field for fast experimentation with integrated waste-to-bioproducts systems; a synergy of novel and traditional algae-cum-plants/animals symbiotic bio-communities could lead us away from present monocultures, thus providing models for various terrestrial applications.

- **INTEGRATING & COORDINATING RESEARCH**: RTD on adding value to a bio-waste has to be closely linked with the specific waste’s origins, process/use economics, existing policies and regulations, even the language and terminology employed; thus, new biowaste-related research topics in the KBBE agenda can be
  - Either integrated with other suitable topics within the same Theme, e.g., targeting the development of a zero-waste biomass-to-fuel bioprocess;
  - Or become the subject of coordinated and/or cross-thematic Calls as, e.g., in the recent biorefinery one or in a future “War-on-Hunger” one, including food waste minimization.

**International Cooperation**

The framework for this part of the meeting discussions was provided by the presentation from the International Cooperation Directorate of DG Research. International Cooperation is a key component of the 2020 European Research
Area (ERA) vision; with respect to this, AG members were truly impressed with the steep rise in international activities having taken place during the last years of FP7’s implementation. The global dimension of present challenges, the need to put together RTD expertise to meet them, worldwide competition for skilled human potential, the high cost of required infrastructures, and the need to coordinate efforts are some of the reasons behind such a strategic role.

Another key aspect of international research cooperation is its multi-dimensional nature that goes way beyond joint RTD projects. Other significant dimensions include researchers’ careers and their training, IP issues, use of infrastructures, business-research-academia partnerships, as well as formulating RTD priorities and other policy issues. Such complexity is reflected on the large number of tools and instruments that can be employed to manage it, including Task Forces, Forums, SICAs, in addition to Targeted and Coordinated Calls.

The presentation of the international cooperation activities within FP7’s Theme 2 confirms the fact that its major thematic nuclei - i.e., agriculture, food and biotechnologies - represent strategic priority issues for most emerging and transitional economies around the globe. In particular, the whole world presently faces a number of Bioeconomy-related, socio-economic challenges that can be met with appropriate joint RTD schemes; such bio-challenges include

- Sustainability,
- Food quantity and quality,
- Food- and feed-related disorders,
- Animal diseases,
- Renewable energies and “green” chemistry.

It is, therefore, no surprise that the whole KBBE Theme activities are open to international cooperation. Participation of third countries and other non-Member States is favoured by a number of specific thematic dialogues, through

- Bilateral cooperation schemes (with 16 countries),
- Bilateral working groups and task forces (6 mentioned), and
- Bi-regional agreements (with 4 regions).

The results from a number of targeted calls (where the participation of third countries is encouraged), SICAs (where such participation is mandatory), and other programme modalities have been very positive, as far as response and participation. Thus, in the period 2007-2008, 124 international cooperation KBBE projects have been selected (15% success rate), with 194 participants – 49 from third countries - and a total budget of 405 M Euro. These figures are expected to further improve after the 2009 data are taken into consideration.

The examination of the trends and dynamics of this type of cooperation reveals an emerging “landscape” generated by several interesting shifts of strategic RTD policy relevance:

<table>
<thead>
<tr>
<th>International Cooperation: The Emerging KBBE Landscape</th>
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<tr>
<td><strong>GOALS &amp; ISSUES:</strong></td>
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<tr>
<td>o Bilateral → Multilateral</td>
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<tr>
<td>o Local → Regional</td>
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<tr>
<td>o Partner Networks → Synergies</td>
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<tr>
<td><strong>TOOLS &amp; APPROACHES:</strong></td>
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<tr>
<td>o Episodes → Systems</td>
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<tr>
<td>o Open/Targeted projects → New Instruments</td>
</tr>
<tr>
<td>o Project-based → Programme-based</td>
</tr>
<tr>
<td><strong>RESEARCH AGENDAS:</strong></td>
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<tr>
<td>o Fragmented → KBBE</td>
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<tr>
<td>o Joint RTD → Dissemination &amp; training</td>
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<td>o Building upon successes → Forward looking</td>
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</table>
A number of presentations by AG members illustrated this tentative mapping with the help of specific examples of challenges and opportunities for international cooperation within Theme 2 activities:

- **GENOMIC TOOLS:** The increasing demand for sustainable breeding creates a need for the development of appropriate bio-informatic tools; international cooperation in this case is well justified by the global interest, the fragmentation of funding, the high level of science required, and the lack of institutional arrangements, e.g., in academic curricula.

- **AQUACULTURE:** The scope for international cooperation in this field results from the significance of the global trade of fish - of the order of 30 billion USD, with Europe dependent upon imports for its fish proteins; the challenges for joint development of biological solutions include issues of market, the environment, health, sustainability, climatic and other risks; EU-Asian bilateral and regional schemes, especially through bottom-up initiatives, are of particular importance.

