Towards a sustainable food future
FOREWORD

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Research and innovation for sustainable food production

In February 2012, the Commission adopted a strategy to help Europe move towards a food-secure, more sustainable, post-petroleum society based on a thriving bioeconomy. A key component of the strategy is the use of renewable resources from land and sea to transform waste into valuable resources, to produce food and feedstuffs, biobased products and bioenergy — while respecting the environment. The bioeconomy strategy, therefore, makes a significant contribution to the objectives of the Europe 2020 flagship initiatives ‘Innovation Union’ and ‘A Resource Efficient Europe’.

Furthermore, securing access to sufficient, safe and nutritious food for a growing world population is an enormous challenge. Environmental pressures and shrinking natural resources will make it difficult for global agri-food systems to adapt to new demands. So Europe needs to mobilise its science and innovation capacity to achieve the necessary transition towards more resilient primary production methods.

This means that we need innovative ideas based on cutting-edge research: to develop new paradigms to build a green future in which biological resources from farmland, sea and forest can be sustainably converted into food, feedstuffs, biobased products and energy with minimal loss or waste. Horizon 2020, the EU’s new funding programme for research and innovation (2014-2020), will play a central role in turning this vision into reality over the next decade.

Horizon 2020 will of course build on the successes of its predecessor ‘FP7’ and this special edition of research*eu focus magazine presents some of the outstanding successes achieved across a wide range of disciplines, including agronomy, plant and animal health, forestry and marine research, improving primary production, processes and consumer benefits.

I am convinced that building on these achievements through Horizon 2020 will pave the way to a more innovative and low-carbon society.

Máire Geoghegan-Quinn
European Commissioner for Research, Innovation and Science

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Agricultural research and the bioeconomy: our bread and butter

Europe faces huge challenges in agricultural, forestry and fisheries production: from climate change and food security to securing a competitive food market and optimising primary production in a global context. The EU is meeting these challenges through a range of coordinated policy responses: EU 2020, the Innovation Union, the Bioeconomy Strategy, and increased international cooperation.

For the past 10,000 years, ever since the agricultural revolution in the Near East, farming has been of fundamental importance to human society. Yet today, more than ever before, we are facing new challenges in this sector. We need to produce ‘more and different’ things from our land and sea — to be used as the primary resources for food, energy and industry — as well as producing ‘better with less’ — to ensure that agricultural production is sustainable and that we reduce resource use and waste.

Feeding 10 billion

The UN Food and Agriculture Organization (FAO) estimates that a 70% increase in food production is needed by 2050, when the world’s population is expected to reach 10 billion. However, farming and animal husbandry already take up 40% of the earth’s land surface, agriculture utilises 70% of all the freshwater we use, and 33% of greenhouse gases originate from agriculture.

‘European agriculture has an obligation to address forecasted growth in food demand and the need to provide a sustainable, safe and secure food supply for the European and an increasing global population,’ says Máire Geoghegan-Quinn, the European Commissioner for Research. ‘Farmers in Europe and elsewhere will have to face up to increased competition for limited and finite natural resources, as well as the additional pressure that this poses on ecosystem services, such as biodiversity, water retention, and pollination or soil quality.’

The increasing demands of climate change, global population, changing diet, and reduced access to natural resources are already putting immense pressure on attempts to maintain current production levels. So Europe needs to find a way to ‘square the circle’ — using research and innovation to meet the growing demand for food, bioenergy and biofuels in the face of climate change and limited natural resources.

‘We must not only mitigate the impact of agriculture on climate change, but also enable agriculture to adapt to the impact of climate change is putting on farming, forestry, fisheries and aquaculture,’ observes Commissioner Geoghegan-Quinn. ‘Climate-change scenarios envisage a higher risk for crop failures and global food price spikes resulting from diminished harvests due to extreme weather events. The challenge is therefore not only to produce more, but also to produce more effectively, and in more difficult conditions.’

Research is needed to better understand the complexity and diversity of farming practices, economies, environments, socioeconomic conditions and market structures. One-third of food calories produced worldwide are lost or wasted — while more than 800 million people in the world still suffer from chronic hunger.

Research can also point the way to food production systems that are feasible, sustainable and profitable. Fortunately, innovation in agricultural techniques and the promise of biobased technologies could help transform our use of farmland, sea and forests into a thriving bioeconomy.
**Producing more ... better**

The bioeconomy, and the potential of research and innovation to produce ‘more and better’, hold great potential for squaring the circle of economic competitiveness, sustainable food production, alternative energy sources and cutting waste. In March 2012, therefore, the European Commission launched a comprehensive strategy and action plan for a European bioeconomy by 2020 — in its Communication ‘Innovating for Sustainable Growth: A Bioeconomy for Europe’, COM(2012) 60 — which addresses the challenges of sustainable agriculture and food security.

Land-based industries form the foundation of about one-fifth of the European economy, so the strategy covers many areas of EU policy. It was co-signed by five Commissioners, responsible for Research and Innovation, Industry and Entrepreneurship, Agriculture and Rural Development, Environment, and Maritime Affairs and Fisheries. It also complements the EU’s Europe 2020 strategy.

For instance, the Europe 2020 flagship ‘Resource-efficient Europe’ emphasises that we need a significant transition in agriculture and alignment of the common agricultural policy (CAP) to a low-carbon economy. Environmental and biodiversity protection is another crucial target if the goals of Europe 2020 are to be achieved.

Research for agriculture, animal health and welfare, and forestry are also key elements of the Europe 2020 flagship ‘Innovation Union’.

Under this flagship initiative, the European Commission’s proposals for Horizon 2020 — the EU’s research and innovation programme for 2014-2020 — identify food security and sustainable agriculture as a specific challenge for future research priorities.

The new programme will fund research into changing the way we farm our land and use our oceans. The EU funding available for agriculture and food research will double to more than EUR 4 billion under this new programme.

**Research goals for Horizon 2020 include:**
- Crop harvesting, storage and distribution;
- Food consumption, behaviour and diets;
- Second-generation biofuels and industrial ‘white’ biotechnologies;
- Life-cycle analysis to cut waste;
- Phenotyping and genotyping of crop plants to improve health, yields and climate adaptability;
- Environmental impacts of agricultural practices and their effects on landscapes;
- Understanding the role of biodiversity and analysing soil metagenomics;
- Animal health and the control of infectious diseases;
- Controlling ‘zoonoses’ (infectious diseases that can be transmitted from animals to humans);
- Sustainable, competitive, multifunctional agriculture and rural development, including forestry;
- Better fisheries management and sustainable and competitive aquaculture;
- Biotechnology and biochemistry for sustainable non-food products and processes;
- Biobased products and processes for ‘greening’ industry — and synthetic biology.

The Europe 2020 strategy also includes new approaches to providing favourable conditions for research and innovation partners to cooperate and achieve better and faster results. European Innovation Partnerships (EIPs), for example — such as those on ‘Agricultural productivity and sustainability’ (EIP-AGRI) and ‘Raw materials’ — will foster innovation that is not just technological, but also organisational or social. EIP-AGRI could be supported by funds from both the CAP and Horizon 2020 in order to build bridges and partnerships between the worlds of research and those who use it — such as farmers, businesses and NGOs.

Public-Private Partnerships (PPPs) are another model that is becoming more important. The planned PPP on ‘Biobased Industries’ brings together research and innovation partners to cooperate and achieve better and faster results.

"We want to put agriculture and food research well and truly back on the agenda."

Máire Geoghegan-Quinn, European Commissioner for Research, Innovation and Science
50 European large and small companies and organisations for research, development and demonstration of biobased technologies.

Regional funding will also complement these research priorities. The Commission has proposed that part of the European Regional Development Fund should be reserved for ‘low-carbon economy’ projects. And regional Smart Specialisation Strategies under the EU Cohesion Policy will support sustainable agriculture and the bioeconomy.

International cooperation for agricultural research

As the main funders of research, EU Member States also play a vital role. The Standing Committee on Agricultural Research (SCAR) promotes better coordination between the Member States with the support of the European Commission, which has also facilitated the creation of two Joint Programming Initiatives on healthy diet and agriculture, food security and climate change to better coordinate national research efforts.

Global problems — such as climate change, sustainable farming and food security — cannot be addressed without more international cooperation. The EU is a major player in defining a global agricultural R&D agenda, in collaboration with international organisations such as UN agencies, the World Bank, the OECD, and G8, multilateral organisations such as the African Union, ASEAN, and Mercosur, and agricultural research bodies like GFAR and CGIAR.

In particular, a new EU policy framework was adopted in March 2010 to help developing countries address food security. This policy also calls on Member States to increase their support for agricultural research, and the European Commission is discussing an increase in research funding under the Food Security Thematic Programme of the EU Development Funds.

‘The bioeconomy is our daily bread and butter — literally,’ says Commissioner Geoghegan-Quinn. ‘It is the food on our plates, the water from our taps, the newspaper in our hands. It can transform our waste into valuable resources. And more and more, it will be the fuel in our cars and the source of power for our workplaces and homes.’

As the rest of this special research*eu focus magazine will illustrate, EU research has already achieved significant progress in building this bioeconomy — and plans to do much more!

Food research under Horizon 2020 will look into:

1. Maintaining an affordable, safe, healthy and nutritious food supply in the face of changing demographics — a growing world population and increasing urbanisation;
2. Finding technological solutions to increase yields, reduce inputs, define and monitor sustainability, and improve nutritional and dietary quality;
3. Support innovation at the socio-economic level with respect to price transparency on food markets and supply chains, on social capital, rural development, and governance.

Size of the bioeconomy, and its sectors, in the European Union

<table>
<thead>
<tr>
<th>Sector</th>
<th>Annual turnover (in EUR billion)</th>
<th>Employment (thousands)</th>
<th>Data source (Figures for 2009)</th>
</tr>
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<tbody>
<tr>
<td>Food</td>
<td>965</td>
<td>4 400</td>
<td>CIAA</td>
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<tr>
<td>Agriculture</td>
<td>381</td>
<td>12 000</td>
<td>COPA-COGECA, Eurostat</td>
</tr>
<tr>
<td>Paper/Pulp</td>
<td>375</td>
<td>1 800</td>
<td>CEPI</td>
</tr>
<tr>
<td>Forestry/Wood industries</td>
<td>269</td>
<td>3 000</td>
<td>CEI-BOIS</td>
</tr>
<tr>
<td>Fisheries and Aquaculture</td>
<td>32</td>
<td>500</td>
<td>European Commission</td>
</tr>
<tr>
<td>Biobased industries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biochemicals and plastics</td>
<td>50 (estimate)</td>
<td>150 (estimate)</td>
<td>USDA, Arthur D. Little, Festel, McKinsey, CEFIC</td>
</tr>
<tr>
<td>Enzymes</td>
<td>0.8 (estimate)</td>
<td>5 (estimate)</td>
<td>Amfep, Novozymes, Danisco/ Genencor, DSM</td>
</tr>
<tr>
<td>Biofuels</td>
<td>6</td>
<td>150</td>
<td>EBB, eBio</td>
</tr>
<tr>
<td>TOTAL</td>
<td>2 078</td>
<td>22 005</td>
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</table>
The Standing Committee on Agricultural Research (SCAR) is a platform of EU Member States representatives with a mandate to provide strategic advice on the alignment of agricultural research policies in Europe. Originally established in 1974 by the Council of the EU to coordinate European agricultural research, SCAR was given a new role in 2005 to contribute to research agendas in the field of the Knowledge-based Bioeconomy (KBBE) and support the European Research Area. In the SCAR committee, delegates from national agricultural and research ministries set up collaborative working groups to define research priorities on a number of issues, including food, non-food uses, biodiversity, forestry, rural development, fisheries and aquaculture. A broader interpretation of agricultural research enabled the SCAR to cover multidisciplinary research and global contexts. New challenges and developments, such as climate change, resource scarcities, world trade agreements, the Kyoto Protocols or the International Convention on Biological Diversity, have an impact on research and require a joint approach at EU level.

