Co-operative Research
on Environmental Problems
in Europe (CREPE)

Agricultural Innovation: Sustaining What Agriculture? For What European Bio-Economy?

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Summary

Nowadays most innovations are promoted under the banner of 'sustainable development', but there are different accounts of what is to be sustained. Likewise sustainable agriculture has different accounts, so it has become an ambiguous concept – even a contentious one. Its diverse meanings were explored by a project, 'Co-operative Research on Environmental Problems in Europe' (CREPE), in which civil society organisations led studies in cooperation with other CSOs and academic researchers. These studies analysed different accounts of sustainable agriculture and proposals for remedies.

As a policy framework for sustainable development, the Europe 2020 strategy promotes resource-efficient technologies and market incentives, thus attributing sustainability problems to inefficiency. However, this prevalent diagnosis has been contradicted by experience: through a rebound effect, efficient techno-fixes have often increased overall demand on resources. EU policy expects greater efficiency to help conserve water, yet more efficient irrigation techniques have increased financial incentives to expand cultivation and thus water usage in southeastern Spain. Likewise EU policy expects that future novel biofuels will help avoid the resource conflicts over current biofuels, yet these conflicts arise fundamentally from a drive to supply growing global markets. Market-competitive pressures on natural resources cannot be alleviated by efficient techno-fixes.

As a policy framework for reshaping agriculture, the Knowledge-Based Bio-Economy (KBBE) links sustainability, renewable resources, economic competitiveness, research priorities and technological innovation. The KBBE has been defined as 'the sustainable, eco-efficient transformation of renewable biological resources into health, food, energy and other industrial products'. Broadening the scope of agriculture, this concept also encompasses diverse diagnoses of unsustainable agriculture and eco-efficient remedies. In the dominant account, agriculture becomes a biomass factory supplying raw materials for diverse industrial products. In agroecological accounts, by contrast, agricultural methods incorporate and enhance farmers' knowledge of natural resources, as a basis for them to gain from the value that they add.

For the latter account, remedies include enhancing biodiversity in crops and cultivation methods through agroecological knowledge. This has been developed via cooperative exchanges among farmers, sometimes also with professional researchers. However, such cooperation faces many barriers, for example: there are cultural differences among potential participants; and research institutions give priority to complex, expensive and commercialisable science. So knowledge mediators have an important role in helping to overcome these barriers.

Beyond the formal research system, Agricultural Knowledge Systems (AKS) link many knowledges relevant to sustainable agriculture and a bio-economy. Shorter agro-food chains have supplied local, organic and/or higher-quality food to more consumers. Bringing them closer to producers also builds knowledge of agro--ecological cultivation methods and consumer support for them. In Brittany, a context dominated by agro-industrial methods, some farmers have rapidly developed short food chains in the past decade. These new markets have given farmers incentives for methods reducing their energy inputs – initially for cost reduction, and later for environmental care. Already available, such methods could be implemented rapidly and at low cost; the main obstacles seem to be farmers' and institutional mindsets.

In the above initiatives, citizen networks become experimental co-creators of knowledge. As forms of social innovation, these practices create participatory, cooperative arenas where people are empowered and create alternatives to the dominant agenda. The CREPE project has illuminated and facilitated such practices, especially by helping civil society organisations (CSOs) to extend their stakeholder and expert networks.

In exploring divergent accounts of innovation for sustainable agriculture and a bio-economy, the project shows how each one uses similar key terms according to its different vision of the future (see Table 1). Such divergences arise in many policy issues – e.g., agricultural research priorities, the post-2013 CAP, territorial development, a low-carbon economy, intellectual property and science education. Different visions contend for influence over European futures. The divergence highlights societal choices, whose legitimacy will depend on citizens shaping the future. Some choices have been highlighted by the CREPE project – itself a social experiment in research cooperation.

Background to the project

CREPE project: aims

This report draws on results of the CREPE project, which had the following aims:

- Capacities: To strengthen the capacity of civil society organisations (CSOs) to participate in research, while engaging with diverse perspectives and expertise – thus facilitating co-operation between researchers and non-researchers, as well as between academics and CSOs.
- Co-operative research methods: To design and test the methods used for co-operative research with CSOs, as a basis to inform future efforts in research cooperation.
- Sustainability: To analyse how diverse accounts of sustainability arise in agri-production systems (including accounts of environment, innovation and alternatives).
- Priority-setting: To relate research more closely to societal needs, as a means to inform policy debate and research priorities for Europe as a 'Knowledge-Based Bio-Economy'.
- Solutions: To suggest alternative solutions related to different understandings of societal problems, agri--environmental issues and sustainable development.

Summaries from each partner's study can be found in the Annexes and are cited in the overview.

Cooperative processes are summarized in the final Annex.

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Agricultural Innovation: Sustaining What European Bio-Economy?

Introduction

Nowadays most innovations are promoted under the banner of 'sustainable development', a term which pervades government policy frameworks and corporate mission statements. Of course, there are different accounts of what is to be sustained – e.g. current production patterns, economic growth, livelihoods, ecosystem services, natural resources, communities, etc. Each of those terms can have diverse meanings. Tensions between social, economic, and environmental sustainability are widely acknowledged, but multiple interpretations of each pillar generate deeper tensions.

Likewise sustainable agriculture has different accounts. Each promotes specific remedies as desirable, or even as necessary to avoid various threats and use opportunities. Consequently, sustainable agriculture has become an ambiguous concept – even a contentious one.

Innovation has become a widespread concept for imagining, promoting and shaping sustainable agriculture. Any innovation pathway involves specific narratives and visions of a better future, especially as the EU is rebranded as an 'Innovation Union'. Identifying diverse pathways can help to open up debate about societal futures and choices. To do so, this report addresses the following questions in the EU context:

- What are various accounts of un/sustainable agriculture, innovative remedies and research priorities? What is to be sustained?
- How do these accounts relate to societal needs?
- What are various accounts of a Knowledge-Based Bio-Economy?
  How are specific futures being promoted as feasible and necessary for Europe?
- What accounts dominate research agendas and other relevant policies?
  What alternatives warrant support?

To answer the above questions, this report draws on an FP7 project, Co-operative Research on Environmental Problems in Europe (CREPE), in which civil society organisations led studies in cooperation with other CSOs and academic researchers (see Annex VII). As a social experiment in research cooperation, the project facilitated a learning process for researchers and practitioners dealing with issues of sustainable agriculture. This learning process contributed to the analysis of policy frameworks and potential European futures.

This overview analyses documents from Europe-wide bodies, in particular: the European Commission, its expert advisors, European Technology Platforms, their precursors, their consortium (Becoteps), civil society organisations and expert advisors (e.g. SCAR foresight group). Their divergent accounts of sustainable agriculture are summarised in Table 1. The overview also cites examples from specific case studies, corresponding to Annexes, in turn summarising longer reports of the CREPE project at www.crepeweb.net

1 Un/sustainable agriculture: divergent diagnoses and remedies

Since the 1970s agro-industrial systems have been criticised for causing environmental harm, such as soil degradation, vulnerability to pests, greater dependence on agrochemicals, pollution run-off, genetic erosion and crop uniformity. Agriculture significantly contributes to greenhouse gas emissions, while climate change potentially destabilises agricultural systems, so this greater vulnerability is to be addressed through adaptation and resilience. These problems are diagnosed in various ways which inform research agendas.

Such agendas have been criticised by a report from the EU's Standing Committee on Agricultural Research (SCAR). Its expert group diagnosed a gap as follows:

> European agricultural research is currently *not delivering* the type of knowledge which is needed by end-users in rural communities as they embark on the transition to the rural knowledge-based bio-society. The problems are not exclusive to agricultural research but they are felt more acutely in this sector where the role of traditional, indigenous knowledge is already being undermined as a result of the growing disconnection with ongoing research activity (SCAR FEG, 2007: 11).

This disconnection has various diagnoses and remedies. From the dominant perspective, many farmers have failed to adopt technological innovation for more efficient production methods, which have attracted public suspicion or opposition, so these obstacles must be overcome. From agroecological perspectives, research agendas and monoculture systems have been devaluing farmers' knowledge; therefore research should draw upon and extend their knowledge of biodiversity – both as a substitute for external inputs and as a societal benefit.

Since the 1990s the Life Sciences have promised to make agriculture more sustainable through greater efficiency, e.g. genetically precise changes which could protect crops from external threats and increase their productivity. European protest led to commercial and regulatory blockages for such crops by the late 1990s, alongside controversy about their beneficent claims. Later the Life Sciences were relaunched as the Knowledge-Based Bio-Economy (KBBE). This was a semantic hybrid between the EU's knowledge-based economy and the OECD's bio-economy.

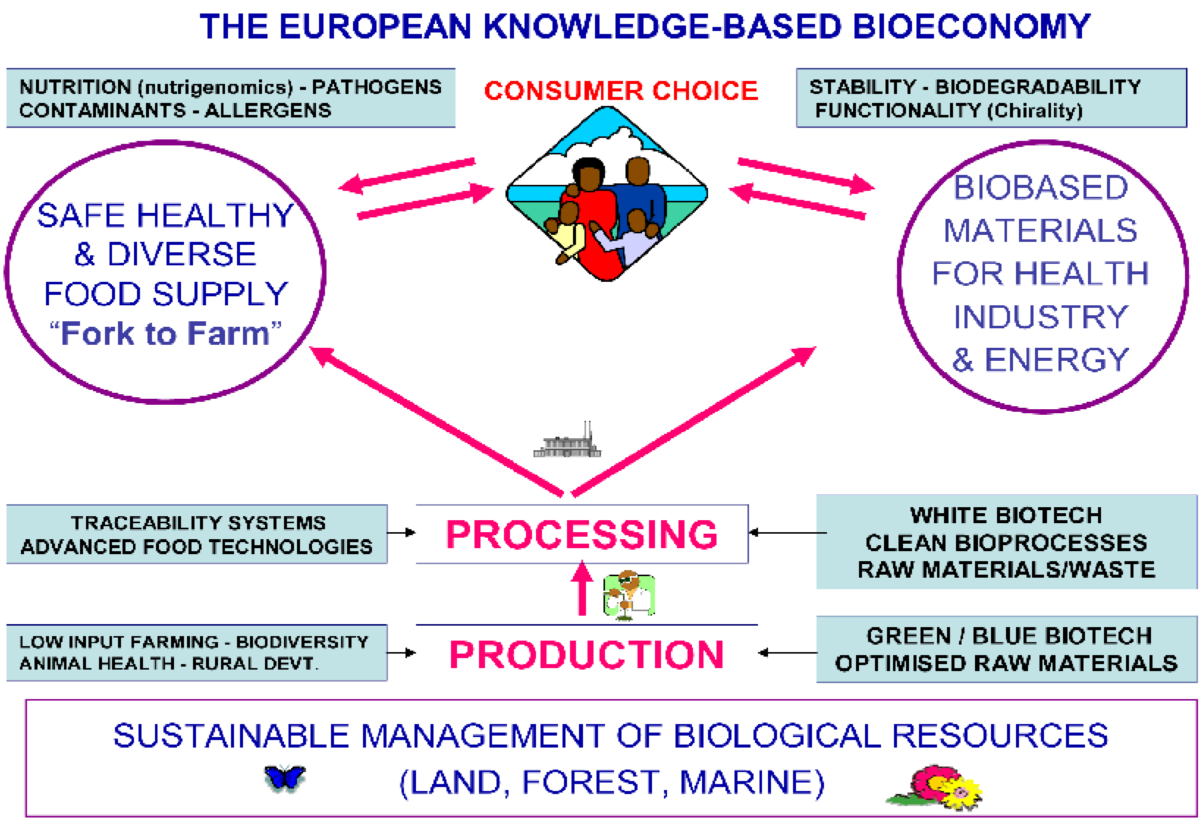
The KBBE has become a policy framework for reshaping future agriculture (DG Research, 2005a: 3). The concept links sustainability, renewable resources, economic competitiveness, research priorities and technological innovation. The KBBE has been defined as 'the sustainable, eco-efficient transformation of renewable biological resources into health, food, energy and other industrial products' (DG Research, 2006 and diagram below).

The KBBE concept encompasses diverse diagnoses of unsustainable agriculture – resource constraints and degradation, alongside competing demands for land use. Each diagnosis informs a different alternative to the current system. According to the Director-General of DG Agriculture, 'The pathway to follow to develop a bio-based economy is controversial. A broad discussion is needed about the best pathway to choose for the transition' (Benitez Salas, 2010).