- **THE EU-US TASK FORCE:** This mega-example of international cooperation in the area of biotechnology research could serve as a good model and inspiration for new, large-scale collaborative schemes; its unique characteristics include a future-oriented agenda, focus on good science, cross disciplinarity, multi-instrument action (conferences, workshops, fellowships, exchanges, position papers, short courses), all based on the adoption of a broad definition for biotechnology as a “set of tools.”

In its recent communication\(^2\) to the European Council and the European Parliament, the European Commission presents the main ideas for “A Strategic European Framework for International Science and Technology Cooperation.” This document makes strong reference to Information Technologies, as well as the Information Society, which in a way serve as the models for the strategic actions proposed therein. Based on the above analysis, we can expect in a future strategic document on the same subject Life Sciences and Technologies, as well as the Bio-Economy, to occupy a more significant position, as they really deserve.

Overall, the discussions in the AG gave a strong indication that KBBE (Theme 2) is a highly relevant and central topic for EU’s FP internationalisation activities. It is, therefore, very important for the Commission to keep a strategic approach in this field. International collaborative efforts within the highly

heterogeneous economic growth- and trade-related areas require a differentiated set of instruments and calls, depending on the countries targeted.

In particular, the global status of KBBE makes it essential to distinguish between the following types of collaborative actions:

- Collaborative efforts with growth economies, where not only European academia but also European industries must be involved to ensure that relevant new knowledge will benefit the commercial sectors of both the emerging economy countries and the EU Member States;
- Collaborative efforts with developing countries, where the scientific social responsibility (SSR), makes it essential that we make our utmost efforts to ensure that new knowledge and experiences will be shared with developing countries, whenever relevant for those countries to develop in a sustainable way;
- Collaborative efforts with other industrialized countries, like the US and Japan, where it is essential that Europe avoids marginalisation, e.g., by unilateral exchange of talent; in these cases, cooperation should be based on mutually benefiting exchange and other programmes, and protection of rights, based on principles, and offering possibilities for win/win solutions.

Recommendations for WP2011

A small *ad hoc* Working Group was formed during the AG8 meeting with the purpose of drafting a short text to be used as AG input to Work Program 2011, specifically covering the topic of bio-waste (side streams/residues - terminology to be adjusted). The AG Vice-Chair was asked to lead this group work.

The following text, which was based on the AG8 presentations, circulated documents and discussions, was drafted by the Bio-Waste Working Group, and represents a preliminary form of the AG recommendation. It is included in this Meeting Report in order to circulate among all AG members and the responsible Commission services before it obtains its final form.

“BioWaste – to –Value”: Proposal for a Cross Thematic Call

**Background:** Research on biomass conversion has moved its focus from 1\textsuperscript{st} generation bioenergy, using the starch from the cereal kernels, to 2\textsuperscript{nd} generation bioenergy, based on lignocellulosic crop residues. Now the time is
right to move on to a more holistic approach with relation to both the feedstocks brought in use, and the products to be recovered and produced from biological materials: “From waste to value” – in a truly sustainable manner.

Among the potentially valuable bio-feedstocks, we find a wide variety of crop, forest-, bio- and organic residues, various agro-industrial and wood-processing side streams, algal biomass, municipal solid wastes, post-harvest crop losses, and sewage sludge. The spectrum of products to be produced goes far beyond bioenergy. It includes, e.g., biochemicals (providing building blocks to a new, non-fossil-based chemical industry), biofertilisers, biomaterials, nutraceuticals, food and feed ingredients etc.

The truly sustainable thinking required needs a more holistic approach, including socio-economic parameters, timely recovery of precious and endangered resources (such as, e.g., phosphorous and potassium), and balanced land use, allowing for production of sufficient food and feed, as well as conservation of natural habitats, flora and fauna (biodiversity protection). Such a holistic approach should include life-cycle and sustainability assessments, covering social values, as well as biomass process, supply chain, and system optimisation activities.

**FP7 Rationale:** This Bio-Waste topic calls for collaboration between at least three FP7 Themes, i.e., KBBE, Energy and the Environment. A joint meeting between the respective AGs is, therefore, highly recommended. WP2010 has already forcefully initiated the visionary use of cross thematic Calls. This AG recommendation is that the new “From Bio-Waste to Societal Value” activity should be considered implemented as a cross-disciplinary and cross-thematic Call for proposals. FP duplications should, of course, be avoided, nevertheless, it seems like this area has not been really covered before, since

- The Energy research programme has had a prime focus on new technologies for production of renewable energy, not on expanding the feedstocks brought in use;
- The Environment research program has been focusing on protecting the environment, avoiding pollution, and dedicated recycling of valuable resources;
- Further, most of the Agricultural work program in this area has focused on crop residues; not on the other side streams and bio-feedstocks mentioned above.
The closest initiative to the proposed one has been within the Biorefinery Joint Calls, and not the least in the Lead Market Initiative on bio-products. It is to be noted that, still, no programme activity has included an incentive in its Calls in order to create drivers for moving up the value chain, by producing more high value products than energy. Furthermore, so far no specific emphasis has been put on the development of the required sustainable technologies, e.g., using biocatalysis or new, combined chemical and biological methods. No specific focus either has been on the recovery of P and K from the residual plant biomass; and hardly any specific research focus on how to ensure that we will not degrade the manifold soil functions, e.g., soil fertility and greenhouse gas conversion, for future generations by removing and/or over-using biomass.