SCAR’s strategic approach to research programming and coordination led to the creation of two Joint Programming Initiatives (JPI) ‘FACCE – Food, Agriculture and Climate Change’ (see box) and ‘Healthy Diet for a Healthy Life’, emerged from the SCAR 2nd Foresight Exercise, which focused on crises and resilience as well as on future challenges like climate change and food security. Coordination efforts are also supported via the ERANET scheme which funds joint research and capacity-building under the Framework Programme.

Mapping research capacities and foresight studies are the main instruments for SCAR to develop its expertise on crucial topics such as biodiversity, green-house gas emissions in the agricultural sector, or global food security challenges. ‘Foresight is our engine for advisory function of the SCAR, to feed the strategic process of research policy-making and to come to more integrated systems of agricultural research,’ summarises Elke Saggau from the German Federal Office for Agriculture and Food. Currently SCAR goes towards the 4th Foresight under the headline “Sustainable agriculture, fisheries and forestry in the Bioeconomy – A challenge for Europe”.

A predicted world population of 9 billion by 2050, along with predictions of food scarcity, put great pressure on agricultural and food systems which may get important for the agricultural sector in a 20 – 30 year perspective. Research and innovation play a key role in providing solutions to cope with these challenges. In Europe, the Standing Committee on Agricultural Research and its working groups make sure that changing conditions in the agri-food sector are better reflected upon and tackled by science.

Joint programming: bigger is better

Environmental pressures will be felt by agriculture first — joint action is the answer

The overall aim of Joint Programming Initiatives (JPI) is to pool national research efforts in order to make better use of Europe’s public R&D resources in a few key areas of major importance. In a JPI, Member States develop common research agendas and engage in joint research activities on a voluntary basis to tackle major societal challenges. Among the main priority topics identified at European level, two relate to the bioeconomy: the JPI ‘A Healthy Diet for a Healthy Life’ (HDHL) and the JPI ‘Agriculture, Food Security and Climate Change’ (FACCE).

The JPI FACCE, which has its secretariat in Paris (FR) and Swindon (UK), has already launched five different actions. It has created a knowledge hub for concerted risk assessment for European agriculture and food security, with EUR 15 million contributed by Member States to fund the efforts of 65 research groups across 17 countries. It has also launched an international call worth EUR 7 million on climate change mitigation. This call involves 11 JPI countries as well as the USA, Canada and New Zealand. In addition, actions are under way on ‘climate smart agriculture’, ‘food security and land use change’, and ‘promoting synergies and reducing trade-offs between food supply, biodiversity and ecosystem services’. For Horizon 2020, FACCE will help identify new topics for ERA-NETs.
GLOBAL OVERVIEW

Knowledge from the networks

Coordinating Member States’ research funding and programmes is the main objective of the ERA-NET scheme. Initially intended to reduce fragmentation and duplication of research efforts, ERA-NET actions have contributed to the development of transnational research activities and networking of funding authorities, thereby fostering synergies and harmonisation across Member States in research programming.

The ERA-NET scheme is part of EU action to strengthen the European Research Area, promoting knowledge and the free movement of researchers. Under the Sixth Framework Programme (FP6), ERA-NET actions were created to encourage research funding bodies to develop joint activities, common research agendas and joint calls of transnational research. Since then, ERA-NETs have been involved in the mapping and mobilising of national research capacities to implement collaborative research targeted at common scientific priorities.

In the bioeconomy sector, including agricultural, forestry, fisheries, food and biotechnology research, more than 30 ERA-NETs have been funded under FP6 and FP7. Under the umbrella of the Standing Committee on Agricultural Research (SCAR), EU Member States identified strategic research topics which led to the launch of two Joint Programming Initiatives — JPI-FACCE ‘Agriculture, Food Security and Climate Change’ and JPI-HDHL ‘A Healthy Diet for a Healthy Life’ — and many ERA-NET projects.

Networking ERA

One way of reinforcing the European Research Area was to set up a network of Member State authorities to coordinate research activities in key areas. Under FP6, this constituted a major step towards boosting transnational research cooperation in Europe.

As a result, ERA-NETs established a community of national research organisations. ERA-NET projects are typically developed by national science funding bodies, calling for their research organisations and technology agencies to collaborate with partners across borders. With a goal to align and map ongoing research in agriculture, networking activities are co-funded by national and European research funds.

Mapping exercises and workshops for mutual learning, knowledge exchange and alignment became the backbone of the thematic networks, encompassing research topics such as energy, ICT, transport, industrial technologies and health.

The 30 ERA-NETs in the bioeconomy sector, including agricultural research, are a good example of what European research coordination stands for. The number of topics covered, ranging from animal health and welfare to biodiversity and biomass, including international biotechnology and the Agricultural Knowledge and Innovation Systems (AKIS) network, underlines the importance of these cooperation initiatives aiming to foster knowledge circulation and promote technology transfer in primary production research.

Growing stronger together

One of the most outstanding examples of innovative ERA-NETs in the agri-food sector combines information and communication technologies (ICT), robotics and agricultural research in the ICT-AGRI ERA-NET1. This project couples cutting-edge research in ICT applications with the need for innovation in agriculture.

The 18 partners from 16 countries involved in this project have come up with a common vision for the farm of the future — precision farming equipped with high-tech sensors, cameras and monitors. For example, milk robots will serve the cows in the stable, while milking machines measure the animals’ body temperature and feeding requirements. This will enable the treatment of each individual animal to be better adapted to its well-being and metabolic needs to produce maximum animal welfare and performance on the farm.

1 http://ec.europa.eu/research/agriculture/scar/index_en.html
At the same time, groups of unmanned tractors are crossing and tilling the arable land, while the growth of crops and status of the soil are being monitored by sensor-equipped drones flying silently over the fields and sending geo-information data directly to the ICT systems operating on the farms. Nowadays, the farmers using such high-tech applications have become more like engineers, analysing and assessing the data in order to define the next steps in the workflow.

Within the ICT-AGRI ERA-NET (see interview on page 11), the smart farm vision is regarded as a key factor in fostering more sustainable and profitable agriculture. Niels Gøtke, coordinator of the ICT-AGRI ERA-NET project, sees agri-electronics as a lever for speeding up innovation in the agri-food sector. ‘Usage of ICT applications in the different fields of farming will not only contribute to more productivity, but also to more efficiency via precision farming,’ he explains. His vision is that, thanks to information systems, sensors and robots, the individual status of plants and animals can be recorded exactly allowing for individual and adapted treatment, and thereby saving precious resources.

These technological solutions will enable a more precise use of resources such as water or fertilisers, while reducing cultivation time. Optimising the steering of animal welfare conditions in the stable can even reduce the use of antibiotics and improve the quality of meat. Animals will only be taken to the slaughterhouse if their meat is mature enough; with precise temperature measuring, stress-free slaughter conditions can be determined which will contribute to prime meat quality for the consumer. ‘Precise ICT tools will support the farmers’ profession and will shape a modern, positive image of an independent high-tech entrepreneur,’ Gøtke predicts.

Looking to the future

However, there is still a long way to go. Mobile ICT applications, coming from other fields, need to be adapted to agricultural production and processing while, at the same time, being engineered by specialised software. Standards have to be harmonised, while new ways of using ICT must become widespread. According to Gøtke, one major step depends on open data access for the sector. A Meta Knowledge Base in the ICT-agri field has been started by the ICT-AGRI ERA-NET covering the latest ICT developments and applications. It will enable scientists, decision-makers and technology developers to accelerate innovation in agriculture, including in remote and outermost areas.

ICT-AGRI’s Meta Knowledge Database delivers a model for other ERA-NETs to open up their data and provide access for new stakeholders. Such openness is seen as crucial for future interactions in open and dynamic innovation models, considering end-user needs as valuable information. Cross-sectoral innovation and the uptake of results from other fields of research will also play a major role in this process. ‘The smart phone revolution in the telecoms sector came from outside to push agriculture,’ says Gøtke, describing the spillover effect of high-tech developments.

Many EU countries are currently adapting their regulations on open data access, and are starting to provide repositories of their research results and an overview of research infrastructures. Crucial for boosting science-based innovation in EU Member States, the development of knowledge and technology transfer solutions will allow research to be better linked to market and societal innovations.

In a survey among ERA-NET members, only 25% of the responding Member States were satisfied with their knowledge and technology-transfer practices. Mapping such transfer systems within ERA-NETs will pave the way for an open research and innovation space in the European Research Area.
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ERA-NET projects funded under FP6 and FP7

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<thead>
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<th>Title of ERA-NET</th>
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<td>ERA-PG</td>
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<td>EUROTANS-BIO</td>
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<td>CAPITA</td>
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<td>C-IPM</td>
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<td>CIRCLE-2</td>
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<td>WOODWISDOM-NET2 &amp; WOODWISDOM-NET+</td>
<td>Wood Material Science and Engineering in the Forest-based Value Chains</td>
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Drones have EU crop fields covered

Interview with Niels Gøtke, coordinator of the ICT-AGRI ERA-NET

Where do you see the most benefits of smart farming?

Niels Gøtke: Robotic and ever-more ICT applications will turn the image of agriculture into a high-tech business. In future, dangerous and smelly work will be done by robots, since ICT allows for better plant management using fewer pesticides and for animals to be treated with fewer antibiotics, thereby boosting animal and plant health and consumer safety at the same time.

These new technologies are very costly. Will the farmers invest in them?

NG: If a farmer sees an opportunity to reap the benefits and to be profitable he or she will invest. Technology on the farms will raise productivity, and save on the cost of labour and materials.

Which new ICT applications will be introduced in agriculture soon?

NG: Milking robots are already widespread. The crop sector will be the next: the run on drones delivering geo-information data and precise pictures of crops, land and soils is speeding up, and is much quicker than we thought. Such devices already cost under EUR 10,000, although to link them to the right software remains a big task. The prototypes are already here, and more will come with mobile computing and apps for outdoor farm management.

What are the barriers to the quick take-up of new technologies on farms?

NG: When we talk about high-tech farming, farmers need more education to be able to use the technologies. We should also focus on certain fields of ICT which come from other business sectors, but require viable applications tailor-made for agriculture. Standards have to be aligned — too many incomplete technology sets for farms still hamper the quick uptake. Better access to data from other ICT sectors will be key.