In the dominant account, informed by Life Sciences, agriculture becomes a biomass factory. Here the KBBE is 'the sustainable production and conversion of biomass into various food, health, fibre and industrial products and energy', according to an industry consortium; such conversion 'is also sustainable, being efficient, producing little or no waste, and often using biological processing', according to a consortium of European Technology Platforms (Becoteps, 2011). Likewise agriculture must provide 'competitive raw materials' (Clever Consult, 2010). In this new vision, agriculture becomes raw materials which can be broken down into various components for further processing.

In a Life Sciences perspective, eco-efficiency is sought in novel inputs, outputs and processing methods, e.g. more efficient crops. Research seeks generic knowledge for identifying substances that can be extracted, decomposed and recomposed along value chains; from this baseline, more specific knowledge can be privatised. As an ideal of eco-efficiency, closed-loop recycling successively turns wastes into raw materials for the next stage. Agriculture becomes a biomass factory; residues become waste biomass for industrial processes. Novel crops are sought for enhancing soil fertility and thus productivity.

In an agro-ecological account, by contrast, eco-efficiency appropriates, enhances and/or integrates ecological processes. 'Organic farming is a highly knowledge-based



Credit: DG Research PPt presentation, 2006 form of agriculture involving both high tech and indigenous knowledges and is based on the farmer's aptitude for autonomous decision making' (Niggli et al, 2008: 34). Organic farming attempts to keep cycles as short and as closed as possible, as a means to use biodiverse resources more efficiently. These practices enhance resource efficiency by enhancing internal inputs as substitutes for external inputs, while also maximising outputs. Residues are seen as media for recycling nutrients via ecological processes and so replenishing soil fertility. Such methods have been linked by a novel concept, 'eco-functional intensification', i.e. intensifying ecological processes.

Such methods also provide a basis to shorten agro-food chains. Consumers learn to trust producers through a specific product identity, featuring overall qualities such as sustainable production methods and/or aesthetic attractions. Farmers' skills can add value and gain more income from the value that they add.

Resource constraints likewise are understood in divergent ways. In the dominant account, Europe must more efficiently use renewable resources, so that productivity increases overcome the constraints and thus continue economic growth via global value chains. In other accounts that emphasise relocalisation, Europe must relink production and consumption patterns in ways reducing external dependence on resources. This pathway offers opportunities for rural development by relocalising economic activity. According to the Director-General of DG Agriculture:

> As biomass is today the only renewable source of carbon, the transition to a bioeconomy will be at the same time a huge challenge and a tremendous chance for rural areas where the main genuine production potential lies. Since energy-intensive transport will become less affordable, local production and consumption cycles will be strengthened, adding value to and creating jobs in rural areas (Benitez Salas, 2010).

In such ways, each term of the KBBE concept – knowledge, biological resources and economy – is given different meanings. These illustrate divergent pathways for any 'transition to sustainable agriculture'.

2 Societal challenges: un/common visions

Sustainability problems are often formulated as 'societal challenges' – e.g. greater global demand for agricultural products, constraints on available resources to supply them, a continual decline in oil supplies, etc. Consequent tasks include sustainable management of natural resources, sustainable production, healthy food production, etc., according to a consortium of European Technology Platforms (Becoteps, 2011). These challenges are meant to elaborate 'common visions' and thus guide the search for common solutions.

Yet some visions turn out to be partial. Societal needs are readily conflated with commercial drivers, whereby agriculture supplies raw materials as feedstock for commodity markets. For example: 'Through the improvement of plants, the Bioeconomy can produce healthier, high-quality, sufficient, diverse, affordable raw material for the sustainable production of food and feed' (Becotops, 2010). Likewise 'improved know-how and use of plants can help address the key global challenges of underwriting sustainable food and renewable raw material production systems' (Plants for the Future TP, 2007: 3). A key challenge is 'sustainable feedstock production', so the post-2013 CAP must help 'to maintain a competitive supply of raw materials' (Clever Consult, 2010: 11).

In the dominant narrative, greater pressure on natural resources comes from global market demand. For example, 'the worldwide demand for feed will increase dramatically as a result of the growing demand for high-value animal protein' (Plants for the Future TP, 2007: 3). Somehow the increasing demand remains exogenous to the agro-industrial production system, which must accommodate the demand – sustainably, i.e. more efficiently through technological innovation. For example: ' In the coming decades, we anticipate the creation of more efficient plants (able to use water and fertiliser more efficiently and to be self-resistant to pests), leading to more efficient farms and new economic opportunities' (Plants for the Future TP, 2007: 5, 9).

Through greater efficiency, then, an expanding commodities market is meant to become more sustainable, while the agro-supply system can avoid responsibility for the greater demands on resources. Moreover, resource constraints must be turned into new commercial opportunities through efficiency improvements. Here sustainability means eco-efficient productivity through resources which are renewable, reproducible and therefore sustainable. This cornucopian narrative encourages political and financial investment in a techno-fix for sustainability (Birch et al., 2010).

Future market opportunities are anticipated as value chains, a concept which helps to mobilise new commercial partnerships. In the dominant vision, technological--industrial innovation must horizontally integrate the agriculture and energy sectors: 'the production of green energy will also face the exceptional challenge of global industrial restructuring in which the very different value chains of agricultural production and the biorefining industries must be merged with the value chains of the energy providers' (Plants for the Future TP, 2007: 33).

Greater efficiency demands subordination of agriculture to a biomass processing industry. An 'integrated diversified biorefinery' would use renewable resources more efficiently via more diverse inputs and outputs, which can be flexibly adjusted according to global market prices. Horizontal integration is being promoted through commercial linkages between novel crops, enzymes and processing methods. Converging technologies become essential tools for identifying and validating compositional characteristics of renewable raw materials.

This R&D agenda favours new knowledge that can be privatised. For addressing societal challenges, 'Knowledge and intellectual property will be critical...' (Plants for the Future TP, 2007a: 9). Biofuels innovation is seen as an extra opportunity for patents, e.g. from genomics techniques: 'The field is becoming increasingly competitive and industrial and academic players are teaming up in larger public-private consortia with ambitious yet focused research agendas and IP arrangements' (EC-US Task Force, 2009: 17-18).

In particular, the Lead Market Initiative for Bio-Based Products seeks substitutes for fossil-based products in order 'to create product cycles that are neutral in terms of greenhouse gas (GHG) and to leave a smaller ecological footprint' (CEC, 2007a). Such products offer many economic and environmental benefits, but Europe lags behind the US, so we must catch up quickly, according to the Commission's expert advisors (DG Enterprise, 2009: 9). To facilitate resource-efficient products, proponents advocate several policy changes – e.g. tax incentives, 'green' public procurement, more public-sector R&D funds, an EU-wide patent system, etc.

Such policies would effectively provide economic planning. Yet they 'do not intend to artificially create markets' (CEC, 2007b: 4), according to the dominant perspective. Favourable policies presumably liberate market forces from artificial constraints, such as regulatory barriers.

Biorefineries already process biomass into energy and co-products such as animal feed, so R&D seeks to generate more lucrative products which would make bioenergy more commercially viable. More diverse pathways have been proposed. Each has different research priorities, scale-up trajectories and ultimate value chains if successful. The necessary development is too costly and commercially risky for the private sector, which therefore requests enormous public funds to cover the risks, especially for biomass-to-liquid conversion (EBTP, 2010: 26). Regardless of technological improvements, this innovation priority cannot match the efficiency of converting biomass to heat and electricity – and so has aims other than efficiency.

3 Competing against whom?

As a key rationale to promote such innovation pathways, Europe faces the threat of global competition, alongside a search for greater competitiveness. An objective imperative gives us little choice: 'Europe must become fit for the bio-economy', we are told, or else Europe will lose the global competitive race and thus our future prosperity. A high-tech Social Darwinism positions Europe as a potential loser in a race to catch up with competitors (e.g. O'Mahony and van Ark, 2003; Aho, 2006).

This race demands institutional and policy changes, we are told. At the 2007 Cologne Summit the German Presidency declared, 'Europe has to take the right measures now and to allocate the appropriate resources to catch up and take a leading position in the race to the Knowledge-Based Bio-Economy' (EU Presidency, 2007: 6). According to the DG Research Commissioner,

> Today, Europe has a strong life sciences and biotechnology research base to support the development of a sustainable and smart Bio-Economy. It has a leading position in chemical and enzyme industries and a fast growing biotechnologies sector. However, a lot of work still needs to be done in order to fully exploit the potential of the sector today and ensure that Europe remains competitive tomorrow (Geoghegan-Quinn, 2010: 3).

Indeed, an emergency allows us little choice, 'As we emerge from crisis in the teeth of fierce global competition, we face an innovation emergency' (CEC, 2010c). Who is competing against whom? and partnering with whom in the race? Europe-based companies seek business partners from potentially anywhere for establishing new global value chains, especially via patents. As innovations make biorefineries more lucrative, commercial operators seek production sites and biomass from the most economically advantageous sources, thus throwing producers into greater competition.

There are rival priorities for value chains, research funding and support policies. European farmers have been promised new markets in the bio-economy, yet they face the prospect of simply supplying biomass, even competing with cheap imports. Some farmers' cooperatives seek innovations that would better use their skills, e.g. special cultivation methods, so that they can gain from adding value to industrial processes. If wood chips can be converted more efficiently to valuable products, then price rises could undermine traditional wood products. Likewise, if animal fats can be recycled more efficiently into energy, then European sources may be replaced by cheaper oils from Southeast Asia, resulting in extra greenhouse gas emissions there.

As a policy narrative, then, 'European competitiveness' conceals internal rivalries in a global integration process, while justifying policies which facilitate that process. Technological innovation has been central to such policies for a long time:

> The idea of 'competitive threat' (especially from East Asia and the USA) was central to developing a rationale for market liberalisation across the European Community and helped to fuel the case for both completing the single market and developing adjunct programmes such as technology policy (Rosamond, 2002: 161).

The dominant account also reinforces a linear model whereby research drives innovation. For example, the European Commission plans to launch European Innovation Partnerships to speed up the development of the technologies needed to meet societal challenges, especially for 'building the bio-economy by 2020' (CEC, 2010b: 10). This vision favours agro-industrial pathways dependent on capital-intensive innovation.

By contrast, many farmers seek to valorise higher-quality products and agro-ecological production methods. These provide a means to gain higher prices, to shorten food chains, to bypass supermarket chains and thus to gain more of the value that producers add. They develop and exchange incremental improvements in production methods – which may not be officially recognised as 'innovation'.

Thus innovation agendas have divergent understandings of societal challenges, agricultural problems, innovative solutions and markets. These uncommon visions contend for influence over research agendas and other relevant policies. These visions are promoted by contending networks of stakeholder groups.

4 Efficient techno-fixes for unsustainable agriculture?

For a long time, technological solutions have promised greater efficiency to remedy sustainability problems. The EU's renewed Sustainable Development Strategy calls for 'Gaining and maintaining a competitive advantage by improving resource efficiency, *inter alia* through the promotion of eco-efficient innovations'. These are meant to 'break the link between economic growth and environmental degradation' (CEC, 2006). Eco-efficiency was later elaborated as follows:

> Mainstreaming eco-innovation, resource efficiency and green growth could be a leading theme… [The EU] has taken the lead internationally in the fight against climate change and is committed to promoting a low-carbon, knowledge-based, resource-efficient economy (CEC, 2009).

An eco-efficiency remedy has been extended by Europe 2020, 'a new strategy to make the EU a smarter, greener social market' through 'smart, sustainable and inclusive growth'. It aims 'to maintain a strong industrial and knowledge base and put the EU in a position to lead global sustainable development' (CEC, 2010a: 16). Apart from that one mention, 'sustainable development' is eclipsed by sustainable growth and sustainable economy, implying increases in GDP as the main indicator. Some types of growth are labelled as environmentally friendly: 'we should focus and streamline our regulatory dialogues, particularly in new areas such as climate and green growth'. This emphasises 'sustainable growth: promoting a more resource efficient, greener and more competitive economy'. In particular:

> 'Resource efficient Europe' to help decouple economic growth from the use of resources, support the shift towards a low carbon economy, increase the use of renewable energy sources, modernise our transport sector and promote energy efficiency (CEC, 2010a: 3-4).

Such concepts were adapted and recast by the Commission's perspective on the post-2013 CAP. It proposes that growth should be: 'smart' e.g., providing incentives for social innovation in rural areas; 'sustainable', e.g. fostering animal and plant health, and enhancing carbon stocks; and 'inclusive', e.g. supporting farmers' income to maintain a sustainable agriculture throughout Europe. To address problems of climate change, it proposes 'improvements in energy efficiency, biomass and renewable energy production, carbon sequestration and protection of carbon in soils based on innovation' (CEC, 2010d: 5). In some of those examples, producers would conserve and enhance natural resources – not simply use them more efficiently, as implied by the Europe 2020 strategy.