**Research Examples:** The following list of RTD topics illustrates the broad spectrum of potential activities that could supported through the proposed Joint Call:

- Higher value products from bio-waste, bio-residues and industrial side streams;
- Biomass conversion processes for the utilisation of under-exploited bioresources in side streams and wastes;
- Biochemical building blocks from biomass in waste and side streams;
- Bio-hydrolysis to obtain high-value products, e.g., amino acids from plant and animal wastes;
- Use of bio-wastes and side streams as substrates for biorefineries, producing higher value products, such as, e.g., plant-based platform chemicals or polymers, biofuel-based chemicals, food ingredients or nutraceuticals;
- Stabilised carbon from organic wastes as a source of soil carbon in semi-arid and arid areas, in order to enhance soil productivity and greenhouse-gases mitigation capacity (soli as a carbon sink);
- Better use of bio-industrial raw materials, through the upgrade of side streams and waste streams;
- By-by-products: Solutions for new wastes – to take care of the secondary wastes, e.g., by their conversion to energy vectors, e.g., biogas;
- Putting together integrated agri- and aquaculture systems, where waste streams from one sub-system become valuable input to the other;
- Minimising the waste in food processing, including the entire food and feed value chain;
- New methods for the recovery of P and K from biomass conversion processes; monitoring and maintaining soil fertility;
- Life-cycle analysis, greenhouse gas balances, sustainability assessment and other methodologies oriented towards the above subjects.

**Suggested Instrument:** Cross Thematic Call, with emphasis on the following characteristics:

- Call text broad enough to allow for several projects to be granted, asking for medium-sized projects;
- Cross disciplinary approach, with integration of social and economic aspects;
- Targeted involvement of industrial partners, including the relevant established industries, SMEs, and new starts-ups;
- Welcoming international cooperation partners from both the growth economies, e.g., the BRIC countries, and the developing countries
Bio-Informatics in the KBBE: Conclusions from a Workshop

On 11 June 2009, an ad hoc Workshop took place in Brussels, organised by the Biotechnologies Unit of the KBBE Directorate (Dir. E, “Biotechnology, Agriculture and Food”, of the EC’s DG Research), under the title: “Bioinformatics sustaining biotechnology research: Where do we focus?”

According to its organisers, the aim of the meeting was to identify key scientific and technological challenges for bioinformatics in the field of biotechnology, and provide clear insights into those areas that are ripe for European collaborative effort. During the whole-day meeting, seven invited experts presented and discussed their views, experiences and other responses to the question of the workshop title.

As the topic and scope of the event are closely linked to the work of this AG, the meeting was open to the AG members (two attended). In addition, the workshop was chaired by the AG Chairperson, who formulated and presented a number of concluding remarks summarising the meeting outcome from the point of view of the KBBE Advisory Group. It was agreed that these conclusions will form an Annex to the AG8 report, which will circulate among all AG members for their information and approval:

(a) The field of bioinformatics – broadly defined by the digitalisation of biological information and its various applications in a digital form – is presently experiencing a major strategic shift, i.e., from Computational Biology to Bio/Eco-Systems Informatics.

(b) The emergence of this new phase generates a set of challenges for research, mainly due to the much higher complexity of both the biological information required for biotechnological systems modelling, and the socio-economic and environmental conditions for the operation of such systems.

(c) Specific, research-related points illustrating the changing bio-info landscape include:

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3 For more details, see the document “Guiding questions for the Meeting”, which was prepared by the Workshop organisers and distributed to its participants.

4 See, e.g., above – p. 3, second bullet from the top.
The emphasis on the design of sustainable bio-systems by appropriate bio-info tools;

The need for databases (DB) containing information on systems rather than molecules, with new DB management tasks (updates, standards etc.);

The demand for increased explanatory and predictive capacities, as well as “navigating” power of the new bio-info tools, to enhance the complexity-management efforts of policy makers, industries and other users;

The importance of the area of environmental biotechnologies for the development of the new breed of bio-info tools; microbial ecology seems to be a strategic sector for bio-info RTD action (see, e.g. its key role in understanding and optimising biodegradation);

Two types of bio-info tools can be distinguished, i.e., those integrated with the particular biotech application, and those available for a spectrum of potential uses; in both cases, early and active involvement of the industrial and other users in the development stage is critical for success.

(d) The European value of collaborative action in the above tentatively mapped bio-info RTD territory is well justified by the strategic significance of the issues concerned; in a nutshell, the bio-info synergies will be instrumental for the deployment of the European KBBE.

(e) A simple and practical recommendation: all biotechnological projects which are to be funded within FP8 should be required to include a bioinformatic component at any point of their research plan they see fit; this idea could be tested in FP7 in a priority area, e.g., bioremediation or biodiversity.