Will society accept robot farms?

NG: Smart farming offers new opportunities for rural developments which can attract the young and well-educated who can be their own managers. The positive image as independent activists for the environment and nature is giving agriculture a big push. If the profits are right, there will be enough chances to live remotely while staying connected to networks and friends across the country at the same time.

How did ERA-NET help to improve coordination in this field of research?

NG: An ERA-NET such as ICT-AGRI can focus on very specific problems, which are common to all European countries, and can create collaboration amongst countries to achieve common solutions.

How did you launch calls?

NG: The national representatives in ICT-AGRI agree on the topics for the call and each country assigns a sum of money to be put into a common pot. This pot is usually a virtual common pot in the sense that a country’s funding can only be used by researchers from this country. The applications are reviewed by an independent panel of experts as a basis for decisions on which projects to fund.

What benefits has ICT-AGRI ERA-NET brought to smart farming?

NG: In two calls in 2010 and 2012, respectively, ICT-AGRI has funded 15 projects aimed at different aspects of smart farming. Each project has research partners from at least three European countries. During the next four years, ICT-AGRI will launch four more calls with a focus on smart farming and benefits for the farmers as well as for society in terms of cost efficiency, food availability and security, and less environmental footprint.

For further information:
European Technology Platforms for the bioeconomy

Ten European Technology Platforms (ETPs) — and one FP7 project to coordinate them — are working to define and refine Strategic Research Agendas for the future of the EU’s bioeconomy.

European Technology Platforms (ETPs) aim to contribute to European competitiveness, boost research performance, concentrate R&D efforts and address fragmentation across Europe. Work began on creating the first ETPs in 2004, bringing together stakeholders from research, industry and administrations.

In the field of agricultural research and the bioeconomy, there are nine ETPs — with an additional project, BECOTEPS, to coordinate their efforts. Each has established a vision of where their sector — whether food or bio-based industries — needs to be in 20 years’ time, along with a Strategic Research Agenda (SRA) to achieve their objectives.

Food

‘Plants for the Future’

The ‘Plants for the Future’ ETP is a stakeholder forum with members from industry, academia and the farming community. Its vision is to:

• Meet increasing demand for more food and feed, with higher quality, greater health benefits and more diversity;
• Develop plants as green factories for bio-materials, pharmaceuticals and bioenergy;
• Produce more efficient plants — improving plant productivity and quality — and reduce the environmental impact of agriculture — enhancing biodiversity.

For further information: http://www.plantetp.org/

FABRE-TP: sustainable farm-animal breeding and reproduction technology platform

The FABRE-TP aims to set up an industry-led partnership to tackle major issues concerning sustainable animal breeding and reproduction in Europe, taking into account what is happening in the developing world. It intends to mobilise research, technological development and innovation efforts in Europe, and to bring together key stakeholders around a common vision for the development of the technologies and issues central to farm-animal breeding and reproduction.

For further information: http://www.fabretp.info/
’Food for Life’

The ’Food for Life’ ETP addresses innovation in the agri-food sector — the largest manufacturing sector in the EU. It has forged strong links with industry, academia and researchers to determine what resources might be needed, where they might come from, and what non-research issues need to be addressed.

Dr Mike Knowles, President of the ETP board, says: ’It is through R&D and innovation that manufacturers remain at the cutting edge of developments, boosting the industry’s competitiveness and, in turn, contributing to Europe’s future economic growth.’

For further information: http://etp.fooddrinkeurope.eu/

ETPGAH: Global animal-health technology platform

The ETPGAH aims to provide a mechanism for focusing and prioritising research to deliver new or improved tools such as veterinary vaccines and diagnostic tests. It will also help to speed up the delivery of new products to market by overcoming constraints throughout the supply chain.

Therefore, it facilitates and accelerates the development and distribution of the most effective tools for the control of major animal diseases — whether vaccines, pharmaceuticals or diagnostic tests.

For further information: http://www.etpgah.eu/

Coordination

BECOTEPS: Bio-economy technology platforms join forces

From 2009 to 2011, the FP7 project BECOTEPS built closer collaboration between the nine bioeconomy ETPs. It also made recommendations for better interaction between the ETPs’ stakeholders on products, research, innovation and policy.

The project addressed synergies and gaps between the ETPs’ research agendas and organised workshops to prepare the scientific community for research in this area. In addition, it organised dissemination events to discuss KBBE and research collaboration.

For further information: http://www.plantetp.org/index.php/about/thebecotepsproject
GLOBAL OVERVIEW

Biobased industries

**TP Organics: European organic food and farming technology platform**

TP Organics aims to identify research and innovation priorities for the organic and low-input sector, by engaging stakeholders along the whole food supply chain, and to advance its development.

Its vision for sustainable food systems combines eco-functional intensification with high quality food and rural empowerment. TP Organics supports European research and development’s efforts towards innovative solutions for sustainable agriculture as well as for environment and consumer protection. The European organic market has a great economic potential and can act as a model for global organic value chains.

For further information: http://www.tporganics.eu/

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**'SusChem': the sustainable chemistry technology platform**

SusChem addresses challenges to research and innovation in the European chemical and industrial biotechnology industries.

‘SusChem’s involvement in FP7 has been profound for sustainable research in Europe,’ says SusChem Chairman Dr Klaus Sommer. ‘Now we are looking forward to truly fulfil our potential also in the area of innovation through Horizon 2020, especially with our involvement in major EU programmes such as the Public-Private Partnerships SPIRE and BRIDGE, future emerging technologies, and key areas such as water, raw materials, key enabling technologies and skills.’

For further information: http://www.suschem.org/

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**FTP: European forest-based-sector technology platform**

The forest-based sector accounts for 8% of manufacturing added value in the EU and provides nearly 4 million jobs. The FTP provides a forum for European forest owners, companies, researchers, regulators and financial institutions to work on new forest-management schemes, products, services and business models.

The FTP says: ‘Forestry in the future bioeconomy will provide renewable and green energy solutions, and wood for carbon-positive housing materials and furnishings. It will help to replace petroleum-based plastics and contribute to clean-water technologies, new medicines and healthy food ingredients, as well as wood-based alternatives to synthetic fibres.’

For further information: http://www.ftpplatform.org/
‘Manufuture’: the agricultural-engineering technology platform

Agricultural technology is a form of production technology. Manufacturing can take place in the fields, in greenhouses or based on livestock.

The challenge, says ‘Manufuture’, is ‘to show how agricultural manufacturing can take place in a highly automated industrial-like way and can contribute to high efficiency and sustainability for agricultural production, thereby contributing to socio-economic development in rural areas and having a highly beneficial impact on European society as a whole.’

For further information: http://www.manufuture.org/manufacturing/?page_id=21

EATiP: European aquaculture technology and innovation platform

EATiP is dedicated to technology and innovation in Europe to assure a sustainable aquaculture industry, and a strong relationship between aquaculture, the consumer and society.

EATiP’s vision is, by the year 2030, ‘to provide annually 4.5 million tonnes of sustainable food products, worth EUR 14 billion, and supporting more than 150,000 direct jobs. This will be achieved by enhancing husbandry, welfare, technology and knowledge management, while improving the understanding of the factors influencing sustainable development — whether technical, commercial or social.’

For further information: http://www.eatip.eu/

EBTP: European biofuels technology platform

Development of sustainable advanced biofuels is part of the European bioeconomy strategy. EBTP brings together industry, biomass resource providers, research organisations and NGOs.

Lars Christian Hansen, chair of the EBTP steering committee, says: ‘EBTP was established in 2006 to contribute to the development of cost-competitive world-class biofuel technologies and accelerate the deployment of sustainable biofuels in the European Union, allowing the development of a healthy biofuels industry.’

For further information: http://www.biofuelstp.eu/
Agriculture, forestry and fisheries research under FP7

The European Union funds research through its Framework Programmes. When launched in 2007, the seventh of these, FP7, was the largest to date — and one of the biggest research programmes in the world. The programme supported ‘Food, agriculture and fisheries, and biotechnology’ research with the aim of building a European ‘Knowledge-based bioeconomy’ (KBBE).

The Seventh Framework Programme (FP7) — proposed by the European Commission and approved by the European Parliament and Council in 2006 — set out to ‘contribute to the Union becoming the world’s leading research area’, with a budget of EUR 50 billion for the period 2007-2013. This made it one of the biggest research programmes in the world, ‘strongly focused on promoting and investing in world-class state-of-the-art research, based primarily upon the principle of excellence’.

FP7 was structured into four specific programmes — Cooperation, Ideas, People and Capacities — with the ‘Food, agriculture and fisheries, and biotechnology’ research theme funded under the ‘Cooperation’ programme. The goal was to build a European ‘Knowledge-based bioeconomy’ (KBBE) to address the growing demand for safer, healthier, higher-quality food, and the sustainable use and production of renewable biobased resources.

Guided by the strategic research agendas of the relevant European Technology Platforms and requests from Member States, ERA-NETs, and expert groups, the EU committed more than EUR 1.9 billion to fund KBBE research over the duration of FP7, structured into three major activities:

1. Sustainable production and management of biological resources from land, forest and aquatic environments

At the heart of the bioeconomy are the land and sea resources on which it depends. Intensive production practices, global competition and climate change are all threats to the sustainability of European agriculture, forestry, aquaculture and fisheries.

The Commission therefore set out to fund projects proposing a balance between socio-economic goals and responsible natural-resource management, favouring an integrated approach that made full use of all the major players involved — farmers, consumers, regulatory bodies and scientists.
2. ‘Fork to farm’: food (including seafood), health and well-being

The production and consumption of food is central to any society. This is one reason why food-related science is so important — along with its potential to reduce the harmful effects of diseases, through functional foods, for example.

To address this, FP7 prioritised projects that reflected the increasingly complex dynamics of food production, and which took a complementary approach to food, health and well-being. Research covered five topics: consumers; nutrition; food processing; food quality and safety; and environmental impacts and the total food chain.

3. Life sciences, biotechnology and biochemistry for sustainable non-food products and processes

Life sciences and biotechnologies also have a broad variety of industrial applications in producing new environmentally compatible products based on renewable raw materials. Research leading to new biobased products — enabled by advances in nano-biotechnologies, bioinformatics and systems biology — could reduce reliance on fossil fuels, for example.

Funding therefore focused on improved production and industrial processing of renewable raw materials, as well as on new ways to protect and improve the environment using biotechnology, such as cutting waste and cleaner industrial products and processes.

For further information:
http://ec.europa.eu/research/fp7/index_en.cfm?pg=food

Food, feed, fuels and fibre: a wealth of knowledge

Securing food supplies and providing the raw materials for biobased products is the main goal of agriculture. However, a growing scarcity of resources is making it more and more difficult for agricultural producers to maintain their performance.