To make economic growth sustainable, the Europe 2020 strategy emphasises resource-efficient technologies and market incentives, thus attributing sustainability problems to inefficient use of resources. This diagnosis can be tested by two examples of resource conflicts – over biofuels and irrigation water – from studies in the CREPE project.

4.1 Biofuel efficiency?

In 2008 the EU was moving towards mandatory targets for transport fuel to come from renewable energy, mainly meaning biofuels in practice. These targets have provoked controversy over the unsustainability of biofuels. Environmental harm has included the following: loss of set-aside land and thus of biodiversity, greater use of agrochemicals, and European oilseeds being replaced by palm oil imports (e.g. from Indonesian plantations), thus effectively exporting GHG emissions and wider environmental harm to such places. Rural populations in the global South have faced environmental degradation, land grabs, food price rises and competition for different land uses – partly due to biofuel expansion.

Future novel biofuels have been promoted as a solution to these sustainability problems. In this narrative, renewable raw materials are currently under-utilised, e.g. straw, wood chippings and even animal waste. This biomass could be turned into liquid fuel through technological innovation, thus relieving pressure on edible plant material. Closed-loop systems aim to minimise or eliminate waste by re-using all by-products. Current biofuel targets are officially justified as necessary for stimulating more efficient innovation. Beyond advantages to the EU, technological innovation is also promised to alleviate sustainability problems of current biofuels in the global South, even to facilitate rural development.

Such solutions are meant to come from more efficient, productive methods. For example, 'The higher the productivity of a feedstock, the less it will compete for land with food, until second generation biofuels are commercially available', argues the European Commission (CEC, 2008a). Its development agency proposes, 'Bioenergy development should be encouraged for crops and lands which compete the least with food and other uses, either directly (they are not staple foods) or indirectly: they have higher yields, hence use less land' (EuropeAid, 2009). Beyond current crops, future novel production methods are expected to further relieve pressure on food material and the best land, especially with crops to be cultivated on 'marginal land' not in competition with food uses.

In these accounts of biofuel production, its sustainability problems are attributed to inefficient use of resources, e.g. low-yielding crops or food crops as biomass. Contrary to such diagnoses and assumptions, however, current sustainability problems are driven by political-economic forces – e.g. extending monocultures to more land, subordinating land use to global markets, linking agricultural prices to oil markets, more intensively extracting labour through global value chains, according to our study (Annex III; also Franco et al., 2010a, 2010b). Even if R&D achieves more efficient ways of converting biomass to liquid fuel, these methods cannot counteract the commercial drivers – and could even strengthen financial incentives for industrialising more land, especially to supply expanding global markets.

Stakeholders bring divergent accounts of sustainability and nature to these issues. Biofuels promoters reduce society-nature relations to a competitive advantage in global markets, especially through agro-industrial monocultures. This agenda gives priority to market-oriented economic knowledge and high-tech corporate knowledge. By contrast, agrofuel opponents see natural resources as a commons to be protected and shared by rural communities; alternative pathways should be based on the knowledge and needs of small-scale producers. These divergent accounts underlie the controversy.

4.2 Water efficiency?

As agricultural and residential expansion aggravates water scarcity in water-stressed areas such as southern Spain, more efficient water technologies have been promoted as a remedy. According to EU policy, solutions should be found in 'clean technologies that facilitate the efficient use of water' (EP, 2008). Larger-scale agricultural producers in Andalucía have invested widely in efficiency measures such as drip-feed systems. In practice, however, the investment has brought political-economic incentives to maximise returns by increasing the cultivated area and thus overall water usage.

EU policy advocates measures for greater efficiency, especially as alternatives to additional water supply infrastructure, as if they were a last resort. For example:

> Additional water supply infrastructures (such as storage of water, water transfers or use of alternative sources) should be considered as an option when other options, including effective water pricing policy and cost-effective alternatives, have been exhausted (CEC, 2008b).

In southeastern Spain, water supply prices have been kept low for political reasons, thus encouraging greater use. By contrast, desalinated water has high costs which drive farmers to over-use their aquifers and only 'top-up' with desalinated water. To satisfy the ever-increasing water demand from Spanish agriculture, moreover, the government aims to build more desalination plants. Their operation will increase greenhouse gas emissions, among other harmful effects.

As seen in this case, eco-efficient innovations do not conserve water but rather sustain its exhaustion – or delay the process, at best. Meanwhile efficiency measures help water users to avoid responsibility for the problem. A sustainable solution would need changes in land use and regulatory measures to ensure that more efficient methods minimise overall water usage. Such changes would depend upon broader knowledge networks for land and water management, according to our study (Ripoll et al., 2010; see Annex IV).

For these water issues, stakeholders bring different perspectives on sustainable development. Large-scale agricultural producers and water providers bring a modernisation approach, separating the environment from the farm, which is seen as a machine for maximising productivity from inputs, including water. They relate its potential scarcity to issues of availability and affordable price. By contrast, environmental NGOs see the value of water in the hydrological ecosystems that it sustains. This divergence underlies the policy conflicts over water conservation measures and techno-fixes.

4.3 Rebound effect?

There is a long history of expectations that greater input--output efficiency will minimise overall resource usage. Yet such expectations have often been contradicted in practice; in the classic case of the steam engine, its industrial take-up greatly expanded coal usage. Such effects were conceptualised as the Jevons Paradox: greater resource usage becomes a predictable consequence of lower costs, especially through financial incentives to expand production and to supply wider markets. These incentives help to explain greater water usage in Spain (see above).

More recently the paradox has been understood as 'rebound effects'. More efficient, higher-quality or more flexible energy production has often stimulated greater usage of resources. An increase in overall resource usage amounts to a significant proportion of the efficiency gains and sometimes even exceeds them, thus backfiring on the original aims or claims (Sorrell, 2009). Therefore technological improvements may not increase overall eco-efficiency and conserve resources, unless various policies and/or consumer behaviour are specifically directed towards such aims (Polimeni et al., 2009).

Despite this long historical experience, EU policy language makes optimistic assumptions about techno--fixes conserving resources. Some innovations are promoted for sustainably increasing resource availability and economic growth – most recently as 'green growth'. Meanwhile the promises justify various policies – e.g., research subsidy, market incentives, IPRs, etc. – to promote more efficient techno-fixes. Yet the sustainability promises are rarely held accountable.

5 Knowledge experiments for sustainable agriculture

According to agroecological diagnoses of sustainability problems, farmers' knowledge of natural resources has been displaced by laboratory knowledge and distant commodity chains. State research agendas have generally locked out agroecology; its incremental farmer-led improvements are not officially seen as innovation, by contrast to lab-based biotech research (Vanloqueren and Baret, 2009). Research agendas have been shifted towards specialist knowledge for agro-inputs and processing methods. Member states have been dismantling the institutional basis for disinterested science, public good training and agricultural extension services, thus undermining farmers' knowledge, warns the foresight report (SCAR FEG, 2008).

The authors advocate several remedies: agroecological approaches, *in situ* genetic diversity, producer-consumer links, etc. Biodiversity should be promoted for reducing vulnerability to climate change and thus increasing resilience:

> ..... it seems more rational to seek to restore varietal diversity to farmers' fields, in order to increase resilience in the face of climate volatility, by arrangements that encourage a freer flow of biological material, data and information exchange (SCAR FEG, 2008: 6).

Here vulnerability is understood as systemic stress from agro-industrial monoculture systems. By contrast, the latter understands vulnerability as occasional shocks which warrant remedial measures. Such resilience means 'the capacity of a system to experience shocks while retaining essentially the same functions and structures' (Jackson et al., 2010: 80).

Towards a systemic resilience via biodiversity, such crops and cultivation methods have been promoted through cooperative relationships which enhance farmers' knowledge. Agroecological methods have been developed via knowledge exchanges among farmers, sometimes also with professional researchers. But such cooperation faces many barriers, especially from research institutions giving priority to complex, expensive and commercialisable science. As knowledge mediators, CSOs can help to overcome these barriers, especially by bringing together agricultural researchers and farmers (Annex I; also Neubauer and Piasecki, 2010).

According to the SCAR report, moreover, Agricultural Knowledge Systems (AKS) already link many types of knowledge and should be broadened:

> AKSs for instance would focus on ways to reduce the length of food chains, encourage local and regional markets, give more scope for development and marketing of seeds of indigenous crop varieties and foodstuffs, and restore the diversity of within--field genetic material, as well as of farming systems and landscape mosaics (SCAR FEG, 2008: 42).

Along those lines, agro-food chains have been shortened by local food networks throughout Europe (Karner, 2010). They have supplied local, organic and/or higher-quality food to more consumers. Bringing them closer to producers also builds knowledge of agro-ecological cultivation methods and consumer support for them. Closer links between producers and consumers have been built in several ways, as highlighted by the CREPE project.

In an economic context dominated by agro-industrial methods, Brittany agro-food networks have shortened food chains in the past decade (Maréchal, 2008). Through closer relations with consumers, many farmers have found incentives for methods reducing their energy inputs – initially for cost reductions, and later for environmental care. Already available, such methods could be implemented rapidly and at low cost; the main obstacles seem to be farmers' and institutional mindsets, according to our study (Annex IV; also Aubrée et al., 2010).

Community-Supported Agriculture (CSA) is a partnership between one or more farmers and a community of subscribers; together they share the risks and benefits inherent in farming. Exemplifying CSAs, in Rome the *Orti Solidali* substitutes locally available resources for external inputs through synergic cultivation methods. Other urban agriculture initiatives have emerged in Italy; they imaginatively use public spaces to reconnect residents through food production. But they face many obstacles, especially centralized spatial planning and urban development patterns that undermine local connections (Annex VI; Pinto & Pasqualotto, 2009; Pinto et al., 2010).

These examples from our studies illustrate social networks experimentally creating or applying new knowledge for sustainable agriculture in novel niches, protected from global market pressures:

> At the niche level, there are everywhere… ongoing experiments ('novelties') and a re-development of knowledge networks… Some of the initiatives involve formal research partners and/or public or private organisations, others are embedded in civil society networks and movements of varying scale (SCAR FEG, 2008: ii).

In such ways, agricultural innovation comes from combining knowledges and practitioners, not simply from applying lab research or technology, as in the concept of 'research--driven innovation' (CEC, 2010b: 7). According to a SCAR working group:

> Innovation is not restricted to a technical or technological dimension. It increasingly concerns strategy, marketing, organization, management and design. Farmers do not necessarily apply 'new' technologies: their novelties emerge as the outcome of 'different ways of thinking and different ways of doing things' and in recombining different pieces of knowledge in an innovative way. Innovation is both 'problem solving' and 'opportunity taking' (CWG AKIS, 2011: 13).

In such experimental niches, practitioners inform research questions. For addressing challenges such as climate change and resource scarcities, 'on-farm research has to be strengthened', argues an expert report (SCAR FEG, 2011: 124). Wherever farmers find that agroecological cultivation methods work well, for example, scientific research can help to explain why – and suggest further improvements or more general applications. As a concept, Agricultural Knowledge Systems may provide a common space for interchanges between divergent paradigms and their research priorities.

6 Conclusion: Opening up agricultural innovation

As surveyed above, there are divergent accounts of sustainable agriculture, a bio-economy and eco-efficient innovation. They promote different narratives of sustainability problems and societal progress for a future Europe. In the context of the KBBE framework, they also have divergent accounts of key terms – knowledge production, biological resources, economic relations and research priorities. These accounts borrow and use similar terms – in different ways, each in their own image, each favouring different pathways (see again Table 1).

The CREPE project has highlighted these differences, especially how a search for eco-efficient techno--fixes obscures beneficial innovations and potentially marginalises them. Tensions between these pathways arise within EU institutions, as well as between different stakeholders. These tensions arise in many policy issues – e.g., agricultural research priorities, the post-2013 CAP, territorial development, a low-carbon economy, intellectual property and science education.

Europe's future remains ostensibly open by 'inventing our future together' via the European Research Area (ERA), but EU policy invokes global competitiveness as an objective necessity and rationale for research priorities (CEC, 2007c). Consequently, some innovation pathways are marginalised. According to research ministers, the European Research Area should 'democratise decision making, for a Science operating as a service to Society' (European Council, 2008). In order to fulfil this aim, the EU would need different procedures and imaginations opening up innovation agendas.

Relevant here is the concept of social innovation, whereby citizen networks can become experimental co-creators of knowledge. Social innovation has been defined as follows:

> Experimental (testing out a range of alternatives and assessing which ones work); Collaborative (making use of the full potential of network technologies to boost productivity in the social fields and to speed up learning); Able to engage citizens as co-creators (BEPA, 2009).
>
> These social innovations, which are often initiated by institutions, play a part in reshaping society as a more participative arena where people are empowered and learning is central (BEPA, 2010: 8).