Between 2007 and 2014, European researchers, in hundreds of collaborative projects from the EU’s Seventh Research Framework Programme (FP7), went on a journey of discovery in the ‘Knowledge-based bioeconomy’ (KBBE). Deploying their different skills in case studies, mapping exercises, interventions, trials and innovative engineering, they achieved extraordinary outcomes resulting in new developments and products. A selection of their research contributions towards solutions for the burning issues in primary production in agriculture is presented here:

CSF-GODIVA: a new marker vaccine to control animal disease

The last epidemic of classical swine fever (CSF) hit Europe hard: 700 000 pigs had to be slaughtered in 1997 in an emergency action with economic consequences that proved disastrous for the farmers. In the Netherlands, 1 300 meat producers had to cull their herds in order to avoid further mass infection, and suffered economic losses amounting to over EUR 1 billion. Europe learnt its lesson: an appropriate vaccine and better diagnostic tools to keep the disease under control were lacking, and research was required to respond to these demands.

In the FP7 project CSF-GODIVA, solutions were finally put forward after 17 national veterinary institutes across Europe and Asia started to collaborate in 2009. Three years later, the results of their joint research were considerable: a robust, live marker vaccine was developed which is currently being registered under the colourful name PESTIDIPORCI.

Furthermore, the project developed a rapid diagnosis tool based on the so-called DIVA principle, which determines if the antibodies found in the animal’s blood stem from the infection or from the vaccine. The vaccine will enable new epidemiologic strategies to be considered, including separating sick animals and controlling the disease through immunising the healthy ones. In addition, pre-emptive mass slaughters could be avoided and meat exports would not need to be totally blocked as the diagnostic tool provides more certainty on the spread of infection.
TAPSIM: a project for the Indian milk revolution

Putting agri-food on the EU-India policy menu: in the TAPSIM project, trade economists and agro-economists developed assessments of future trends in supply, demand and trade for the main agricultural commodities and the agri-food chain in India. The country’s weight is demonstrated best in its basic figures: a population of more than 1 billion and an economic growth rate of 6-8% a year. The project, under the leadership of Dr Floor Brouwers in Wageningen, the Netherlands, and including partners from India, not only investigated the main domestic trends in India but also explored how changes in the global agri-food system affect the country. At two dedicated meetings, the European Commission’s Directorate-General for Agriculture was informed about the main findings, creating a better understanding of India’s position at international trade talks.

The Indian ‘milk-revolution’ seems to be the leading transformation in the agri-food sector. What happened?

Floor Brouwers: Actually, it was the ‘Operation Flood’ which started in the seventies in India to increase and better organise milk production in the country. India is the biggest milk-producing country in the world — 40% of milk is consumed in tea. But the productivity of the cattle was very low then — farmers carried five-litre cans by bike to small dairy factories. With ‘Operation Flood’, India started to bundle milk production into rural cooperatives and, in addition, breeding programmes raised productivity.

What has changed since then?

FB: With the industrialisation and urbanisation of India comes a dynamically growing demand for high-value commodities, such as preserved dairy products. The middle class has grown to 200 million people over the last 10 to 20 years. Their purchasing power, together with being a comparatively young society, will count. More investment in technology, distribution systems and retail are desperately needed to meet demand. Unilever, Tesco, Pizza Hut — they are all there, with growth rates of 50-70% per year.

Will India be a future importer or an exporter of food?

FB: It will be both of those! There is not a simple picture to draw from the country because the disparities are still enormous. India is a big exporter of Bt-cotton, but needs a technology push in seeds, fertiliser, irrigation and infrastructure to boost its agricultural primary production and food processing. Import tariffs will be a big issue in future free-trade talks, too. The Indian administration is very cautious about lowering these. And, there is still the Indian dilemma: while they store millions of tonnes of rice, people starve. Food security will become a big issue for India.

For further information:
http://cordis.europa.eu/projects/212617
http://www.tapsim.eu

‘We save a lot of money and energy from these discoveries in veterinary medicine,’ says Frank Koenen, coordinator of the CFS-GODIVA project and manager at the Veterinary and Agrochemical Research centre (VAR) in Brussels, reflecting on long research routes involving trial and error. Although the pestivirus causing CSF has been eradicated in Western Europe, it is still virulent in wild boar and in home-raised pigs in some of the newer Member States. Cross-border transport can spread it through direct or indirect contact of pigs with various items such as swill, vehicles, waste and equipment. The pestivirus can survive in meat and pig products for many months.

New knowledge in genetics and new support strategies in epidemiology finally led to the project’s successful antiviral vaccine which was developed in the laboratory of the participating German national research institute on Riem Island in the Baltic Sea. The patent was later sold to Pfizer Zoetis, a global animal health company.

For project leader Frank Koenen, the significant benefit of this collaborative EU project goes far beyond the product’s success: the collaboration allowed the unification of all the diverging national epidemiologic strategies into one common safety standard. ‘CSF GODIVA gathered together all the EU veterinary experts, who were working separately before, and built trust,’ he comments. ‘For me, this is the biggest success among the story’s many successes.’

More information: http://www.csfvaccine.org/

ROBUSTMILK: more healthy milk from more robust cows

Modern dairy cows are big performers on the farm. As real working animals which produce the high-value proteins for dairy production, on average they each provide 7000 litres of milk per year — an energy-consuming and stressful job that can cause many cows to lose their energy balance and can even affect their fertility. An EU project found out how to improve the health of milk cows, and how to maintain high-quality milk production, using an adapted genetic selection of the right traits for robust livestock.

‘High-quality food combined with animal welfare is what consumers ask for,’ says project leader Roel Verkamp from the Animal Sciences Group in the Netherlands.
We therefore had to develop new cow-breeding methods and new breeding management tools to stay competitive in Europe."

ROBUSTMILK is the name of the FP7 project led by Wageningen University. The project joined together six EU organisations that are active in dairy cattle breeding and have strong links with the dairy industry. The creation of a common database across the partners, coming from the Netherlands, Ireland, Belgium, Sweden and Scotland, was the start of the work and included unique and scarcely recorded phenotypic measurements for traits underlying robustness and milk quality. These traits include measures such as feed intake, regular body condition scoring, and detailed health and fertility recordings.

In a second step, measurement tools for robustness (energy balance) and milk quality (lactoferrin and fatty acid composition) using mid-infra-red spectrometry were developed and applied in routine feed and milk analysis. Finally, ROBUSTMILK developed genomic selection tools through the identification of genomic markers and applied them in cow breeding by combining genomic selection with knowledge of the phenotype databases.

According to Verkamp, ‘Europe currently dominates the available DNA information for the traits of robustness and sustainability. Others look to us and follow.’ He says the EU’s investment in the research paid off, putting farmers on an equal footing with the US and New Zealand. ROBUSTMILK’s knowledge provides more power to farmers and will, according to Verkamp, help to feed the world now that dairy consumption in the emerging countries, such as Brazil, India and China, is taking off.

More information: http://www.robustmilk.eu/

SHARCO: sweet fruits protected from Plum pox viruses

Peaches, apricots, plums and cherries have a number one enemy: the Plum pox virus (PPV) which causes the so-called Sharka disease. Sharka affects stone-fruit trees, rendering them acidic and deforming the fruit, which means they cannot be sold. Moreover, the classic way to limit the disease’s spread is to destroy all trees infected with PPV, which is a very costly exercise for mainly Southern European, low- to mid-income rural areas.

EU-funded researchers have now found ways to protect money and jobs by attacking the virus by means of fortified plants. The EU-funded project SHARCO — Sharka containment — not only created knowledge about the infection in stone-fruit trees and viral diversity, but the researchers also discovered new cost-saving principles for plant resistance and new protection methods. The tools developed in the project will help gardeners and fruit producers as well as the fruit industry to minimise the risk of infection. Best practices were demonstrated all along the fruit-tree multiplication chain, such as resistant germ plasm evaluation, molecular-assisted selection of resistant cultivates, and the early monitoring of outbreaks in plum orchards. For apricot trees, markers were developed linked to resistance to PPV in apricots. For plums, new breeding programmes have been implemented to accelerate selection processes and engineer antiviral resistance.

Led by the French INRA Centre in Villenave D’Ornon in the département de la Gironde in the Aquitaine region, researchers offered producers access to PPV-resistant plant materials and reliable methods of PPV detection. National plant protection officials received new insights into epidemics. Likewise, certification standards at EU level are needed to guarantee PPV-free production, transport and nursery sales. Experts estimate that millions of euros could be saved thanks to the results of four years of research into Sharka, creating a wide impact across the stakeholder community. A major scientific seminar in Sofia, Bulgaria reached 80 high-level stakeholders. Moreover, practitioners received insights during practical training seminars in European and other PPV-endemic regions, such as Poland, Bulgaria, Romania, the Czech Republic and Turkey. All in all, sweet fruits of their labours indeed!

More information: http://www.sharco.eu/
SIRRIMED: how to water fruit trees sustainably
Irrigated farms in the Mediterranean countries are the largest freshwater consumers, taking up to 80% of the water supply. To preserve food production capacity, new research was carried out into integrated water management methods, with results in farmers’ training and improved water governance and policies in participating regions. In the SIRRIMED project, researchers from Egypt, France, Greece, Italy, Lebanon, Morocco, Spain, the Netherlands and the United Kingdom cooperated to lay the ground for solutions to the multifaceted challenge of water scarcity.

Oussama Mounzer, project partner from the Spanish Centro de Edafología y Biología Aplicada del Segura (CEBAS), lists an array of causes for the increasing water scarcity in the Mediterranean regions. In Egypt, it is the fast-growing population; in Lebanon, the political instability and weak governance; and in southern Spain, the reduced rainfall and increased extension of irrigated land over the last 20 years. Overall, water scientists observe more frequent droughts than before, which are being attributed to climate change.

One citrus tree consumes 6,000-7,000 m³ of water annually, but the sustainable maximum supply is 5,000 m³. Vast citrus plantations in Spain’s Murcia region are currently experiencing water problems and have called for new management strategies. So, what can be done?

Regulated water allocation brought few improvements until the SIRRIMED researchers tested new methods of precise, ICT-steered irrigation. Moreover, improved systems to recycle waste water have been introduced, which have helped to overcome the current contribution made by waste water to soil salinisation and pollution. The project also included drought-resistant cultivars and began several case studies.

‘The Murcia region is now a model for limited water consumption in agriculture. Increasing areas of irrigated land was stopped, which should be a must for all stakeholders,’ says Mounzer. He believes that the knowledge gained in the project should now be transferred to other parts of the world. Thus, SIRRIMED partners have become active in broadening their network, inside and outside the EU, looking to South Africa, the Middle East and South America.

More information: http://www.sirrimed.org

JOLISAA: small-scale farming as a role model for Africa
A deeper understanding of farming models in three sub-Saharan regions — Kenya, Benin and South Africa — was generated by the JOLISAA project, which put together fragmented and unstructured knowledge to raise and link the innovation capacities of African farmers.

A lot of fieldwork, including structured case studies, resulted in insights with the potential to change the rules of the game.

‘There is no one-size-fits-all approach,’ says system agronomist and project co-ordinator Bernard Triomphe, from CIRAD, a French scientific organisation with its main offices in Montpellier, which specialises in development-oriented research. Besides technologies, the solutions most needed are access to markets and cheaper inputs, such as seed or fertiliser. The project put the emphasis on smallholders. ‘Twenty
years ago, theory told us they would disappear. Today, we know that they are there more than ever and are eager to learn,’ according to Triomphe.

More flexibility for more types of producers is the main lesson to be learnt from JOLISAA, which looked at hundreds of thousands of farmers in the case studies. Farmers’ responses to growing urbanisation in Africa play a big role. There will be new demands for traditional quality food as well as the establishment of new value chains offering tools and management know-how translated to local needs. Making money from food production could start to improve standards of living. Education, health and infrastructure should follow.

‘Benin and Kenya are very dynamic. A lot of our JOLISAA research is being continued by Africans now. Civil society can drive a new agricultural orientation in these regions,’ concludes the French researcher, who is looking forward to contributing to social innovation and alleviating poverty through an EU project.

More information: http://www.jolisaa.net/

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**3SR: genetic screening for sheep and goats**

The images of rural idylls in the good old days are still evocative: flocks grazing on green hills and endless meadows with the sun going down. In fact, these picturesque scenes are still true for many parts of Europe where the shepherds’ flocks deliver unadulterated sheep’s wool, lamb meat and goat cheese for the gourmets.

Outsiders may be satisfied with the nostalgia, but insiders know better: genomics has taken off in the last decade, and made it possible for the breeders of small ruminants to adopt new selection and management methods. Keeping pace with both animal welfare requirements and sustainable breeds — resistant to disease and climate change — European sheep and goat farmers are using the latest scientific methods of genetic selection, and are keeping abreast of their colleagues in New Zealand and Australia, the big sheep-breeding countries.

‘The pooling of capacities in the EU has kept us at the forefront of research and linked us to the world-best international consortia,’ says Huw Jones, an animal scientist from Edinburgh in Scotland. His experience in knowledge transfer in biosciences is added value in the 3SR project he led.

**What can genetics achieve for sheep and goat breeding?**

**Huw Jones**: By identifying genetic markers we are able to find the best parents for the next generation.

**What are the most desirable traits?**

**HJ**: It depends on the country. In France, farmers want animals with a high milk yield, whereas this does not play a role in UK. Here, the meat production is predominant in sheep farming, thus strong meat yield is the trait in demand. We researched a wide diversity of breeds because reproductive capacity or disease resistance also play major roles.

**What are the project’s main achievements?**

**HJ**: We could transfer testing and genetic selection methods from other animal sectors to the farming of small ruminants. Breeders were offered a kind of genetic-forecast of their flocks by genomic databases of traits and pedigrees as well as by selections after molecular tests. Here, we could develop an affordable ‘single nucleotide polymorphism’ (SNP) chip — a small chip with arrays of many SNPs that can be interrogated simultaneously — as a pre-competitive tool for tests in labs.

**Can EU farmers catch up with breeders overseas?**

**HJ**: Flocks in Australia and New Zealand comprise more than 5,000 animals; they are kept more intensively than in Europe where small-ruminant farming is mostly done on marginal land, with flocks of several hundreds. But thanks to the EU project, we could link the sector to the most eminent researchers in the world, in China, Argentina and Australia. Likewise, our EU consortium is part of the International Goat and Sheep Genetic Consortium providing genetic maps, but also keeping an eye on biodiversity.

For further information: http://cordis.europa.eu/result/brief/rcn/10038_en.html http://www.3srbreeding.eu/
Safeguarding Europe’s forest ecosystems

Shrinking biodiversity and increasing demand for biological resources will put greater stress on European forests. As a major natural resource, forests are complex ecosystems in great need of preservation.

In this context, EU-funded research projects are looking at approaches to safeguard forest ecosystems by better understanding tree genomics and offering breeding methods for climate-robust forests. At the same time, wood supply chains should be optimised to tap the economic potential of forests sustainably.

NOVELTREE: creating novel vigorous forests
Changing climate scenarios need different trees. What biology achieved naturally by developing adapted species over time may become an engineering model for genetically selecting and cultivating the best-fitted tree species in forest ecosystems to survive under difficult climate conditions.

In the NOVELTREE project, researchers investigated an improved understanding of the biology of model tree species of high economic importance. A bold data collection exercise, involving phenotyping and genotyping, was launched to exploit the available genetic diversity of forests and preserve them in the long term. A main prerequisite to meet the demands of industry and society are healthy and vigorous trees. Novel breeding strategies may offer solutions.

The consortium, coordinated by the INRA research centre in Orleans, France comprised 15 public and private European entities. They took a close look at four tree species which form the backbone of regional forestry: maritime pines in Atlantic and Mediterranean areas, Scots pine in Northern and Central Europe, spruce in Scandinavia and the UK, and poplar in several regions in Western Europe.

The researchers analysed a large network of field plots where tree populations have been replicated across a wide range of climate conditions. These trials played a major
role in documenting the genetic patterns of adaptation and identifying phenotypic markers. The knowledge gained improves understanding of how natural populations will react under different climate conditions and how they might be adapted to different scenarios.

A further example illustrates how better-focused tree breeding can lead to improved economic exploitation: wood properties that promote the transformation of cellulosic biomass for bioenergy applications were detected by genetic screening. A genetically engineered selection of spruce or popular trees could meet these characteristics and help boost the competitive advantage of Europe’s forest industry. Other, rapidly growing trees will serve the requirements of a sustainable supply of forest raw materials. Adapted novel tree species could also contribute to enhanced biodiversity in forest ecosystems while continuing to play their multifunctional role.

Project leader Catherine Bastien from the INRA gives details about some of the findings.

NOVELTREE has developed phenotypic and molecular tools which allow future matching of phenotypes with expected climatic conditions. In Southern European regions, the sustainability of forests will depend on the genetic traits for water-use efficiency or pest resistance. In Northern Europe, tree survival and vigour very much depend on the timing of growth in relation to the prevailing climatic conditions. The timing is under strong genetic control, which needs to be taken more into account for breeding.

More information: http://www.noveltree.eu/

FLEXWOOD: improved management in wood value chain

Better logistics in wood supply chains would put a higher value on the economic potential of forestry. Forest researchers in the FLEXWOOD project estimate this potential to be worth a yearly turnover of EUR 100 billion in the EU. Improved logistic systems could boost forest management and EU wood industry’s competitiveness.

FLEXWOOD project leader Barbara Koch from the University of Freiburg in Germany works with geographic information systems (GIS) for efficient data sourcing, gathering and mapping.

Who will benefit most from the IT methods in forestry?

Barbara Koch: The main beneficiaries will be the wood industry, paper mills and sawmills. So far, uncertainties in the supply of raw materials coming from forests are too high. IT can change that. Better standardised data can also be of use for public forest services, where traditions can hamper a more harmonised approach which is a prerequisite for internationalised industries.

What are the new IT tools in forestry?

BK: There is a whole range of new imaging methods — geoinformatic data gathered by planes or drones, laser scanning, and remote sensing for recording growth and wood quality. All these tools deliver parameters for cartographics and the use of economic data. Sawmills and furniture producers can be informed in advance about the quality of the material they will process. Cuts in time will raise quality.

Do these tools fit the forester as a carer for nature?

BK: The old days have gone. Information systems are a matter of fact in today’s forestry. Before going to the woods, the forester is informed through IT-based systems on the status of the lots. iPads are the instruments for mobile and interactive working preferred in modern forestry.

Do differing national attitudes to forests pose obstacles to better exploitation of wood supply chains?

BK: Indeed, many Germans have a romantic look on their forests. They very much appreciate wooden floors in their homes — the so-called ‘parquet-mania’ — but they don’t want the material to be taken from their woods. Each felled tree is a drama in their eyes. In contrast, Scandinavians show a much different behaviour, as many people there earn their living from wood industries. For them, forests are economic treasures. In Southern Europe there is little consciousness on forest values, whereas in Germany, free access to all forests makes them a public space which should remain untouched in people’s minds. Only a few see how many employees and how many public and private forest owners live from the output of forest products by respecting the sustainability of the resources. These are not contradictions. People should be better informed on the resources and their management in forest ecosystems as well as being made aware of the economic systems of the wood industry.

For further information:
http://www.flexwood-eu.org/
EU-funded projects for a sea change in fisheries

Better understanding marine ecosystems and unlocking the economic potential of the oceans are the main goals of EU research into fisheries and aquaculture.

Offering high-value food, both wild stock fisheries management and the cultivation of seafood in aquacultures are important ways of fish farming in both marine and freshwater. ‘Blue research’ in these fields is of great interest as experts predict that by the year 2050, 50% of proteins in human nutrition will need to come from the sea. Much research and innovation is needed to manage these challenges in sustainable and environmentally friendly ways.

FACTS: to eat and be eaten — how small fish swarms are a key component of sea ecosystems

Forage fish — herring, mackerel, sprat and sand eel — nourish themselves on sea plankton, while at the same time they are the feed and prey of bigger fish, such as tuna and cod, as well as seals and birds. As the key link in marine ecosystems, tonnes of small fish swarms can set the scene for other species.

‘Once a prey species becomes extinct, it does not come back,’ says Stefan Neuenfeldt, marine researcher at the National Institute of Aquatic Resources and Marine Ecology in Copenhagen and project coordinator of FACTS. To establish the right balance in marine ecosystems by observing and sustainably managing the sea will be crucial in maintaining wild stock fish and tapping into valuable protein sources from seas.

The FACTS project, joining up 15 marine research institutes and government organisations, is analysing and assessing the basic challenges facing forage fish swarms in different sea environments, conducting case studies from the North, Barents and Baltic Seas to the Gulf of Biscay.

Future, robust marine ecosystems will be vital for food security in Europe and beyond. Maritime experts know that only 10-15% of forage fish are the prey of bigger fish predators — much of small-mesh-fishing production nowadays goes to animal feed for pigs and chicken. To produce 1 kilogram of pork, 10 kilograms of forage fish are needed. Nutritionally, the pork protein is very desirable. But from the biomass and environmental standpoint, the ratio is not optimal for a rapidly growing world population. Many more protein sources should be taken directly from seafood or plant resources.

‘We have to change the strategies,’ says marine expert Neuenfeldt, ‘forage fish could become primary nutrition, too.’

To do this will mean a sea change in fisheries policies in the EU with its traditional fisheries sector. The knowledge gained in the FACTS project can provide the latest tools and assessment studies, and not only for European policy-makers. The scientists have also established close contacts with US researchers in forage fisheries and marine ecosystems. Together they are working towards a science-based international fishery policy, a must in times of changing sea biodiversity caused by climate change and human activities. The knowledge on ecosystem-based management established in the project is also of interest for practitioners — from the UK’s Secretary of State for Environment, Food and Rural Affairs to the fishermen who attended the many workshops provided by the FACTS
More information: http://www.facts-project.eu/

**COCONET: protecting marine areas is a key issue globally**

Geographic information systems (GIS) and specific software are powerful tools for analysing and managing ocean data. The COCONET project is using all these tools to build a network of ‘marine protected areas’ (MPA). These form vital reservoirs of natural capital, helping fuel atmospheric restitution and recovering biospheres.