Such practices create participatory, cooperative arenas where people create alternatives to the dominant agenda. The CREPE project has illuminated and facilitated such practices, especially by helping civil society organisations (CSOs) to extend their stakeholder and expert networks. Social innovation should be expanded to encompass all relevant knowledge producers. Such means will be needed to open up, deliberate and experiment diverse pathways of sustainable agriculture.

Social innovation is mentioned in rebranding the EU as an Innovation Union:

> Social innovation is an important new field which should be nurtured. It is about tapping into the ingenuity of charities, associations and social entrepreneurs to find new ways of meeting social needs which are not adequately met by the market or the public sector (CEC, 2010b: 21).

However, this concept remains marginal to 'research-driven innovation', within a globally competitive race (ibid: 7). The dominant account marginalises other pathways for social innovation and societal benefits.

As a way to imagine agricultural futures, then, innovation for sustainable agriculture and a bio-economy has divergent pathways. The divergence highlights societal choices, whose legitimacy will depend on citizens shaping the future. Some choices have been highlighted by the CREPE project – itself a social experiment in research cooperation.

Table 1: Agricultural Innovation as Contending Agendas

	Life Sciences & global value chains	**Agroecology & agro-food-energy relocalisation**
Problem-diagnosis: agro-economic threats	Inefficiency (of farm inputs, processing methods and outputs) – disadvantaging European agro-industry, which falls behind in global market competition for technoscientific advance.	Agro-industrial monoculture systems – making farmers dependent on external inputs, undermining their knowledge, distancing consumers from agri-production knowledge, etc.
Solution in sustainable agriculture	More efficient plant-cell factories as biomass sources for diverse industrial products. As new oil wells, agriculture can substitute for fossil fuels, thus expanding available resources.	Agro-ecological methods for maintaining and linking on-farm resources (plant genetic diversity and biocontrol agents), thus minimising usage of external resources.
Sustaining what?	Sustaining 'green' economic growth, competitive advantage, resource availability and commodity flows.	Sustaining the resource base, communities, farmers' cooperation and solidarity.
Society as community; social sustainability	Individual beneficiaries of global markets through rural employment and novel 'green' products available for rational consumer choice.	Closer producer-consumer links through trust in a comprehensive product identity based on images of quality, food culture and territory/place.
Natural resources	Mechanical-informatics properties as a natural cornucopia which must be identified, unlocked, mined and commercialised in value chains.	Ecological processes (e.g. nutrient recycling, soil as a living system, whole-farm systems, etc.) which can be used by farmers for agricultural production.
Resource constraints: solutions	More efficiently use renewable resources, so that productivity increases overcome constraints and thus continue economic growth, i.e. commodity circulation in the global economy.	Relink production and consumption patterns in ways reducing dependence upon external inputs, while enhancing diverse outputs, towards greater self-sufficiency.
Resilience against vulnerability	Capital-intensive defences against external shocks (e.g. climate change), so that the system can maintain, restore or even increase productivity.	Bio-diverse farming systems with lower dependence on external resources, thus avoiding endemic stresses of monoculture systems & climate change.
Knowledge	Computable data for more efficient, flexible agro-inputs, production methods and/or outputs which can gain advantage in value chains. Laboratory research to create databases of standard information. Privatisable knowledge, verified by pre-competitive research and public reference standards.	Farmers' collective experiental knowledge of natural resources, ecological processes and product quality, as a basis to minimise dependence on external inputs. Scientific research to explain why/how some agroecological practices are effective. Open-source exchange of information and biological materials (organicEprints)
Quality	Compositional qualities that can be standardised, identified, quantified, extracted, decomposed and recomposed for extra market value.	Comprehensive product qualities – e.g. aesthetic, production methods, farmers' skills, rural space – recognisable by consumers as a basis for their support.

	Life Sciences & global value chains	**Agroecology & agro-food-energy relocalisation**
Eco-efficiency as intensification: using renewable resources more efficiently	Sustainable intensification via smart inputs from lab knowledge: enhancing external inputs, engineering their compositional qualities and increasing land productivity.	Eco-functional intensification via farmers' knowledge of agro-ecological methods: improving nutrient recycling techniques, enhancing biodiversity and improving the health of soils, crops and livestock.
Knowledge-Based Bio-Economy (KBBE)	Sustainable production and conversion of biomass [or renewable raw materials] for various food, health, fibre, energy and other industrial products.	Agro-ecological processes, in mixed and integrated farming, for optimizing use of energy and nutrients, so that producers gain from the value that they add.
Agricultural Knowledge Systems (AKS)	Cooperation among actors in value chains, esp. for linking biological characteristics with novel inputs and products.	Cooperation between lab science, agronomy and farmers, especially for enhancing their knowledge of natural resources for sustainable production methods.
Product validation	Technological convergence for databases to standardise properties of molecular components and their new combinations.	Certification systems for product identity or integrity that will be recognised by consumers.
Economy & markets	Global value chains realising market value in commodities (agro-inputs and outputs) and proprietary knowledge, as a basis for capital-intensive knowledge to gain from added value.	Shorter agro-food chains, based on consumers' trust and greater proximity to producers, as a basis for valorising their knowledge of natural resources, cultivation methods and food culture.
Government policy on research	Private-sector access to public funds for research, and natural resources and proprietary knowledge.	Farmer access to integrated agro-ecological research & advisory (extension) systems.
food chain	Avoid unfair anti-competitive practices which block more efficient supply chains.	Support for food re-localisation via infrastructure and urban-rural linkages.
bio-energy	Subsidy and targets for biofuels to create a European market and thus stimulate innovation which can be exported.	Measures for farm-level development of bio-energy which can substitute for (or supplement) external sources.
externalities	Green public procurement rewarding processes which minimise externalities.	Incentives for actors along value chain to internalize as many externalities as possible
Public knowledge and support	Need a European society in which all stake-holders understand and trust the concept of the bio-economy, e.g. by improving its public image through better communication.	Need a public which is knowledgeable about agro-production improvements via agro-ecological methods and relocalising European economies.

Sources: Table 1 draws on several typologies, as summarised in Table 2: Contending Paradigms: binary typologies (Levidow and Papaioannou, 2010: 48). Such typologies come from: Allaire and Wolf (2004), Marsden et al. (2002), Lang and Heasman (2004: 28-34), SCAR FEG (2008), SCAR FEG (2011), and Vanloqueren and Baret, 2009). The Table also draws on many other sources; some are cited in the overview.

Annexes

I

European agricultural research priorities

Authors: Claudia Neubauer and Fabien Piasecki (Fondation Sciences Citoyennes, FR)

Environmental harm from industrial agriculture is widely recognised, so nowadays most agricultural research projects claim to develop knowledge which contributes to sustainable agriculture. European agricultural research priorities have been studied by the Fondation Sciences Citoyennes, in cooperation with the Open University. Research objectives here included the following:

- To analyse how research agendas selectively favours some priorities, amidst competing accounts of the agro-environmental problems that warrant research.
- To analyse how these priorities relate to sustainable development as envisaged by civil society.
- To inform CSOs' efforts towards influencing research priorities for agro-environmental problems, including cooperation between agricultural scientists and peasants.

Divergent meanings and agendas

Life Sciences agendas have incorporated key concepts from agroecological agendas, while using such language for their own account of sustainable agriculture. To clarify these meanings, the study did a semantic analysis of key terms appearing regularly in discourses on sustainable agriculture and research agendas. Such terms include: innovation, participation, holistic approaches, and soil health. These terms were analysed for their frequency, their meaning and their context of use. The semantic analysis compares documents from various actors who manage research agendas or attempt to influence them.

Similar terms are used according to different accounts of sustainable agriculture. The European Technology Platform (ETP) Plants for the Future links sustainable agriculture with global economic competitiveness and support for European biotechnology research; the terms biotechnology and sustainable are often directly linked with each other. By contrast, other documents put sustainable agriculture in a complex, multi-factorial context linking environment, society, health, economy and culture; these approaches link farms, eco-systems and landscapes through systemic interactions (SCAR, 2007). By emphasising biotech, research agendas have lost other important expertise, argues the IAASTD report. It calls for a reorientation of Agricultural Knowledge, Science and Technology (AKST), which 'would also recognize farming communities, farm households, and farmers as producers *and* managers of ecosystems'.

Soil degradation appears in all the documents analysed. Towards a remedy, the SCAR report proposes breeding practices that include farmers and highlights their active role in soil health. Although the ETP Plants for the Future refers to commonly shared observations about soil, it envisages laboratory solutions – via genomics, plant genetic improvement, genetic engineering techniques, molecular breeding, transgenesis and DNA sequence inventories – to increase productivity of plants.

Differences also arise with concepts such as innovation and participation. In the ETP agenda, the innovation process depends centrally on laboratory research, especially biotech. Wider participation is foreseen as a means to gain public understanding and support. Other reports consider wider participation in research – e.g. farmer-based participatory breeding, participatory or action research, integration of peasants' knowledge – as an essential means to achieve sustainable agriculture. The latter reports also emphasise farmers' knowledge as central to sustainable agriculture, especially agro-ecological methods, which are 'highly knowledge-based'. Agricultural benefits are public goods, whose enhancement depends on methods and research using a systemic approach.

As a means towards sustainable development, agroecological methods have potential applications beyond organic-certified farms. Yet agroecological methods generally remain marginal in R&D budgets, finding a place mainly in some 'organic' research projects. Such projects have been given much less funds than biotech in Framework Programme budgets since the 1990s. Agroecological research is being promoted as a research priority by the IFOAM's Technology Platform Organics.

In the above ways, different results can emerge from diagnosing the same situation. Any agronomic solution also has social and environmental consequences. Therefore social and environmental costs should be reintegrated into economic calculations.

Participatory research for agro-ecology

The above semantic analysis helps to identify different research priorities and how they promote different societal futures. This analysis served as a briefing document for workshops bringing together representatives of agro-ecologists and peasants. As a workshop aim, we sought to evaluate how various research agendas relate to the visions of civil society actors. On this basis, the workshops sought to identify prospects for joint proposals for research projects, as well as obstacles that need to be overcome. Some key discussion points from the workshops follow.

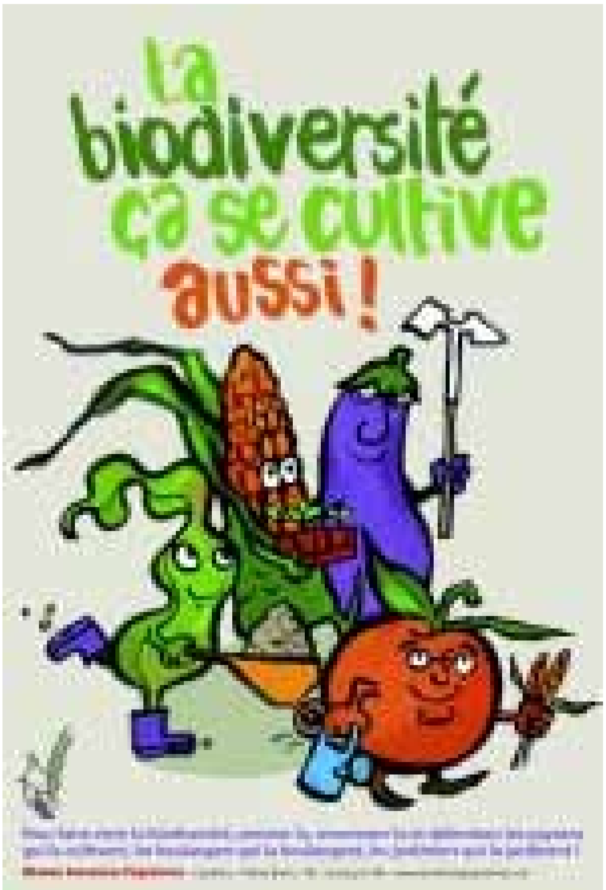
Although there are common interests between agricultural researchers and peasants, cooperation in research has faced many obstacles. Peasants have difficulty to find researchers who can respond to their questions. Either no researchers work on such questions, or else researchers are unwilling to exchange knowledge with peasants. Peasants feel abandoned by research agendas that seems distant from their practices, knowledge and concerns.

Over the past couple decades, greater importance has been given to highly technological, expensive innovation. Little scope remains for other approaches, even if they are knowledge intensive, e.g. agroecology. International participatory research projects often impede cooperation of researchers with non-researchers, partly because English is the dominant language and thus a barrier. Some peasants reported that, after some years of difficult cooperation with researchers, they stopped working with them and favoured knowledge exchange only amongst peasants.