Professor Ferdinando Boero from Italy, co-ordinator of the COCONET project, manages 22 countries and 39 institutions, ranging from Norway and Denmark to Morocco and Georgia, covering both the Mediterranean and the Black Sea. ‘We need to improve the perception of nature in our culture,’ he says, ‘otherwise nature cannot sustain us.’

The major pressure on the seas comes from coastal urbanisation and industrialisation, while others stem from overfishing and pollution. COCONET’s main concern is that currently only 3% of the oceans are protected. Therefore the project is working on the establishment of MPA both in coastal zones as well as on the high seas.

Pilot projects, case studies and workshops are the experts’ chosen methods. They aim to produce guidelines for the creation of MPA networks in the Mediterranean and Black Sea, including the protection of offshore and deep-sea populations. Another aim of the project is to establish feasibility scenarios for offshore wind farms in the Mediterranean and the Black Sea as a way to produce clean energy in line with MPA.

‘The Mediterranean Sea is very deep and the coastal zones are too touristic to be touched,’ reports Boero on the project’s assessments. At the same time, the professor is optimistic about the seas, because he enjoys the ‘pristine zones’ — untouched areas, pure nature without any impact from humanity. ‘You do not find this on land anymore and these habitats have become rare in Europe,’ he says. His goal is to create a unitary vision for the protection and conservation of the zones by more international efforts. COCONET has made a start.


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**AQUAINNOVA: aquaculture in Europe provides 2.6 million tonnes of seafood and 190,000 jobs**

Fish farming has become an important factor in the provision of seafood in Europe — more than 50% of EU fish consumption today comes from aquacultures inside and outside the Union. Researchers with close links to the sector are predicting a steep rise in this — they believe that aquaculture in 2030 will produce nutritious food with lower environmental footprints than any other type of food production for humans.

To strengthen the capacities of this sector in the EU, the European Commission has set up a platform of all stakeholders around aqua-farming — the European Aquaculture Technology and Innovation Platform, EATiP. In 2012, this platform issued a common strategic research agenda with a vision for 2030 of an annual production of 4.5 million tonnes of sustainable food products worth EUR 14 billion.

Within the FP7-funded project AQUAINNOVA, the forces to achieve this vision were assembled. Integrated multifunctional aqua-farms could be a model for the future: ideally, such a farm combines clean energy production and other services along coastal regions, producing safe and healthy food, and creating jobs and economic opportunities. To enhance knowledge and research, AQUAINNOVA is looking into all aspects of aquaculture and formulating future requirements concerning animal health and welfare, feed issues, technology systems, managing biological life cycles, integration within the environment and socio-economic aspects.

Moreover, the project aims to promote the exploitation, dissemination and communication of results from EU RTD research projects, looking to improve the manner in which the knowledge generated is efficiently and effectively managed, disseminated and transferred.

The project issues technical leaflets summarising former FP projects in aquaculture — to take stock of the knowledge already gained. Cold-water marine fish (salmon) are being studied, as well as shellfish (offshore production), Mediterranean fish (such as sea bass, sole and turbot) and freshwater fish (such as trout and carp) providing opportunities for inland fish farming.

Integration with the environment and society will be future challenges since European aquaculture operates within a commercial globally influenced market. Therefore, governance and competitiveness issues play another role in AQUAINNOVA, as do the export of cutting-edge aquaculture technologies from Europe to other parts of the world. European aquaculture professionals have a vision for a responsible aquaculture value chain, and a detailed action plan will be the next step in taking this further.

For further information:
http://cordis.europa.eu/result/brief/rcn/10215_en.html
http://www.eatip.eu/default.asp?SHORTCUT=100

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research.eu focus magazine — N° 14 — April 2014

RESEARCH IN FP7

researchers, and who are now working on new projects on prototype models for ideal ecosystems and sea biodiversity maps.

More information: http://www.facts-project.eu/
The genomics revolution in European agricultural research

‘Genomics’ is the science of sequencing and studying plant and animal genes. The field could help transform the production of food and other biobased products — and is an increasingly important part of the EU’s research programmes.

Most of us have heard of DNA, the deoxyribonucleic acid that encodes our genes, and the role the latter play in shaping plants and animals — and ultimately ourselves. ‘Genomics’ is the study of these genetic codes, from sequencing their structure to understanding the effects of each gene on the living organism.

Scientists’ ever-improving understanding of genetics has huge potential to benefit agriculture, forestry and fisheries — which, after all, are industries based on biological organisms. For many people, this brings to mind ‘genetically modified organisms’ (GMOs), but this is only a small part of the story, as the rapidly developing field of genomics can inform everything from traditional plant and animal breeding to disease prevention.

What ‘omics’ can do

Basic research in genomics is being joined by other fields often referred to collectively as ‘omics’: the study of proteins and their relation to genes (proteomics), of the RNA that helps translate genes into proteins (transcriptomics), and of the key chemicals involved in metabolism (metabolomics). These are now the basis for a wide range of agricultural applications.

For example, in the field of animal health, genomics, proteomics and metabolomics provide new tools for the identification and understanding of diseases, and better models to track disease epidemics. Omics can also help develop new vaccines and veterinary medicines, or portable test kits to diagnose a range of diseases based on one small sample — very useful for large animal herds. Genome knowledge also means that animals can be bred for disease resistance or other desirable traits.

Among the basic techniques resulting from the rise of genomics are tools for ‘high-throughput molecular analysis’. These can identify the structure of chemicals quickly and cheaply and then build large databases of molecules that can be analysed statistically or compared to find similarities. They can be used in forests and grasslands, for instance, to identify species, varieties or even individual trees that can adapt well to expected changes, stresses and disturbances in their environment. These techniques can also contribute to the preservation of biodiversity — an important factor in protecting plant populations against disease or other threats.

When it comes to crops, new technology has enabled much faster sequencing of genomes, and led to the building of genomics databases for various crop plants. The scientific opportunity now is to use these for practical crop improvement. Of course, genetic modification (GM) research is one way of doing this, but traditional breeding methods — informed by better knowledge of a particular species’ genome — remain very important.

These new molecular and bioinformatic tools also help explore more fully a resource which has often been neglected — the biodiversity available in the wild species related to our crop plants. This biodiversity holds a massive reserve of genetic variation for traits that will be of value in breeding crops for sustainable production systems. With new tools for high-throughput genotyping, proteome and metabolome screens
and high-throughput phenotyping, the search for useful traits can become much more efficient.

**Genomics in action**

According to a 2011 assessment report to the European Commission, ‘Impacts of EU Framework Programmes (2000-2010) and prospects for research and innovation in agriculture, animal health and welfare, and forestry’, genomics have contributed to a wide range of EU-funded research through successive Framework Programmes.

For example, the ‘Metabolomic technology applications for plants, health and outreach’ (META-PHOR) project, funded under FP7, brought together plant metabolomics experts, crop biologists and nutritionists to develop a metabolite-based platform to improve plant breeding for a more varied range of food products with enhanced nutritional quality.

Another example was the FP6 ‘High-quality solanaceous crops for consumers, processors and producers by exploration of natural biodiversity’ (EU-SOL) project, which looked into the two most important vegetable products in the EU, tomatoes and potatoes — members of the Solanaceae family. The project focused on developing high-quality and healthy tomato and potato varieties, looking at the mapping, isolation and characterisation of the genes for health, nutrition, flavour, fragrance, texture, colour and shelf-life traits. In addition, it studied those aspects important to farmers, such as the ability to cope with extremes of temperature and drought — growing issues due to climate change and water shortages — as well as contributing to international genomics initiatives.

For some of our most important crop plants — wheat, barley and rye (called ‘triticeae’) — the role of new genomic and bioinformatics technologies is vital. These plants have genomes of such size and complexity that studying their genomics requires new high-throughput analysis technologies and large bioinformatics databases. The FP7-funded project, ‘Genomics for triticeae improvement’ (TRITICEAEGENOME), set out to push forward the state of the art in triticeae genomics to help breed improved varieties for European agriculture. The project team produced new genome-sequencing tools and bioinformatics resources, such as new databases for wheat and barley genomic information, and software to visualise and compare genetic maps. These tools have already helped to improve breeding programmes for traits such as better yields.

**Animal health and well-being**

The increased use of genomics has led to more and more animal production and breeding projects over the course of FP6 and FP7. As with crop plants, animal breeding can benefit from DNA information, as shown by the FP6 project ‘Cutting-edge genomics for sustainable animal breeding’ (SABRE). The team delivered results in genomics and bioinformatics, numerical genomics and animal well-being, as well as product safety and quality, with papers published in high-quality journals. In the longer term, the outcomes could result in improved animal health and welfare that, in turn, will lead to safer, higher-quality food.

In other projects — such as ‘Pathogenic *Escherichia coli* network’ (PEN) and ‘Studies on the epidemiology, early pathogenesis and control of Porcine Circovirus Diseases’ (PCVD) — the focus on genomics and the genetic basis of epidemiology and pathology has led to new knowledge which can inform new diagnostic tests, vaccines and controls.

Another FP6 project, ‘The mitochondrial genome of the fish parasite *Gyrodactylus salaris* — characterisation and utility’ (MT GENOME G. SALARIS), used genomics to tackle this flatworm parasite in the Atlantic salmon, which is a serious problem in European countries with coasts on the Baltic Sea or North Atlantic.

**What needs to be done**

As these examples show, the genomics revolution opens up opportunities to address animal health and welfare through breeding. The use of genomics, proteomic, metabolomics and other new technologies in understanding diseases and host-pathogen interactions will lead to new vaccines which, in turn, will improve the productive efficiency of agriculture and reduce greenhouse gas emissions. This field of research could even lead to new ‘functional foods’ — with additional nutritional value — and crop varieties with higher yields or greater resistance to disease, drought and climate change.

It is clear, from the way genomics informs other techniques, that it will play an important role in the sustainable production of food and other biobased resources.
Farming, fisheries and forests: the ground the bioeconomy is built on

The bioeconomy is a key element for smart and green growth, contributing to the EU 2020 strategy and two of its flagship initiatives, ‘Innovation Union’ and ‘Resource-efficient Europe’. But the basis for all this is ‘primary production’ — in other words: farming, fishing and forestry.

‘An economy based on biological resources — farming, fishing, forestry — is the oldest economy there is,’ says Máire Geoghegan-Quinn, the European Commissioner for Research. For thousands of years, farmers and foresters have turned plants, soil and sunlight into food, products and services — and this is now set to enter a new era.

‘We have come full circle, and an economy based on biological resources is also the newest economy,’ continues the Commissioner.

But globally, those biological resources on which the bioeconomy is based are under pressure, while countries around the world are putting bioeconomy strategies in place. The EU needs to produce ‘more with less’ and develop smart, sustainable farming, fisheries and aquaculture.

This requires a coherent approach, with coordinated action through the common agricultural policy (CAP), the common fisheries policy (CFP), the Horizon 2020 research programme, European environmental initiatives and regional funds, the ‘Blue Growth’ agenda for the marine sector, and the ‘European innovation partnership on sustainable agriculture’ (EIP-AGRI).