Researchers may want to involve farmers but face many barriers or even create them. In many cases, the research design has been unnecessarily complex, perhaps in order to seem sufficiently scientific to commercialise or to publish in specialist journals. But why make it complicated when one can make it easy? Many researchers feel a need to work in interdisciplinary teams (e.g. with social scientists) but lack relevant experience. They have difficulties in publishing results of such cooperation; in the current publication system, systemic approaches are often less valued as analytical approaches. Often calls for project proposals are effectively calls for results, whereby participants must nearly know in advance the results of the research, and where there is an imperative to publish in specific journals. Participatory research projects have difficulties to accommodate this pressure, since the process is as important as the tangible results and since the results are very open.

Workshop participants sought ways to promote agroecological research, which implies recognising the importance of diverse knowledges, as well as questioning the current dominant mode of knowledge production. To engage in participatory research with peasants, therefore, researchers have profoundly modified their working practices. Through the workshops, the FSC brought together other civil society groups with peasants and scientists in order to develop research agendas around agroecological knowledge. Mutual learning between those groups is needed, especially for them to overcome cultural barriers and for CSOs to gain trust research institutions. On this basis they can jointly answer calls for research proposals. Closer links could strengthen efforts to expand research funding for agroecological methods.

Civil society organisations should be involved in formulating calls for proposals and research questions. CSO representatives want clear recommendations for two main aims: how to deal with funding institutions (especially the European Commission), and how to build co-operative research projects. Towards those aims, the FSC plays the role of a knowledge-mediator and boundary-spanner among relevant stakeholders.



Credit: Reseau Semences Paysannes, www.semencespaysannes.org

II

Agricultural innovation narratives

Authors: Les Levidow and
Theo Papaioannou (Open University, UK)

Innovation narratives in EU-funded agricultural research were studied by the Open University, in engagement with many stakeholders attempting to influence such priorities. The study explored these questions:

- How do innovation narratives conceptualise agro-environmental issues in terms of sustainable development?
- How do such narratives favour choices and directions for a future Europe?
- Which narratives inform priorities for R&D funding, and which remain marginal?
- How do they bear upon stakeholder involvement and social relations of knowledge-production?

KBBE as sustainable agriculture: divergent accounts

Nowadays many innovations are promoted as means to 'sustainable agriculture', a concept which thereby acquires divergent accounts and pathways. Each involves a narrative of a better future. From its problem-diagnosis of unsustainable agriculture, each narrative favours specific remedies as desirable or even as necessary, so that society can avoid threats and use opportunities. In EU policy frameworks more generally, master narratives equate techno-scientific innovation with societal progress, as if the main issue were the optimal choice of technology (Felt et al., 2007).

As a master narrative, the Knowledge-Based Bio-Economy (KBBE) combines two antecedents – the knowledge--based economy from earlier Commission policy, plus the bio-economy from the OECD. This concept encompasses diverse diagnoses of unsustainable agriculture and potential remedies. Consequently, key terms of the KBBE concept – knowledge, biological resources and economy – have different meanings, thereby changing the role and meaning of agriculture (see Table 1). Likewise the key concept 'eco-efficiency' has been given different meanings.

In a Life Sciences account of the KBBE, agriculture becomes a biomass factory. Research seeks generic knowledge for identifying substances that can be extracted, decomposed and recomposed; this favours knowledge that can be privatised. Eco-efficiency takes for granted industrial systems, which are expected to increase pressures on natural resources, as if production simply accommodates markets exogenous to the system. R&D seeks innovation for more efficiently using renewable resources, thus expanding available resources and market opportunities. These opportunities are foreseen as value chains linking novel external inputs, outputs and processing methods. As an ideal, closed-loop recycling means turning wastes into raw materials for the next stage: residues are seen as waste biomass for industrial processes.

By contrast to that account of eco-efficiency, it also has been given agroecological meanings. Organic farming attempts to keep cycles short and as closed as possible, e.g. by recycling nutrients via ecological processes. These practices enhance resource efficiency by minimising inputs and maximising outputs. In agroecological methods, moreover, efficient resource usage provides a basis to shorten agro-food chains. Consumers learn to trust producers through a specific product identity, representing comprehensive qualities such as sustainable production methods and/or aesthetic characteristics.

Stakeholder representation: uncommon visions

Since the late 1990s the EU has faced societal conflicts over the direction for future agriculture, especially the high priority given to agbiotech research. Another problem was a perceived gap between research agendas and industry needs. As a governance strategy for FP7, the Commission invited industry to establish European Technology Platforms (ETPs). These were meant to define research agendas that would attract industry investment, especially as means to fulfil the Lisbon agenda goal of 3% GDP being spent on research. ETPs were mandated to involve 'all relevant stakeholders' in developing a 'common vision' emphasising societal needs and benefits.

For the agro-food-forestry-biotech sectors, now seen as the KBBE, ETPs were initiated mainly by industry lobby organisations, with support from scientist organisations and COPA, representing the relatively more industrialised farmers. Oriented to capital-intensive research and innovation, ETPs effectively define who is (or is not) a relevant stakeholder, according to their prospective contribution to value chains; citizens are relegated to the role of consumers, at most. For these structural reasons, CSOs have had only marginal involvement, amidst uncommon visions of societal futures.

In such ways, the Commission effectively outsources responsibility for stakeholder involvement to ETPs, which are not held accountable for how they play that role. In the name of creating a common vision, ETPs represent one vision as a common one. ETPs selectively represent or construct some stakeholders as partners in the KBBE. An expert group has advocated greater involvement by CSOs in ETPs (DG Research, 2009), thus downplaying the conflicts over research agendas and putting the burden on CSOs.

Towards alternative agendas, various experts and CSOs advocate different kinds of knowledge production: agro-ecological methods; scientific research more closely linked to farmers' knowledge; and food relocalisation, based on consumer knowledge of food production methods and product quality. Taking up such agendas, Technology Platform Organics was initiated by organics research institutes and gained support from a wide range of stakeholders, especially through consultation procedures on research priorities. TP Organics has recast mainstream terms, such as technology and bio-economy, to promote farmers' knowledge of biodiversity as resources for agro-ecological methods and as societal benefits.

Diversified factory farm: research agendas

In the dominant KBBE narrative, agriculture gains greater importance by linking several sectors – feed, energy and other industrial products. According to proponents, technological innovation provides new opportunities for rural employment, but this depends on horizontally integrating the agriculture and energy 'value chains', i.e. prospects of gaining greater market value from renewable raw materials. Here the 'value chains' concept plays a promissory role by mobilising economic and political investment around a prospective El Dorado.

Research is seen as necessary for scientific knowledge and standards that can lead to more efficient products that enhance economic competitiveness. Converging technologies become essential tools for identifying and validating compositional characteristics of renewable raw materials. On this basis, the KBBE narrative promises economic, environmental and social sustainability.

Agriculture becomes a terrain for mining renewable resources to feed the 'diversified integrated biorefinery'. This has multiple meanings – an industrial model of renewable raw materials, an infrastructure for processing them into diverse products, and integration of agriculture with the oil industry. In such a prospective biorefinery, inputs and outputs can be flexibly adjusted according to global market prices. As investors undergo global capital integration, through new partnerships across sectors and continents, this process is portrayed as 'European competitiveness', thus projecting a unitary Europe.

Given the divergent agendas of research for sustainable agriculture, these co-exist within research programmes, as in the FP7 Theme 2 work programme on Food, Agriculture, Fisheries and Biotechnology (FAFB). Its main objective is 'building a Knowledge-Based Bio-Economy'. The work programmes link the term 'renewable' with 'sustainable', meaning biological resources being used more efficiently as substitutes for chemical ones: 'Eco-efficient products are less polluting and less resource-intensive in production, and allow a more effective management of biological resources.' The programme emphasises product innovations, especially via simulations of natural processes.

Approximately half the calls for proposals have been based on proposals from officially recognised ETPs. The Commission defers to them as if they were neutral experts in both technological and commercial prospects. These calls prioritise research which could help commercialise resources and new knowledge, especially by bringing together academic and industrial research partners. The evaluation procedure anticipates commercial prospects, e.g. for 'market-led innovations' and in some cases for patents. Such priorities are called 'pre-competitive' research, featuring generic knowledge useful for later commercialisation.

Beyond the dominant Life Sciences agenda, the FAFB programme has included other research agendas. Some promote knowledge for protecting public goods in an agricultural context. Others promote agro-ecological knowledge through key terms such as enhancing soil management, recycling organic waste, replacing chemical pesticides, etc. Such priorities have gained a stronger role since the start of FP7, partly by incorporating proposals from TP Organics. Its novel concept, 'eco-functional intensification', has gained interest from DG Research as well as from the organic section of COPA. Thus the overall FAFB programme encompasses divergent accounts of the KBBE.

III

Global agrofuels

Authors: Jennifer Franco, Lucia Goldfarb, Maria Luisa Mendonça, David Fig, Mireille Hoenicke (Transnational Institute, NL) and Les Levidow (Open University, UK)

In 2007 governments were increasingly promoting biofuels as a more secure and 'greener' renewable source to replace fossil fuels. These claims underwent increasing challenge; many reports were documenting harm to food security, rural livelihoods and environments in the global South. Criticism was directed at the threat from 'agrofuel because of the intensive, industrial way it is produced, generally as monocultures, often covering thousands of hectares, most often in the global South' (Econexus et al., 2007). So our report generally uses the term 'agrofuels' rather than biofuels, except when referring to official language such as 'biofuels policy', sustainable biofuels', etc.

This study was led by the Transnational Institute in cooperation with its international research network and the Open University, looking especially at EU policy aspects. The TNI team brought together activist-researchers from many backgrounds – land rights, environmental justice, human rights, food sovereignty, etc. The study had several aims:

- To identify the socio-political forces promoting agrofuels.
- To identify EU policy assumptions regarding societal benefits of biofuels.
- To compare those assumptions with practical experiences and effects, especially through three case studies – Germany, Brazil and Mozambique.
- To identify different accounts of sustainable agriculture in the controversy.

EU policy promotes agrofuels in several ways. By 2020, 20% of all energy used in the EU and 10% of each member state's transport fuel must come from renewable sources – in practice, expected to come mainly from agrofuels. Fulfilment of such an ambitious target will depend on large-scale agro-industrial crops for agrofuels in the global South as well as in Europe, thus making the policy highly contentious. The policy has been driven by a partnership between government and agro-energy business extending the agro-industrial model from commodity crops to energy uses. Similar alliances in the global South have been promoting agro-industrial development there. EU policy creates an agrofuels market and thus commercial incentives for agrofuels development, both in the EU and in the global South. Key actors have frictional encounters, which create intentional or inadvertent resistances to the agrofuels project.

EU policy assumptions

EU biofuels policy rests upon arguments about societal benefits of three main kinds – environmental protection, especially GHG savings; energy security through import substitution; and rural development. Each argument in turn involves several assumptions, e.g. about what these putative benefits mean and how they can be fulfilled. Our results question the EU's optimistic assumptions, as follows:

Environmental protection: Pursuing the most ambitious targets among EU member states, Germany had expanded its rapeseed production to the maximum by 2007 and subsequently became more dependent upon biodiesel imports, thus generating GHG emissions elsewhere. Further expansion will plausibly stimulate indirect changes in land use, e.g. palm oil plantations displacing forests in Southeast Asia. In Brazil bioethanol from energy-rich sugarcane has great potential for GHG savings, relative to other agrofuel crops. But savings are undermined by sugarcane plantations destroying carbon sinks in the Cerrado savannah and Amazon rainforest, as well as by wider environmental harm from agro-industrial development. GHG emissions also result from soya plantations displacing cattle ranches which in turn clear more rainforest frontiers. Yet these indirect emissions are not counted by Brazil, much less by countries importing agrofuels, and would require many years to repay the carbon debt. In Mozambique, GHG savings from bioethanol are somewhat undermined by agro-industrial practices, e.g. land clearances and the extra infrastructure needed for *de novo* installations distant from metropolitan centres.

Energy security: As transport fuel usage within Europe increases for the foreseeable future, agrofuels supplement fossil fuels, thus limiting the benefits for energy security as well as for GHG savings. As highlighted by the case of Germany, further efforts towards the 10% target would require even more imports. At most this diversifies the import sources for transport fuel, rather than gaining energy independence. In Mozambique agrofuels can play only a small role in import substitution and thus energy security; most agrofuel production is aimed at exports, like its current electricity production.

Rural development: Agrofuels have been promoted as an opportunity for rural development in the global South, especially by including small-scale producers. But their role has remained marginal in Brazil, where agro-business interests have prevailed. The Brazilian government regards millions of hectares as 'marginal' or 'degraded', thus providing a basis for sugarcane plantations to expand there without harming the environment or food production. In practice, however, agrofuel producers seek and gain access to quality land, water sources and infrastructure. Such plantation developments devastate natural resources and local agriculture, as well as some forest reserves. These also destroy employment and degrade labour conditions, even via quasi-slave labour; mechanization reduces employment without improving its conditions. In Mozambique plans for plantations have created conflicts between agrobusiness interests and local residents over scarce water supplies, which crucially affect arable land. Such plans also conflict with legal protections of communal land rights. These results challenge optimistic assumptions about the great availability of 'marginal' or 'idle' land (EuropeAid, 2009: 4).

Remedies for un/sustainability

Amidst controversy over harmful effects of agrofuel production, EU policy explains current sustainability problems along two lines: (i) inadequate management – a problem to be addressed through better management mechanisms or '(self-) governance', e.g., voluntary compliance with sustainability criteria or standards; and (ii) inefficient use of resources – a problem to be addressed through eco-efficient technological innovation.

Contrary to the above assumption about management measures, agrofuel promotion has created pressure to relax environmental and social protection in the global South. Already Brazil has softened its law on environmental crimes to accommodate agro-industrial sugarcane plantations. The European Commission has cited EC development policy as a means to address sustainability problems, but the relevant bodies have scant power or resources to limit harm in the global South.

Regarding the assumption about technological solutions, these will supposedly come from more efficient feedstocks, especially from novel future biofuels. They have various generic names – advanced, 2nd generation or next-generation. For example, it is assumed: 'The higher the productivity of a feedstock, the less it will compete for land with food, until second generation biofuels are commercially available', seen as the ultimate solution (CEC, 2008a).

Contrary to the above diagnoses and assumptions, sustainability problems have causes in political-economic drivers – e.g. for extending monocultures to more land, for subordinating land use to global markets, for gaining a competitive advantage in global value chains. If technically successful, more efficient methods per se would not counteract those drivers of harm in the global South. Indeed, greater efficiency arguably provides greater commercial incentives for extending agro-industrial systems to more land, especially to supply expanding global markets for fuel and feed. A 'smart-green' techno-fix provides a false solution. It is aimed at the wrong problems – e.g. how to sustain Europe's growing consumption of transport fuel, and how to maximise value-added from global commodities.

MST and other social movements protest outside the International Biofuels Conference, São Paulo, 20 November 2008. Slogans blame biofuel policy for slave labour and more expensive food.
Credit: http://archive.corporateeurope.org/brazilconference.html

IV

Water scarcity and agro-food exports

Authors: Santiago Ripoll and Tom MacMillan (Food Ethics Council, UK), María Jesús Beltrán Muñoz, Esther Velázquez, Cristina Madrid López (Fundación Nueva Cultura del Agua, ES), Les Levidow (Open University, UK)

This study analyses the contribution that food production makes to water scarcity and explores potential ways to alleviate the burden, by focusing on Almeria as a case study. It was carried out collaboratively by the Food Ethics Council (UK) and the Fundación Nueva Cultura del Agua (Spain), with a contribution from the Open University, especially on EU policy aspects.

Objectives include:

- To study causes and impacts of water scarcity in Almeria (in Spain's southeast), as a case study of a wider EU problem, in order to inform demand-side mitigation strategies.
- To analyse different understandings of sustainable development which underlie policy conflicts over defining water-supply problems and evaluating possible solutions.

Southern Spain is one of the most water-stressed regions of Europe, exporting large volumes of water-intensive produce to other EU countries, including the UK. As the most arid province of Spain, Almeria is also the country's most productive area in agriculture. Fifty-five percent of Almeria's agricultural produce is exported; of that export, 90% goes to the EU. Since 1970 legislation has regulated the level of underground abstraction. Despite those laws, the area of irrigated land has continued to increase, and 63% of aquifers are over-exploited. The 'thirstiest' sub-sectors have been greenhouse farming in southwest Almeria and open-area irrigated farming in northeast Almeria.

Policy frameworks for efficient water usage

Since its enactment in 2000, the EU Water Framework Directive (WFD) has required local authorities to maintain water sources in a 'good ecological status'. The WFD diagnoses water-supply problems from both poor quality and scarcity, whereby each problem can worsen the other. Member States must 'ensure a balance between abstraction and recharge of groundwater, with the aim of achieving good groundwater status' by 2015.

As an incentive for improving water quality, it requires 'full cost recovery' from water users, while allowing exceptions for economic difficulties if consistent with the overall ecological aims. There can be exceptions to 'full cost recovery' only if the environmental objectives are still met. These EU requirements have stimulated recent changes in Andalusia but also have tensions with them.

Tensions also arise from the EU policy emphasis on technological innovation for using water more efficiently and thus conserving water. Such measures are seen as alternatives to additional infrastructure for water supply, which should remain a last resort. It emphasises "technological innovation in the field of water, given that water efficiency will be an increasingly important factor for competitiveness" (CEC, 2008b). For example, solutions should be found in 'clean technologies that facilitate the efficient use of water' (EP, 2008). Water-efficiency measures are already widespread in irrigation systems among large agricultural producers in Almeria, but these measures bring incentives to increase the cultivated area and so increase overall usage of water, partly in order to recoup the investment. At best, such measures delay resource depletion, partly because they do not tackle the fundamental problem: consumption-led growth.

The creation of an independent body to administrate water resources — the Andalusian Water Agency — has represented a major step forward. The Agency can assess the ecological status of their water basins, derived from the structure and functioning of associated water ecosystems, in turn as a basis to develop action plans to address water quality. Through the new agency, EU guidelines are being integrated into regional law and regulations.

But this localisation process faces many contradictions. The right incentives for sustainable use of water have not been established: gains in water efficiency are translated into greater use of resources – in a classic 'rebound effect', for many reasons. Water allocation greatly exceeds water availability; strict price policies (for cost recovery) are politically too risky and are not fully implemented. Public authorities are not able (or willing) to carry out the necessary surveillance to ensure compliance with allocated volumes and prices, nor to ensure that increases in supply of desalinated water translate into less use of water from aquifers.

Desalinated water already has high costs which drive farmers to over-use their aquifers and only supplement them with desalinated water, thereby contributing little to water conservation. There are no means to ensure that desalinated water *substitutes* for aquifer water. Thus aquifer depletion will continue, leading to saline intrusion, thus undermining their future capacity to hold water and buffer water ecosystems. Due to the competitive 'pull' from external markets, producers have little incentive to save water in absolute terms. That is why production-perspective or supply-side approaches – focusing only on water use – have contributed little to water conservation.

As the main strategy to maintain or even increase water supplies, especially for agriculture, the regional authority plans to build more desalination plants. The change in supply-side policy— from water transfers to desalination — effectively outsources environmental harms and societal responsibilities beyond water policy. Environmental impacts change their character: from *tangible* effects (building infrastructure on site, reducing river flows, redirecting water flows, etc.) to environmental impacts that are *less tangible* – more carbon emissions aggravating climate change, as well as salt residues. Thus the water policy bodies and water users can less easily be held accountable.

Desalination also contradicts the WFD because cost-recovery is politically untenable. Farmers and water providers can easily mobilise public opinion against strict pricing policies. Cost recovery may be included in principle in the law but is unlikely to be implemented.

Demand-led initiatives

So what can be done to promote water conservation? Consumption-perspective or demand-led approaches assign some responsibility to those who consume products that are water-intensive. These perspectives bring supermarket supply chains and consumers into water governance debates. They introduce the concept of 'virtual water': the volume of water required to produce a commodity or service for export. Another useful concept is 'water footprint': the amount of water used by an average person, a business or a geographical area (Velazquez et al., 2011). Water footprint puts the consumer, the region or the business in the spotlight, showing the impact of their behaviour on natural resources. In the case of Almeria, our study calculated the virtual water flows from Almeria to the UK for two major crops: tomatoes, as the main horticultural export (produced mainly in greenhouses) and lettuce, as the most valuable export of open-area irrigation – and the main produce of Primaflor, the company in our case study.

Credit: Primaflor brand, http://www.fruittoday.com

Water stewardship focuses on the negotiation of responsibilities because water issues are so complex that they defy simple measurement and technical solutions. A fundamental part is stakeholder dialogue: involving stakeholders in the development of principles and criteria for water governance. Our two-day workshop deliberated governance of the water supply chain: the discussion highlighted the need to focus on irrigation systems, to ensure water allocation is linked to availability, to improve surveillance to ensure legality of extraction, and to address the climate change effects of desalination (Ripoll, 2009).

As participants pointed out, however, supply-chain responses could not replace the role of the public sector in water governance. Supermarket-supplier deliberation fora cannot address the problem of economic growth. Their survival in current form depends on increasing productivity and increasing consumption – an implausible starting point towards the objective of living within environmental limits.

Policy-makers could do the following: (i) introduce and maintain efficient irrigation systems (ii) allocate water according to volumes of total local availability (iii) ensure surveillance and policing of water extraction and irrigated land area (iii) limit the use of desalinated water to emergency situations, (iv) reward producers that limit production according to locally available water resources, and (v) ensure that efficiency measures serve to limit water usage.

V

Local food networks in Brittany

Authors: Pascal Aubrée, Blaise Berger, Gilles Maréchal (Federation Régionale des Centres d'Initiatives pour Valoriser l'Agriculture, FR)

This study analyses the development of short food-supply chains and their environmental effects. It has been carried out by the Federation Régionale des Centres d'Initiatives pour Valoriser l'Agriculture et le Milieu rural (FRCIVAM). Our intervention method is traditionally based on *education populaire* (popular education). This study has aims which include the following:

1. To identify and explain the main environmental benefits when farmers get involved in a local agro-food network.
2. To identify available methodologies and tools to assess those environmental effects.

Shortening food-supply chains

In the last decade, local food networks – better known as *circuits courts alimentaires* (short food chains) – have been quickly developing in Brittany (Maréchal, 2008). These networks feature traditional forms of short chains, such as open air markets, micro farm-shops and collective shops of farmers. These networks also develop innovative schemes, especially Associations pour le Maintien de l'Agriculture Paysanne (AMAP), which accept orders via internet for home delivery. New practices are linked at farm level: 30% of direct sales come from organic production, whilst organic producers are only 3% of the overall farmers. Nevertheless they are linked in the consumers' mind, seeing direct sales as organic far beyond the level of official certification.

Traditional forms of short chains, such as open air markets and micro farm-shops, also have expanded. In the late 1990s the Rennes area had 21 weekly markets; by 2009 there were 35, with more being planned. Some new ones are open in the early evening, to target "back home transit" consumers, while the traditional ones are morning or early afternoon markets. Most favour local or organic producers. At the same time, direct sales seem less present in Brittany than in the rest of France.

Some commentators portray direct sales as a leftover from earlier agriculture or as a disappearing practice. According to the dominant agricultural organizations of Brittany, 'There still remain some farmers who use direct sales as a niche market, but short food chains have no future.' Despite that narrative, *circuits courts alimentaires* have been expanding for several reasons. There are greater demands to protect natural resources (water, air and soil) and to bring consumers closer to producers. Agro-industrial practices remain dominant in Brittany. Environmental issues are especially prominent there – both in public debate and in the physical world – e.g., pollution from fertiliser run-off, biodiversity loss, uniform landscape, etc.

Farmers converting to organic agriculture, or to sales in short chains, have encountered hostility from conventional farmers, even from their neighbours. Adoption of sustainable agriculture or direct sales was considered as a rupture, or even a betrayal, by their professional environment. They have to recompose a new professional network through a higher density of new relations in each territory. Our study investigated how they develop these new relations and change their practices, in ways that also bring environmental benefits.

Reducing GHG emissions

In the context of agro-industrial practices, the environment is considered something external to the farm. Most productivist farms follow the *hors sol* ("out of ground") scheme, where natural spaces mainly serve as pollution sinks, whilst the production system becomes highly artificial, dependent upon chemical inputs. The environment is seen as a "*charge*" (meaning a burden and expense) that is mainly used by authorities to impose tasks and taxes upon farmers.

Our research has shown that re-integrating the farmers' responsibility for their own commercialisation scheme, through short supply chains, leads to a new vision of the environment: It becomes an internal resource that can provide the whole farm system with free inputs and ecosystem services. In this way, the route is no longer to shape environment according to technical external rules, but rather to adapt the whole agricultural system to potentials of the farm territory. The environment becomes a benefit, both for the farmer's (and his family's) needs and pleasure and the whole society.

From our study of how farmers develop short food-supply chains, we identified three distinct routes. The first is followed by farmers who use short chains for only a small proportion of their turnover, as a complementary means to enhance profitability. They continue the conventional model, seeking technical excellence in production and high apparent productivity through large-scale commodity production. The second route is followed by farmers who progressively shifted more of their production through local sales, while also changing their vision of added value. Discovering that they could gain higher prices, they tried to improve their economic efficiency by reducing their input costs (e.g. fertilizers, pesticides). Through this pragmatic approach, a lower environmental impact becomes an extra gain, although it is not pursued for itself. The third group is composed of farmers who have a social and environmental commitment as activists. They always aimed to implement an environment-friendly system, e.g. through organic or low-input production methods.