Reflecting this, the European Commission’s bioeconomy strategy — ‘Innovating for Sustainable Growth: A Bioeconomy for Europe’ — was co-signed by five Commissioners, responsible for Research and Innovation, Industry and Entrepreneurship, Agriculture and Rural Development, Environment, and Maritime Affairs and Fisheries.

Sustainable primary production: getting more from less

One of the most important action points identified by the Commission in the strategy is therefore to ‘Provide the knowledge-base for sustainable intensification of primary production’. This means research related to food and non-food biomass — including agricultural and forestry waste — taking into account added value, sustainability, soil fertility and climate mitigation.

In its report on the Commission’s strategy, the EU’s Committee of the Regions (CoR) emphasises that the agricultural sector
could actually become more sustainable by supplying a variety of non-food biobased products — without undermining its primary role in food supply and food security.

‘The bioeconomy encompasses many different policy fields: agricultural, environmental, energy, research, regional affairs, etc.,’ agrees Rogier van der Sande, Member of the Executive Council Province of Zuid-Holland and one of the authors of the CoR report. ‘So it is not only the question of how the bioeconomy fits with other EU policies, but how a truly integrated and holistic approach for the bioeconomy can be put in place: for example, through the CAP we can reach out to the farmers and secure feedstock (plants and waste) — a primary source of production.’

Europe therefore needs a secure and sufficient supply of sustainable and high-quality biobased products sourced from resource-efficient primary production — optimising the supply and demand of biomass, promoting sustainable land use and increasing farming production capacity. For instance, research to develop second- and third-generation biomass can minimise the negative effects of first-generation biomass and thus address the ‘food versus fuel’ debate.

Turning science into such real-world improvements means enhancing knowledge exchange, simplifying European patent law, and improving access to public research results, as well as creating Public-Private Partnerships (PPPs).

‘The PPP on “Biobased Industries Initiatives (PPP-BBI)”, for example, brings together almost 50 European large and small companies, clusters and organisations,’ says Mr van der Sande, ‘all committed to invest in collaborative research, development and demonstration of biobased technologies.’

The EIP-AGRI also aims to foster a competitive and sustainable agriculture and forestry sector that ‘achieves more from less’ — while supporting innovation that is not just technological, but also organisational or social. To achieve this goal, the EIP-AGRI builds bridges and partnerships between the worlds of research and those who use it — such as farmers and businesses. The CoR has recommended that it should be supported by funds from both the CAP and Horizon 2020.

Turning farming into the bioeconomy: a role for regions

Regions will also play a vital role: the bioeconomy could be partly supported through ‘Smart Specialisation Strategies’ under future EU Cohesion Policy. The Commission has proposed that part of the European Regional Development Fund should be reserved for ‘low-carbon economy’ projects, whether in less-developed or richer regions.

‘The bioeconomy’s employment potential can certainly kick-start economies and reinvigorate communities in some of our most peripheral and deprived areas — far-flung islands and coastal areas, agricultural and woodland regions,’ says the Research Commissioner.

The CoR notes that agricultural regions should not only be considered as suppliers of biomass, but that close relations with urban regions are important for establishing technology transfer and knowledge valorisation.

‘I strongly believe that all regions can benefit from the transition towards the bioeconomy if they create a unique profile and act according to it,’ says Mr van der Sande, so they focus on ‘the production of specialised or high-quality biomass, for example, or the smart use of waste materials.’

From raw produce to new products

There should also be a focus on value chains — from the production of raw materials to market-ready products — and products with high added value, say both the Commission and CoR.

Advanced regions in the bioeconomy field could build value chains with less-advanced regions. For example, biorefineries replace fossil resources by renewable ones, creating new sources of income and jobs in agriculture, forestry, fisheries and aquaculture.

‘I see the regions as first executors of the European bioeconomy strategy,’ continues Mr van der Sande. ‘They are the linking pin between regional knowledge institutes, companies, governments and civil society — and are familiar with the available regional value chains and innovative potential.’

He picks out examples such as the way industrial and agricultural resources work together with bio-refineries in the Champagne-Ardenne Picardie Region, or the ‘Biobased Delta’ initiative in the south-west of the Netherlands.

This is perhaps the most promising aspect of the bioeconomy. Linking high-tech of the future with the long years of experience held by farmers, fishermen and foresters — creating new opportunities for some of the poorer regions in Europe.

‘To the non-expert, agriculture, fisheries or forestry represent traditional, centuries-old parts of the economy — so they may seem low-tech,’ concludes Commissioner Geoghegan-Quinn. ‘And that’s what is really exciting about the bioeconomy. While it is rooted in tradition, it also points the way to the future.’
LOOKING FORWARD

Agriculture and the bioeconomy in Horizon 2020

The European Union’s Europe 2020 agenda has the aim of ‘smart, sustainable and inclusive growth’ for the rest of the decade. As part of this strategy, the EU has launched Horizon 2020 — its new research programme for 2014-2020 — which has a new structure based around the goals of ‘excellent science’, ‘innovative industry’ and ‘social challenges’.

With more than EUR 70 billion committed over seven years — a 25% increase in real terms compared to the Seventh Framework Programme (FP7) now ending — it is the biggest EU research programme yet, and one of the largest worldwide. It is the only major programme in the EU’s new budget with an increase in resources — including double the previous EU funding available for agriculture and food research, at more than EUR 4 billion. But a bigger budget is not the only difference.

‘Horizon 2020 is a totally new type of research programme for the EU,’ says Máire Geoghegan-Quinn, European Commissioner for Research, Innovation and Science, ‘and it is designed to deliver results that make a difference in people’s lives.’

Horizon 2020 will champion excellent science, with increased funding for the European Research Council (ERC) and the Marie Skłodowska-Curie actions on researcher training and mobility. But it will also ensure that scientific breakthroughs are translated into socio-economic benefits. For instance, funding under the ‘innovative industry’ heading will provide support to maintain Europe’s lead in biotechnology.

Two new watchwords for the programme aim to make it easier to participate and its results more effective: ‘simplification’ means that the same rules apply in all parts of the programme, while ‘coherence’ means that all EU-level funding for research and innovation will be brought together under one roof, from fundamental research all the way to innovative products, services and processes.

‘We will be less prescriptive about what projects need to do,’ says the research Commissioner, ‘but we will be more demanding about the impacts that projects must have.’

"Horizon 2020 will support the drive for sustainable agriculture, as well as research and innovation in food security and the bioeconomy."

Máire Geoghegan-Quinn, European Commissioner for Research, Innovation and Science
Research for sustainable agriculture and the bioeconomy

‘Horizon 2020 will take a challenge-based approach,’ says Commissioner Geoghegan-Quinn. ‘This is because the challenges facing Europe — whether food and energy security, clean transport, public health or security — cannot be solved by a single field of science or technology, let alone a single sector or organisation.’

Therefore, Horizon 2020 funding under ‘Societal Challenge 2: food security, sustainable agriculture, marine and maritime research and the bioeconomy’ will help secure sufficient supplies of safe, healthy and high-quality food and other biobased products. It will develop productive, sustainable and resource-efficient primary production systems, and foster related ecosystem services and the recovery of biological diversity, while building competitive and low-carbon supply chains. And socio-economic sciences and humanities will not be left out, as we need to understand food markets, rural economies and social aspects of diet, farming and fishing.

Under Societal Challenge 2, support for research is structured into four funding lines:

1. Sustainable agriculture and forestry — aiming for more productive, resource-efficient and resilient agriculture and forestry systems in order to supply sufficient food and biomaterials without compromising natural resources. This will include support for, and guidance from, the ‘European Innovation Partnership for Agricultural Productivity and Sustainability’.

2. Sustainable and competitive agri-food sector for a safe and healthy diet — aiming to meet citizens’ demands for safe, healthy and affordable food, and to make the food and feed industry more sustainable and more competitive.

3. Unlocking the potential of aquatic living resources — has the goal of optimising the contribution to secure food supplies by developing sustainable and environmentally friendly fisheries and competitive European aquaculture in the context of the global economy, and boosting marine innovation through biotechnology to fuel smart ‘blue growth’. This research funding will also be coordinated with the EU Atlantic Strategy.

4. Sustainable and competitive biobased industries — aiming to promote low-carbon, resource-efficient, sustainable and competitive European biobased industries. This will include support for the Public-Private Partnership ‘Biobased Industries Initiative’ (PPP-BBI).

Agriculture and fishing, of course, are often the major industries in poorer regions, so new Structural and Investment Funds — under the remit of EU Cohesion Policy — will work hand in hand with Horizon 2020 to build excellence, based on new concepts such as ‘Twinning’ and ‘Teaming’. These could upgrade research infrastructure or support transnational cooperation between research-intensive regional clusters.

‘In the future, we will be looking for even greater synergies with the new round of Structural Funds post-2014, based on regional “smart specialisation strategies”,’ says the Commissioner. ‘Naturally, clusters will play a major role in creating these synergies.’

All in all, the stage is set for Horizon 2020 to make a huge contribution to science and technological innovation in the fields of agriculture, fisheries and forestry — and, furthermore, to fuel Europe’s transition towards a sustainable biobased economy.

Whether looking out across a landscape shaped by farming, or a seascape that is the dangerous workplace of fishing fleets, it is clear that big changes are on the horizon.

Horizon 2020: a change of approach

New features in the Horizon 2020 research programme include:

The European Innovation Partnership for Agricultural Productivity and Sustainability (EIP-AGRI) brings farmers, researchers and businesses closer together — organised as ‘operational groups’ focusing on individual innovative projects — with a bottom-up approach, to work on new ideas where they are really needed.

Multi-actor projects aim to meet the needs of end-users through demand-led projects with clearly defined roles — from planning to demonstration — for the different participants in a project.

Synergies with other funding programmes

The new Regional Funds under the EU budget for 2014-2020 include more than EUR 80 billion for smart growth through research and innovation. This should help rural enterprises access EU innovation projects and networks. The EU’s common agricultural policy (CAP) will see a new and strengthened innovation section within rural development policy to provide support for EIP-AGRI innovative solutions. The CAP also includes support for young people taking up farming, transfer of research results to agriculture, and exchange of information within the farming community.
ROUND-TABLE DISCUSSION

Lessons for the future and Horizon 2020

Better, safer and healthier diets consisting of less but higher-quality food are the future, according to a panel of four industry experts who met to set out their expectations for the Horizon 2020 funding programme in the field of agriculture, biotechnology, fisheries and food research. Along with future food production challenges of – resources – stress, scarcity and climate change – commodity markets will become more volatile and food prices will rise.

Moderated by economist and journalist Sylvia Schreiber, the roundtable discussion brought together Beate Kettlitz of FoodDrinkEurope; Pekka Pesonen of COPA-COGECA; Courtney Hough of the Federation of European Aquaculture Producers; and Carel du Marchie Sarvaas of EuropaBio. The topic was ‘Lessons for the Future’ and the participants shared their views on how far earlier framework programmes have helped advance the bioeconomy, where it can be done better, and what the industries in the bioeconomy need and expect from research, development and innovation over the coming years.

What are the research priorities?