For improving the environmental practices of farmers, the second group is a major target, given that the first group would be difficult to change and the third one already implements environmentally-friendly methods. For the second group, the environment is initially seen as an externality that can provide the farming system with free resources. Later this environmental care turns into a commercial argument and is thus maintained. This pragmatic basis has great potential for expansion to more farmers (Maréchal et al., 2010).

Public interventions

Until recently, most public interventions on environmental issues have been based on law (new rules) or direct economic incentives (subsidies, grants). Alternative food networks have found little scope to gain support from public authorities, e.g. via policies on rural development or public procurement (*restauration collective*). As our research reveals, local authorities now use indirect incentives – e.g. public procurement, creation of sales points, information on local products – for local sales to gain local environmental benefits that will also address global environmental issues.

Indeed, our research has helped to persuade some local authorities to give such support through new policies. In the Brittany regional context, agro-food policy is still dominated by agro-industrial farming interests. Short food supply chains could not gain support through political lobbying, especially by criticising agro-industrial systems. As a different strategy, our research has highlighted environmental advantages of short food supply chains, especially in the wider policy context of climate change and food insecurity.

Box scheme (panier) in Brittany. Credit: FRCIVAM

In wider discussions over reducing GHG emissions from agriculture, this aim has become a rationale to invest in scientific research towards technological innovation which could use resources more efficiently. Although such efforts may be worthwhile, they ignore or even marginalise farmers' organisational innovations which significantly reduce GHG emissions. Already available, such solutions could be implemented rapidly and at low cost. The main obstacles are farmers' and institutions' mindsets, as well as government policies, which therefore need more research towards overcoming them.

VI

Community-supported agriculture in Italy

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This study, led by the Fondazione dei Diritti Genetici (FDG), focuses on Community-Supported Agriculture (CSA) as a model of sustainable agro-environmental development in urban areas. A CSA is a partnership between one or more farmers and a community of consumers. This arrangement helps to ensure the operating budget of a particular agricultural activity, via a subscription to one or more "units" of the harvest season. Subscribers sign agreements to finance the agricultural activity during the growing season, thus sharing risks and benefits inherent in farming.

Our case study was a specific CSA, called O*rti Solidali* or Solidarity Gardens. It develops *agricoltura sinergica* (synergic agriculture), a technique which provides methods for enhancing soil fertility, minimising material inputs, improving the natural and cultivated biodiversity level and substituting knowledge of natural resources for external inputs. This method also provides a potential basis for new knowledge--sharing among participants – paid workers and subscribers who pay for food boxes. We investigated its sustainability – environmental, economic and social. We also compared these aspects with other alternative agro-food initiatives.

Sustainability indicators

We devised appropriate indicators for the sustainability of such an initiative.

Synergic agriculture at the Orti Solidali, http://ortisolidali.wordpress.com

Environmental: We considered issues of primary importance such as energy efficiency, protection of natural and cultivated biodiversity, management of soil fertility and water resources, GHG emissions. The choice of indicators has been compared with expert knowledge, involving academic institutions. The initial list turned to be too wide, so we decided to select fewer indicators according to four criteria: priority, relevance, communicability, measurability. We then defined a useful framework that could be applied in the future to calculate the environmental performance of an alternative agriculture initiative.

Economic: We focused on self-sustainability – the ability of a CSA to sustain itself from its own resources and services offered to subscribers, as a basis for paying the workers' wages. Such costs were covered by the incoming subscriptions and by other forms of direct or indirect sponsorship.

Social: Questionnaires to subscribers posed questions about their satisfaction and involvement in the CSA initiative. Responses came from approx. half the subscribers. They expressed a wide range of economic, social, environmental and personal reasons for participation as subscribers. The most important motive was 'ethical'. We interpret this term to mean a commitment to an alternative production--consumption model carrying many features that consumers have chosen for ethical reasons.

A degrowth niche

From those features of sustainability, the case study illustrates alternatives being discussed around degrowth perspectives. These advocate a reduction of economic growth and a transition to a new economic system based on environmental protection and social equity. The *Orti Solidali* translates this call into a food production initiative that uses an environmentally sustainable agronomic method, creating goods while providing living wages and fair working conditions to the producers. Moreover, the *Orti Solidali* has developed alternative organizational models and social relationships for the actors involved. It addresses calls for relocalisation of food, redistribution of wealth, reduction of environmental pollution, restructuring of production-consumption patterns – many of the 'R' imperatives suggested by the degrowth movement.

For innovation theory, a niche emerges from a novelty when a network of social actors constitutes a set of ethical values, cognitive frames, relational codes that shape a protective environment. This gives the niche a relative stability, dependent on the commitment and the dedication of the participants, until establishing itself. Alternative agro-food networks (AAFNs) act as such niches. They play a transformative role in co-building knowledge around an alternative food provision. In the *Orti Solidali*, often we made a virtue of necessity in dealing with problems. Both the organizers and subscribers had a strong commitment which helped to create a niche protected from the market, so that the novel community could establish itself.

Workshop: 'CSAs in urban areas'

A public workshop entitled 'CSA and alternative food networks in urban areas' was held in November 2009. It was attended by subscribers of the *Orti Solidali*, by CSOs from other Italian regions engaged in similar projects, and by several academics. The workshop investigated the multifunctional sustainability of alternative food networks involving different stakeholders, focusing on the features of the CSA model. The three main topics discussed have been: agricultural methods, community building, and urban planning (Pinto & Pasqualotto, 2009).

Agricultural methods:

This discussion focused on the synergic method, as a possible way to develop Local Food Networks in urban areas. Participants agreed that this would depend on a change from the agro-industrial vision towards an agro-ecological vision. It needs a change from agricultural productivity to quality, from large-scale retail trade to local distribution, from high input of fossil energy towards low external inputs. Together these changes can reduce environmental impacts during production, distribution and consumption of food.

Community building:

Participants felt that an urban food system must build a path through which consumers improve their awareness of agro-environmental and food safety issues. They can become consume-actors, thus constituting a food community. This can be the basis for creating a CSA initiative. Several food communities could develop a food network on regional or national or even global scale.

These experiences are important for trying out alternative techniques of production, marketing and management of urban and peri-urban areas. However, they do not appear as real solutions to address urban environmental issues, nor as a way to involve the population in participatory urban planning processes. From the environmental viewpoint, isolated cases of urban agriculture exclude the possibility of establishing food systems based on ecological cycles. Moreover, the role of citizen involvement in promoting urban agriculture for an urban transformation loses its strength when people cannot make real decisions on economic and urbanisation choices.

Urban planning:

In the 1970s urban agriculture re-appropriated urban areas against new models of speculation. By contrast, in recent years urban agriculture has become a bargaining tool within the processes of urban governance. Urban agriculture has been promoted within the processes of participatory planning in the form of city parks, countryside, gardens social groups or woodlands markets for producers.

Participants discussed and criticized zoning rules (functional separation of the different parts of the cities), the centralized planning of space and the disappearance of local connections. Given that most big cities have no space designed for agriculture, the workshop discussed strategies to create spaces for urban agriculture. For example, they can take back 'the empties' – areas that are left empty or abandoned by urban planning.

But this can be a very demanding strategy: a Bologna activist group told us about their difficult experience trying to take back an empty space for urban agriculture. In Italy access to urban land is guaranteed only to citizens' associations or companies (in case of town and country parks or urban gardens) or to particular population groups (such as vegetable gardens for the elderly or educational gardens for children). Access to land is denied to any other social groups.

Participants proposed to rethink the old concept of commons – lands, forests and streams that could be freely used by the peasants in medieval Europe. The original concept could be adapted to today's urban spaces. For example, food and environment can be seen as commons that should be preserved, as well as collective alternative uses for urban commons.

VII

Cooperative research processes in the CREPE project

Authors: Sue Oreszczyn and Les Levidow (Open University, UK), Stephen Hinchliffe (Exeter University)

Cooperative research has been defined as a 'form of research process, which involves both researchers and non-researchers in close cooperative engagement' (Stirling, 2006: 9). Such research also aims to open up the assumptions and aims of research through deliberative processes. As part of the overall CREPE project, this study aimed to:

- facilitate self-reflection on the social process and methods of the project as co-operative research;
- identify and facilitate ways to enhance collaborative--reflexive processes and to inform;
- benefit other efforts at collaborative research.

Within the overall project, this study has been designed to promote *reflection* on the issues faced by partners. Partners tried out methods – and then discussed with others what worked well, how it worked, what failed and what could be improved. All partners kept a 'cooperative research diary' detailing the cooperative research (CR) aspects of the individual studies. Entries described the participants with whom they cooperated, how they developed cooperative relations, what methods worked well and what worked less well. Partners were encouraged to record descriptive accounts, conversations, difficulties, tensions, excitements and so on. Reflection exercises were conducted within the partners' meetings. The following themes have emerged from this activity.

Cooperative relations

Partners' meetings discussed the concept of cooperative research and how it relates to similar concepts, e.g. action research and partnership research. This was important for facilitating cooperative research activities in partners' individual studies, e.g. how they draw in different expertise and challenge assumptions. Reflection on cooperative processes helped to make more explicit the participatory relationships that already existed in various contexts and enabled partners to focus more closely on their research practice. For example, as an agricultural extension agency, FRCIVAM was already practicing cooperative research with academics but had not previously described the relationship in this way (Annex V). The CR concept has helped FRCIVAM to clarify means to extend such cooperation as a normal, beneficial feature of research.

All partners in CREPE have been funded by the project for their research activities. Furthermore, the overall project has been jointly managed and run by all the partners. These joint stakes put partners on a more equal footing and strengthen CSOs' capacity to participate in research activities, e.g. by enabling more staff time or new posts to be funded for such activities.

In cooperative research we distinguish between academics and CSO staff, but a distinction between researchers and non-researchers can be misleading. Such categories ignore the multiple roles being played by both academic and CSO partners. The latter reflected on their multiple identities, especially the challenges faced in being both a researcher and a CSO staff member; for example, they may be treated as political activists rather than being taken seriously as researchers.

In this project, the individual studies varied in ways reflecting the thematic focus, organisational culture and strategic perspectives of each CSO partner. For example the TNI study of 'agrofuels' mainly involved CSOs and social movements which had an affinity with TNI's critical perspectives (Annex I). As agricultural extension agents, FRCIVAM had already worked with academics in order to research the practical issues of farmers in short food-supply chains; its CREPE study was further used to influence policies of local authorities (Annex V). By contrast to those two case studies, the study of water scarcity built networks including all relevant stakeholders, amidst practical and policy conflicts over water management; workshop discussions were meant to clarify current practices and future options for improvement, especially through greater cooperation among stakeholders (Annex IV; also Ripoll, 2009).

As highly networked organisations, CSO partners have seen co-operative research as an opportunity to extend their networks. More participants were drawn into the issue which animates the CSO partner. Furthermore, by working with academic researchers, CSOs made links with the wider academic and policy networks of those researchers. In this way CSOs can gain many benefits, some of which may be unexpected and unplanned.

CSOs' workshops enabled participants to combine different knowledges, to share experiences, to build new relationships and thus to foster their networks of practice (cf. Brown and Duguid, 2001). All this informed the direction of partners' studies. For example, alongside the Rome workshop on community-supported agriculture, a national meeting of urban food projects provided a temporary 'community of practice' (see workshop reports at http://crepeweb.net/?page_id=191).

For communities and networks of practice, new opportunities for learning and fresh insights often occur at boundaries (Wenger et al., 2002). The studies in CREPE highlight the need for boundary spanners who have the necessarily knowledge and facilitation skills to span different communities of practice. Within CREPE some partners have been playing a knowledge mediation role in their studies, e.g. by mediating between various experts, CSOs and other practitioners. For example, FSC sought to play a mediation role between agro-ecologists, peasants and CSOs, as a basis for such actors to share their knowledges and cooperate in research activities (Annex I).

'Good practice'

Within CREPE, good practice included the following: building a network of practice; being flexible about research plans; reflecting on our practice and documenting those reflections; acknowledging the differences between the academic and CSO cultures; and providing spaces to enable learning from each another. Our experience highlighted the diversity of practices in cooperative research. As a broad concept, 'good practice' takes account of the many possible practices that could be called 'good', depending on the aims, contexts and participants of the research. It enables researcher and CSOs to make more explicit the existing relationships, networks and ways of operating. Making them more explicit helps participants to consider how best to utilise the potential.

This diversity of research practices also has implications for any standardised guidelines, assessment tools or precise management methods. Such measures deny the complexity and specificity of cooperative activity, which needs to remain flexible and open to alternative ways of addressing issues as they arise during the research process. This complexity adds weight to the argument that there 'no simple prescription for best practice' (Huxham and Vagen, 2005: 34) – indeed, that there can be diverse types of good practice.

Diverse experiences also highlight the need to focus on processes of participation, rather than a toolkit approach that emphasises tools for the job (Reed, 2008). As a metaphor, 'tool' implies that there is a knowable task or problem that a tool can fix. In contrast, cooperative research opens up the task or problem in order to find solutions or ways forward. Reflecting on experience, as in this report, may inform others' efforts at cooperative research, allowing participants to reflect on their own unique situation in light of others' experiences.

There is a general need for funding bodies and academic researchers to have greater flexibility than would normally be the case, to accommodate the particular difficulties that CSOs face. Following the initial design of the individual studies, CSO partners had staff changes resulting in changes in expertise; staff turnover was more frequent than in academic institutions. In such ways, they may be less stable than academic institutions and so need greater flexibility to overcome any problems. Working with others can enable them to find solutions, but consequently makes heavy demands on other partners, particularly the coordinator. Therefore the scope and ability to be flexible is crucial.

At the same time, intervention into societal issues does not entirely depend upon research. Indeed, most useful knowledge does not come from activity that is formally recognised as research, even if resulting from a systemic investigation. So cooperative research with CSOs has important roles beyond answering research questions. New relationships extend knowledge networks among stakeholder groups, while also redefining the problems to be researched, thus opening up policy assumptions and perhaps societal futures.

References

Aho Report (2006*) Creating an Innovative Europe*. Report of the Independent Expert Group on R&D and Innovation appointed following the Hampton Court Summit and chaired by Esko Aho, http://ec.europa.eu/invest-in-research/pdf/download_en/aho_report.pdf

Allaire, G. and Wolf, S. (2004) Cognitive representations and institutional hybridity in agrofood innovation, *Science, Technology and Human Values* 29(4): 431-58.

Aubrée, P., Berger, B., Maréchal, G. (2010) Local agro-food networks and environmental effects in Brittany, WP4 report of CREPE project, www.crepeweb.net

Becoteps (2011) *The European Bioeconomy in 2030: Delivering Sustainable Growth by addressing the Grand Societal Challenges*, www.becoteps.org, http://www.europabio.org/EU%20Projects/bioeconomy-2030-becoteps-final-white-paper.pdf

BEPA (2009) Conclusions of the BEPA workshop on social innovation. Brussels: Bureau of European Policy Advisors,

BEPA (2010) *Empowering People, Driving Change: Social Innovation in the European Union*, http://ec.europa.eu/bepa/pdf/publications_pdf/social_innovation.pdf

Birch, K., Levidow, L. and Papaioannou.,T. (2010) Sustainable capital? The neoliberalization of nature and knowledge in the European 'Knowledge-Based Bio-economy', *Sustainability* 2(9): 2898-2918; http://www.mdpi.com/2071-1050/2/9/2898/pdf

Brown J. S. and Duguid, P. (2001) Knowledge and organization: a social-practice perspective, *Organization Science* 12(2): 198-213.

CEC (2006) *Renewed Sustainable Development Strategy.* Brussels: Commission of the European Communities.

CEC (2007a) A Lead Market Initiative for Europe, Annex 1: Action Plan for bio-based products

CEC (2007b) A Lead Market Initiative for Europe, SEC(2007) 1729

CEC (2007c) *Inventing our Future Together: The European Research Area: New Perspectives,* EUR 22840.

CEC (2008a) Commission Staff Working Paper accompanying the Communication, *The EU – a Global Partner for Development: Speeding up progress towards the Millennium Development Goals. Climate Change/Energy/Biofuels, Migration and Research*, COM(2008) 177 final.

CEC (2008b) Follow up Communication on water scarcity and droughts in the European Union COM(2007) 414 final, SEC(2008) 3069, 12 December

CEC (2009) Mainstreaming Sustainable Development into EU Policies: 2009 Review of the EU Strategy for Sustainable Development, COM(2009) 400 final

CEC (2010a) *Europe 2020: A strategy for smart, sustainable and inclusive growth*, Brussels: Commission of the European Communities, http://ec.europa.eu/eu2020

CEC (2010b) *Europe 2020 Flagship Initiative: Innovation Union*, SEC(2010) 1161.

CEC (2010c) The Innovation Union – turning ideas into jobs, green growth and social progress, 6 October. IP/10/1288.

CEC (2010d) *The CAP towards 2020: Meeting the food, natural resources and territorial challenges of the future*. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Brussels: Commission of the European Communities.

CWG AKIS (2010) WP1: Reflection paper on AKIS. Brussels: SCAR Collaborative Working Group on 'Agriculture Knowledge and Innovation Systems'.

DG Enterprise (2009) *Taking Bio-Based from Promise to Market: Measures to promote the market introduction of innovative bio-based products*. Brussels: Commission of the European Communities.

DG Research (2006) FP7 Theme 2: Food, Agriculture, Fisheries and Biotechnology, 2007 work programme. Brussels: Commission of the European Communities.

DG Research (2009) Strengthening the role of European Technology Platforms in addressing Europe's Grand Societal Challenges: Report of the ETP Expert Group, October 2009 http://www.kowi.de/Portaldata/2/Resources/fp7/ETP-expert_group-report.pdf

EC-US Task Force (2009) EC-US Task Force on Biotechnology Research, Workshop on Research for Sustainable Bioenergy, held in February 2008.

Econexus et al. (2007) *Agrofuels: Towards a Reality Check in Nine Key Areas*, http://www.econexus.info/pdf/Agrofuels.pdf

EP (2008) Addressing the challenge of water scarcity and droughts in the European Union. European Parliament resolution of 9 October 2008 on addressing the challenge of water scarcity and droughts in the European Union (2008/2074(INI)

European Council (2008) European Research Area Vision 2020, http://ec.europa.eu/research/era/2020_era_vision_en.html

EuropeAid (2009) Position on biofuels for the ACP-EU Energy Facility.

Felt, U., rapporteur (2007) *Science and Governance: Taking European Knowledge Society Seriously.* Brussels: European Commission, EUR 22700, http://www.bmbf.de/pub/EuropeanKnowledge(1).pdf

Franco, J., Levidow, L., Fig, D., Goldfarb, L., Hönicke, M., and Mendonça, M.L. (2010a) Report of CREPE project, WP1, Agrofuel Crops., www.crepeweb.net

Franco, J., Levidow, L., Fig, D., Goldfarb, L., Hönicke, M., and Mendonça, M.L. (2010b) Assumptions in the European Union biofuels policy: Frictions with experiences in Germany, Brazil and Mozambique, *Journal of Peasant Studies* 37(4): 661-98.

Geoghegan-Quinn, M. (2010) Commissioner for Research, Innovation and Science, 'Bioeconomy for a better life', Conference on the 'Knowledge-Based Bio-Economy Towards 2020', Brussels, 14 September.

Huxham, C. and Vangen, S. (2005) *Managing to Collaborate: The Theory and Practice of Collaborative Advantage*. London: Routledge.

Jackson, L. et al (2010) Biodiversity and agricultural Sustainagility: from assessment to adaptive management, *Current Opinion in Environmental Sustainability* 2(1) 80-87, http://www.diversitas-international.org/docs/publications/jackson_et_al.pdf

Karner, S., editor (2010) *Local Food Systems in Europe: Case studies from five countries and what they imply for policy and practice*, booklet of the FP7 project, Facilitating Alternative Agro-Food Networks (FAAN): Stakeholders' Perspectives on Research Needs, www.faanweb.eu

Lang, T. and Heasman, M. (2004) *Food Wars: Public health and the battle for mouths minds and markets.* London: Earthscan,

Levidow, L. and Papaioannou, T. (2010) Innovation Narratives in EU-funded Agricultural Research, WP7 report of CREPE project, www.crepeweb.net

Maréchal, G., ed. (2008) *Les circuits courts alimentaires: bien manger dans les territoires*, Dijon: Editions Educagri.

Maréchal, G. and Spanu, A. (2010) Les circuits courts favorisent-ils l'adoption de pratiques agricoles plus respectueuses de l'environnement ?, *Le courrier de l'environnement de l'INRA* 59: 33-45.

Marsden, T, Banks, J and Bristow, G (2002) The social management of rural nature: understanding agrarian-based rural development, *Environment and Planning* A 34 (5): 635-656.

Neubauer, C. and Piasecki, F. (2010) European Research Area: Agro-environmental Priorities, WP6 report of CREPE project, www.crepeweb.net

O'Mahony, M. and van Ark, B., eds (2003) *EU Productivity and Competitiveness: An industry perspective. Can Europe resume the catching-up process?* Brussels: European Commission, http://www.ggdc.net/pub/EU_productivity_and_competitiveness.pdf

Niggli, U. et al. (2008) *Vision for an Organic Food and Farming Research Agenda to 2025*, Brussels: Technology Platform Organics, http://www.organic-research.org/index.html, http://orgprints.org/13439/

Oreszczyn, S., Levidow, L. and Hinchliffe, S. (2010) Cooperative research processes in CREPE, WP8 report of CREPE project, www.crepeweb.net

Pinto, B. and Pasqualotto, A. (2009) Community-Supported Agriculture and alternative food networks in urban areas, workshop report for WP2 of CREPE project, www.crepeweb.net

Pinto, B. Pasqualotto, A. and Levidow, L. (2010) Community supported urban agriculture: The Orti Solidali project in Rome, *Urban Agriculture magazine* 24, September, http://www.ruaf.org/sites/default/files/UA%20Magazine%2024%20sept2010web%2058-60.pdf

Plants for the Future TP (2007) *European Technology Platform Plants for the Future: Strategic Research Agenda 2025. Part II.* Brussels: European Plant Science Organisation.

Polimeni, J.M., Mayumi, K., Giampietro, M. and Alcott, B. (2009) *The Myth of Resource Efficiency*. London: Earthscan.

Reed, M. (2008) *Stakeholder Participation for Environmental Management: A literature review*. Sustainability Research Institute (SRI), University of Leeds

Ripoll, S. (2009) Water Scarcity in Almeria: Multi-stakeholder Deliberation Sessions 1st & 8th October 2009, workshop report of CREPE project, www.crepeweb.net

Ripoll, S., MacMillan, T., Velázquez, E., Lopez, C.M., Beltrán Muñoz, M.J., Levidow, L. (2010) Water scarcity and its virtual export from Spain to the UK, WP3 report of CREPE project, www.crepeweb.net

Rosamond, B. (2002) Imagining the European economy: ‘Competitiveness’ and the social construction of ‘Europe’ as an economic space, *New Political Economy* 7(2): 157-177.

SCAR FEG (2007) *FFRAF Report: Foresighting Food, Rural and Agri-futures*, Brussels: Standing Committee on Agricultural Research (SCAR), Foresight Expert Group on http://ec.europa.eu/research/agriculture/scar/foresight_en.htm

SCAR FEG (2008) *2nd Foresight Exercise: New challenges for Agricultural Research: Climate change, food security, rural development, agricultural knowledge systems*. Brussels: Standing Committee on Agricultural Research (SCAR), Foresight Expert Group,

SCAR FEG (2011) *Sustainable Food Consumption and Production in a Resource-Constrained World*. Brussels: Standing Committee on Agricultural Research, Foresight Expert Group.

Schmid, O. et al. (2009) *Strategic Research Agenda for Organic Food and Farming*, Brussels: Technology Platform Organics, http://www.organic-research.org/index.html

Sorrell, S. (2009) Jevons’ Paradox revisited: The evidence for backfire from improved energy efficiency, *Energy Policy* 37: 1456-69.

Stirling, A. (2006) From science and society to science in society: Towards a framework for ‘co-operative research, Report of a European Commission workshop, ‘GoverScience’, 24-25 November 2005, http://eurosfaire.prd.fr/7pc/bibliotheque/consulter.php?id=308

van Ark, B. (2006) *Europe’s Productivity Gap: Catching Up or Getting Stuck?*, Economics Program Working Paper Series http://www.tos.camcom.it/Portals/_UTC/Studi/ScenariEconomici/39746563627843588/EPWP0602.pdf

Vanloqueren, G. and Baret, P.V. (2009) How agricultural research systems shape a technological regime that develops genetic engineering but locks out agroecological innovations, *Research Policy* 38(6): 971-83.

Velazquez, V., Madrid, C., Beltran and M.J. (2011) Rethinking the concepts of virtual water and water footprint in relation to the production-consumption binomial and the water-energy nexus, *Water Resources Management* 25: 743–761.

Wenger, E., McDermott, R. and Snyder, W. M. (2002) *Cultivating Communities of Practice*. Boston: Harvard Business School Press.

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