‘Diet not food’ is the trend according to Beate Kettlitz who wants R&D outcomes to add years to life. ‘The food industry is reformulating all the time, more fibre, less saturated fat, for example. At the same time we are continually seeking new ingredients that can contribute to healthier diets,’ she adds. These are the research drivers — the determinants of healthier diets — such as diet-related diseases, new diet-friendly crops and diet-related processing for nutrient preservation.

For agriculture, Pekka Pesonen echoes this view but adds that competitiveness and communication must be at the core. ‘In agri-food research, the current bottleneck is very much in the field of communication — for example in nutrition, how can we communicate research agendas in an impartial way for Economic Co-operation and Development (OECD) and Food and Agriculture Organization of the United Nations (FAO). He is a member of the Bioeconomy Panel of the European Commission.

Sylvia Schreiber, journalist and economist by training, is working in EU research and innovation policy and its communications since ten years. Before becoming the director of a research and innovation regional EU office in Brussels, she has been the EU correspondent of the newsmagazine Der Spiegel. Currently she is contributing as Brussels correspondent to the monthly magazine “ParisBerlin – Living in Europe”.

Carel du Marchie Sarvaas is director for agricultural biotechnology at EuropaBio — the European Association of Biotechnology Industries. He has many years of experience as a senior government affairs and communications specialist in Brussels, The Hague, and Washington DC. He is an expert in agricultural biotechnology and its interfaces with regulatory, policy, trade and communications issues.

Round-table panellists

Beate Kettlitz is the director for food safety, science and R&D at FoodDrinkEurope, an industrial association representing the European food and drink industries. She has a background in food chemistry and is an expert on technical regulatory matters in the food chain. She is a member of the Bioeconomy Panel of the European Commission.

Pekka Pesonen is secretary general of COPA-COGECA, an agricultural association representing 70 national farm organisations in Europe. He is an agricultural economist and was previously state secretary for the Finnish Ministry of Agriculture and Forestry.

Courtney Hough is general secretary of the Federation of European Aquaculture Producers (FEAP). He has worked in R&D in the food industry, in the international development of fish farming and with international organisations such as the Organisation for Economic Co-operation and Development (OECD) and Food and Agriculture Organization of the United Nations (FAO). He is a member of the Bioeconomy Panel of the European Commission.

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looking forward

How to get more competitive?
A more competitive sector is also vital, says Pesonen, and resource efficiency and co-production methods should be R&D priorities, but increasingly Europe fails to implement research outcomes which are sometimes better exploited elsewhere. ‘Traditional production methods are fine, yet some of our most important R&D-led businesses are packing up and leaving Europe because of the difficulties their research-relevant agendas are facing — this is unacceptable.’

Carel du Marchie Sarvaas points to the potential benefits of GMO crops: increasing productivity, protecting biodiversity, less pesticide and fertiliser, food with fewer toxins. ‘As population and demand rise, the question is how agriculture can operate better and more efficiently — this is the “sustainable intensification” concept that biotech or “GM” crops can help bring about.’

What about more feed for thought?
For Courtney Hough, aquaculture’s priorities depend on who you are talking to — but overall the future availability of suitable feed materials is a common challenge, as are consumer expectations of more processed food products. Since 30 to 40 years ever more protein comes from the seas, with a rising share of aquaculture sources. Domestic aquaculture fish and seafood and imported aquaculture products together already contribute to 50% of the fish and seafood consumption in Europe. Disease is another challenge: ‘Vaccines are needed to prevent disease and that’s one vaccine for each fish species, as they are all different. We face growing challenges from new diseases, particularly with the growth in sea-borne trade.’

Governance and awareness of regulatory frameworks should be of concern to science
However, for the aquaculture industry, governance is the hot issue and should be incorporated in R&D efforts. ‘There’s a lot of biology and engineering but little on the economic or social benefits of innovation choices. What’s missing is uptake by scientists of the implications of, for example, fisheries policy reforms in their R&D efforts,’ says Hough.

This emphasis on the need to link R&D to developments in the evolving socio-economic framework, such as consumer communications and the regulatory environment, proved a common thread in the discussion. As Beate Kettiltz notes: ‘To remove bottlenecks to innovation, scientists must start talking to the regulators.’

Smaller, more efficient, less wasteful?
‘Reliable incomes need scale,’ insists Pekka Pesonen, so small-scale farming is not a solution for feeding everybody. ‘For example, meeting animal welfare targets needs a critical mass. Without larger farms and incomes, how can we encourage more young farmers? ‘Prizes of future agricultural products will be determined by bulks. There can’t be too much prize-spread for higher quality, the bulks will be the reference, states Pesonen.

Courtney Hough agrees: ‘As far as R&D is concerned, again we come back to socio-economic issues of sustainable development and people’s perceptions which must be solved to boost farming and farmers. How can they be competitive? This is the basic issue, without profits that allow reinvestment you cannot survive.’ On the socio-economic side we also see limitations

to citizens so that they can make informed decisions? It’s a real challenge involving controversy and perceptions which can lead to unfair competition, for example with genetically modified organisms (GMOs).’

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to install more fish farms on coastal sites - to install more fish farms on coastal sites - they could on one side conflict with tourism and on the other side they could be too remote to be attractive for young farmer families. Rural development issues including infrastructures also matter in future sea fish farming, says Hough.

“An increase of 30% in crop yields”
Carel Du Marchie Sarvaas highlights the potential efficiencies of biotech crops and estimates yields could be increased by 6% to 30% on the same land area using these technologies. As far it concerns bio-fuel production from crops in big dimensions he sees rising conflicts with land-use for food production. But to his mind, the path of bio-based products, such as bio-plastics or bio-based chemicals, which do not consume huge amounts of land, should be followed intensely to contribute to the competitiveness of the European bioeconomy sector.

Are GM crops the miracle solution?
‘Innovation in plant breeding is essential to feed a growing world population and help to reduce poverty,’ explains Du Marchie Sarvaas. ‘We need to double food production in the developing world. Farmers need access to every possible tool — including biotech crops — that can increase their land productivity.’

However, he takes issue with the accepted wisdom that consumers reject GM-based foods, saying that many polls and questionnaires are misleading. ‘As new products with direct health and consumer benefits are developed […] we may see a shift from a debate fuelled by fears to a more rational discussion on what brings value to people,’ he says.

“This is killing us”
For Pekka Pesonen, the agricultural sector finds it difficult to accept that the EU is cutting GMO applications at the same time as the use of plant protection chemicals for non-GMO alternatives. This leads straight to unfair competition where EU farmers are losing ground to the US and Brazil, among others.

‘This is killing us: the EU has high productivity but this lead is being eroded and we have no response,’ he explains. ‘Even worse, it is producing a drain of agricultural R&D businesses out of the EU, including young research talent.’

We need to decide
‘If we want food security then compromises have to be made,’ says Courtney Hough. ‘At present, we suffer from ‘paralysis by analysis’, we spend too long thinking about things and not doing things. This is one of the reasons technology platforms created their research agendas — to push for decisions.’

But such compromises have to be better explained to citizens, insists Pekka Pesonen. ‘If we were to start explaining GM crops to the general public today, we would do it in a very different way,’ he says. ‘After all, Europeans are adaptable, they relate happily to advances in health and medicines, but for some reason not in foodstuffs. This is a major challenge for food-chain research, we must learn to address people’s perceptions of what comes out of research.’

Beate Kettlitz supports this view and believes better consumer education is desirable as is presenting clear choices.

From lab to lobby?
Courtney Hough finds the lack of political awareness among scientists of EU policies and their implications to be deeply troubling. ‘How to build the bridge between R&D and the surrounding political and regulatory frameworks is a challenge, one that the technology platforms are trying to face,’ he notes. A further issue he highlights is the strong ‘project dependence’ of research today as it follows the funding — leading to career disruption and a lack of specialisation among R&D scientists.

Tailored solutions
For Beate Kettlitz, Horizon 2020 can overcome this by channelling academic knowledge to industrial needs: ‘The emphasis on innovation is new and obliges scientists to take account of regulatory constraints.’

Courtney Hough notes that industry has preferred the more applied SME programmes, based on experiences with FP7. ‘I don’t know how this can change under Horizon 2020 as ‘old habits die hard’; he explains.

Pekka Pesonen says that, so far, R&D has unfortunately offered little real assistance to farmers: ‘We need R&D and innovation that supports implementation and competitiveness — agriculture is no longer a raw material supplier, it now needs tailor-made solutions that take growth and employment into account.’

Courtney Hough agrees and says, ‘The bioeconomy concept gives us the framework conditions for this new viewpoint — this is something we did not have previously, it can help spot synergies.’

How to feed the world?
‘In 2050, with a projected world population of 9 billion, what contribution can Europe make to feeding them all?’ asks Sylvia Schreiber. For aquaculture, Courtney Hough explains it is already highly efficient, the problems are elsewhere: the future availability of feed, above all, but also the effects of climate change on feed, land use and the appearance of new pathogens.

In biotechnology, Carel Du Marchie Sarvaas believes no other industry is better placed to enhance the quality of life, but he insists Europe must ask itself whether it wants to be part of this ‘biotech journey’. There is enough land, says Pekka Pesonen from the EU Farmers association, but better efficiency is needed and the EU urgently needs to act to keep its leading technological position. For the food and drink industry, Beate Kettlitz finds that the trends are global, so we need global regulations, such as Codex Alimentarius, and we need to consider alternative protein sources, and better ingredients to produce better foodstuffs with more added value. She also considers it is essential that safe and good food is affordable for less-favoured consumers. Regulations and industry have to respond to this basic requirement despite the mega-trend towards high-quality products with higher prices.
Useful links and references:

**Horizon 2020 and other funding opportunities available under the Participant Portal:**
http://ec.europa.eu/research/participants/portal/

**DG Research website for the bioeconomy sector:**
http://ec.europa.eu/research/bioeconomy/

**Standing Committee on Agricultural Research:**
http://ec.europa.eu/research/agriculture/scar/

**FACCE Joint Programming Initiative:**
https://www.faccejpi.com/

**HDHL Joint Programming Initiative:**
http://www.healthydietforhealthylife.eu/

**European Innovation Partnership on Agricultural Productivity and Sustainability:**
http://ec.europa.eu/agriculture/eip/

**Public-Private Partnership on Biobased Industries:**
http://biconsortium.eu/

**Smart Specialisation Platform:**
http://s3platform.jrc.ec.europa.eu/home

Relevant publications:

*Information about FP7 projects in the field of agriculture, forestry and fisheries research:*

**Interim catalogue of FP7 projects funded under the KBBE programme (2007-2012):**
http://www.healthydietforhealthylife.eu/

**Catalogue of FP7 projects funded under the Ocean of Tomorrow programme (2010-2013):**

**Marine-related proposals 2007–2010:**

**Bioeconomy ERA-NET actions under FP6 and FP7:**

**Catalogue of EU animal production research projects:**

**Catalogue of EU animal health research projects:**

**Catalogue of EU low-input and organic agricultural research projects:**

**Agricultural Knowledge and Innovation Systems Towards 2020:**
CORDIS is the Community Research & Development Information Service

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Innovation Union:
http://ec.europa.eu/research/innovation-union/index_en.cfm

Horizon2020: