



# 2014 - Special edition **Innovation Catalogue** Selected bioeconomy research projects

© shutterstock.com



This project has received funding from the European Union's Seventh Programme for research, technological development and demonstration under grant agreement No 289699. Contact us at: [commnet@commnet.eu](mailto:commnet@commnet.eu)



# Table of contents

## FORESTRY

3

### SIMWOOD

Researchers from the SIMWOOD project are boosting forest management, sustainable regional development and forestry technologies through case studies and pilot projects in 14 different model regions across Europe. The goal is 'wood mobilisation' in the forest-based bio-economy - a response to needs of the growing forest-based markets with a potential of already more than EUR 600 billion turnover per year.

5

### SUMFOREST

Forests belong to the endangered eco-systems. To mitigate the threats, renewed forest policies and new management are leading priorities. The ERA-net project SUMFOREST proposes appropriate approaches through networking and joint research providing a scientific basis for new forest policies. SUMFOREST also reaches out to Russia and to Mediterranean neighbours.

## BIOTECH

7

### OPTIBIOCAT

Novel eco-friendly bioprocesses for lipsticks, liquids and lotions will advance green cosmetics towards sustainable production methods and more transparency for consumers. The research consortium of OPTIBIOCAT has many SMEs and industry members - ensuring fast transfer of innovative cosmetic products to the beauty industries and markets.

9

### SUCCIPACK

Less waste, more intelligent packs, less carbon footprint, flexible technologies and degradable bioplastics - these are the promises of SUCCIPACK, a project that works on 100% bio-resourced green plastics produced with succinic acid made from wheat, maize or beetroots. The natural SUCCIPACK products will serve the food packaging industry with new films, trays and boxes for food produce such as marinated vegetables, cheese or tofu.

## FOODCHAIN

11

### PicknPack

The PicknPack project gives a glimpse of tomorrow's food factories where most of the packaging works will be done by robots. These will be designed as flexible automated systems adaptive to many different demands of food packaging - with sensors, imaging technologies, processing devices and intelligent networked engineering. The robots will be guided by human creativity to design individual and personalised packs, portion sizes and labels.

13

### FOODINTEGRITY

Researchers, government agencies, labs and industry are cooperating in the FOODINTEGRITY project dealing with the safety, quality and authenticity of Europe's high-value food products. The EU agri-food economy is under constant threat from fraudulently labeled imitations, with the result that consumers and producers are losing trust - and value. The project's goal is to establish a hub of knowledge sharing, cooperation and capacities in the fight against food fraud and to ensure that the food is accurately and authentically labelled.

# RAISING RENEWABLE RESOURCES TO BOOST THE FOREST-BASED BIOECONOMY

## SIMWOOD: How better management responds to growing timber markets



A landscape full of opportunities: more than one third of European territory is covered with forests. Forests have major economic and social implications for the surrounding areas. Many regions are economically dependent on the forest and timber sectors and their related manufacturing and service industries. This is especially the case in northern Europe, where large industrial wood and furniture manufacturers or pulp and paper industries are global players. The European timber industry and wood manufacturing industry, together with pulp and paper production, are one of the largest economic sections of the European bioeconomy. According to data from the Confederation of European Paper Industries (CEPI) and the European Confederation of Woodworking Industries (CEI-BOIS), the forestry/wood industries together with the pulp and paper sector in the European Union employ nearly half a million people, generating turnovers of more than EUR600 billion per year. However, climate change, European fragmentation and a lack of business knowledge in management threaten these economies. At the same time, the demand for wood and wood-derived products such as fibres, biomass and wood-based energy are constantly on the rise. The chemical industry is looking for lignocellulosic raw materials for the production of green plastics and fine chemicals. Car manufacturers and construction companies are currently rediscovering wood as a valuable material. New markets will emerge for the European forest-based economy in the decades to come.

The bundling of resources and economies in the forest-based sector is addressed in the EU-funded SIMWOOD project, which aims at improving forest management, raw material supply and the mobilisation of forestry-based resources as well as of all key stakeholders and actors; the 'wood mobilisation'.

### **Major barriers to unlocking wood production are not only technical**

The European wood-mobilisation problem has been addressed in many studies, projects and initiatives. Traditionally, lack of market access and poor knowledge transfer are seen as the major barriers. However, most of the ongoing rather small initiatives are not likely to fill the gap between future timber supply and demand. More than ever, innovative approaches to overcoming the present barriers to wood mobilisation are required. The main barriers impeding a widespread wood mobilisation in forestry are not only of a technical nature, but also, to a large extent, socioeconomic. They are dependent on the motivation of a multitude of forest owners and other stakeholders.

Therefore, the overall goal of this project is to promote collaborative wood mobilisation in the context of multifunctional forest management across forested European regions. It proposes a novel, integrated approach by addressing the five domains in wood mobilisation - governance, ownership, management, harvesting and functions - at the same time.

### **Mobilisation of forest owners**

The project targets a broad mobilisation of forest owners. It considers all types but has a special focus on private owners, who represent a major opportunity to unlock currently unused wood production.

It responds to major opportunities in growing wood markets by developing novel, integrated wood-mobilisation solutions to overcome socioeconomic and technical barriers: new harvesting technologies should be introduced and new supply chains with robust and fast-growing tree species should be explored. SIMWOOD focuses on multifunctional forest management in order to integrate forest ecosystem functions and to balance the economic, ecological and social impacts of proposed wood-mobilisation measures.

### **Case studies and a regional approach enabling customised actions**

In 14 model regions, case studies in different forestry environments, and with different scenarios, are conducted and presented. As wood mobilisation is more likely to be successful when embedded in collaborative regional initiatives within and beyond the forest-based sector, the project specifically targets regional initiatives, participatory processes and governance related to the sustainable development of forest-dependent regions in Europe.

### **SIMWOOD fosters Regional Learning Laboratories**

To ensure a strong anchoring of the case studies within the regions, Regional Learning Laboratories (RLL) will be established as an integral component of the research process. Linked to existing initiatives in the regions, this forum is intended as a first step towards collaborative learning.

Guided by the project team, the participants obtain fresh findings on the regions' specific status quos, chances and proposed solutions. A forest governance dialogue will be initiated and a common strategy for wood mobilisation enabled.

This project is dealing with wood mobilisation, but, as described in the proposal, it cannot be reduced to this single issue. The





are transferred to stakeholders all over Europe. The approach represents an improved, transferable European research methodology ready to be applied in any other forested region of Europe.

- The profiles of model regions gained through the case studies form a base for mapping the strengths of the sector and for initiating comparative studies.
- Market studies, forestry governance systems and wood usage overviews: a tested set of multifunctional criteria and indicators (solid and soft data) allows integrated wood-mobilisation solutions for European forestry.
- Quality and feedback: the European online information system (MOBILISER) serves as a suitable feedback and control procedure (quality circle) for a pan-European monitoring system of current and future wood mobilisation. It enables mutual learning and the transfer of best practices between regions.
- Impact measurement: the MOBILISER's method of a quality circle allows a stepwise, flexible adaptation of criteria and flexible indicators to gain feedback on the extent of wood mobilisation and its impact on the forest.

#### **Next steps: Advisory Board and eastward expansion**

The project had its kick-off meeting in November 2013. Since then, there has been very good progress in all activities. There is very good interaction and collaboration among the partners. The progress will be thoroughly analysed and discussed at the upcoming SIMWOOD Week in February 2015 in Edinburgh, Scotland. Decisions on the adoption of the work-plan for the upcoming twelve weeks will be taken then at the General Assembly.

The integration of non-partner countries and regions from Eastern Europe is currently underway.

One task, the setting-up of an Advisory Board of the Regions (ABoR) has been postponed and is pending due to the European elections and the new composition of the European Committee of the Regions at the end of 2014. A first meeting of the ABoR should take place during the first quarter of 2015. The ABoR will be composed of forestry experts and non-experts that will use their specific knowledge to advise on the overall progress within the project.



socioeconomic, technical and environmental barriers reflect an increasing societal concern about the forests that cannot be solved by forestry alone. Each of the five domains deals with important topics that influence wood mobilisation or, better still, the mobilisation of forest owners.

The important domain forest governance includes many aspects that impact wood mobilisation or, better still, the sustained change of people's behaviour:

- Policy, incentives and programs,
- Stakeholders, organisations and relationships,
- Communication,
- Context and scale.

#### **A contribution to pan-European up-scaling and monitoring**

SIMWOOD's common research concept proposes an effective, efficient research procedure to carry out comprehensive case studies in each model region, in order to advance the useable knowledge on sustainable wood mobilisation for forest owners. The concept integrates a decentralised, participative, bottom-up research approach with consistent, objective, cross-regional analysis and evaluation. This generates real EU-added value.

- Knowledge is transferred through case studies and pilot projects. To identify, test and validate success factors for mobilisation, case studies and pilot projects are established in each of SIMWOOD's 14 model regions. The experiences with, and results from, these case studies and pilot projects



#### **SIMWOOD**

**Project coordinator:** Bavarian State Institute of Forestry (LWF), Freising, Germany

**Contact:** Roland Schreiber

**Email:** [Roland.Schreiber@lwf.bayern.de](mailto:Roland.Schreiber@lwf.bayern.de)

**Website:** [www.simwood-project.eu](http://www.simwood-project.eu)



# KEEPING AN EYE ON ENDANGERED FOREST ECOSYSTEMS ACROSS EUROPE

## SUMFOREST: A network to align European forest policy and research

Our forests are vast transnational ecosystems playing a crucial global role as 'climate-makers'. At the same time, the forest ecosystem is more and more vulnerable to climate change. A new international study published in Nature Climate Change August 2014, shows a drastic increase in damage from wind, bark beetles, and wildfires to Europe's forests in recent years. 'Disturbances like windthrow and forest fires are part of the natural dynamics of forest ecosystems, and are not, therefore, a catastrophe for the ecosystem as such,' says the principal researcher involved in the study, Rupert Seidl of The University of Agricultural Sciences (BOKU) Vienna, 'However, these disturbances have intensified considerably in recent decades, creating increasing challenges to sustainable management of forest ecosystems.'

Damage caused by forest disturbance has increased continuously over the last 40 years in Europe, reaching 56 million cubic metres of timber per year in the period 2002–10. Scenario analyses for the coming decades also suggest a continuation of this trend. The study estimates that forest

disturbances will increase damage by another million cubic metres of timber every year over the next 20 years.

European forests consist of a wide variety of tree species and ecosystem diversity, with different systems as determinants for different goods and services. They are thus affected more or less severely by climate and land-use changes. Hence, the current forest policy environment in the European Union and the formulation of forest policies is fragmented, complex and sometimes contradictory. There is also a lack of large scale infrastructures and long term experiments.

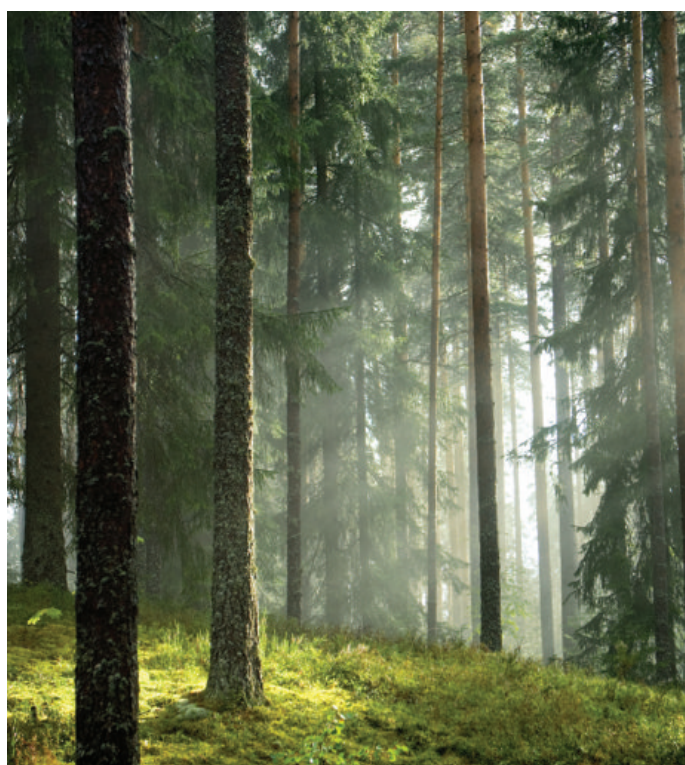
### **Greater impact through cooperation and knowledge exchange**

Sustainable forest management needs new forest leaders. The emergence of specialised and research-oriented European forest centres of excellence, which are competitive on a global scale, should be a goal of future forest policy. As a base, the SUMFOREST project begins by networking. SUMFOREST offers a platform for science-policy dialogue to different forest ministries and forest research institutions in European Member States and associated states, as well as in the Eastern Partnership countries with a view to discussing and to preparing for future challenges, coordinating forest research and creating a European Research Area (ERA) for forestry. SUMFOREST stands for 'Sustainable forest Management; Multifunctional Forestry, European Forest Policy'.

The transnational ERA-NET 'SUMFOREST' aims at reinforcing scientific cooperation for European forests, which will also build new cooperative arrangements with EU neighbourhood regions, such as Russia. This will lead to a reduction in the fragmentation of research activities and will maximise their impact on sustainable forest management and multifunctional forestry, providing a scientific basis for policy decisions in the framework of the Europe 2020 Strategy, and for the new European Forestry Strategy.

### **SUMFOREST goals: Policy Recommendations and Action Plans**

SUMFOREST aims at producing policy recommendations that are suitable for transnational forest policies. One of the project's work packages is dedicated to improving the understanding



of the forest-related policy framework by identifying and characterising the EU Directives and international policies, directives and conventions affecting sustainable forest management and multifunctional forestry.

Additionally, the emerging knowledge-and-information needs of policy makers in the rapidly evolving environmental, social and economic context are identified. Based on the previous two steps, the project also aims at detecting knowledge gaps that need to be addressed by the scientific community.

SUMFOREST will come up with a strategic action plan including a list of priority themes for joint research calls and guidelines for the joint use of pan-European capacities (e.g. large research infrastructures, mobility agreements, and alignment opportunities) related to forest research.

Two joint research calls funded by national funding partners, the second call dedicated to Russia and the Eastern Partnership countries, will, for the first time, prove the ability of the 23 partners and the observers to work together and create a European research network in the forestry area. The forestry-related research, which has so far been very fragmented, will thus be harmonised. Parallel work and redundancies will be avoided and synergies will be generated.

### Reaching out to Russia and the Mediterranean regions

SUMFOREST brings together 23 key actors from 15 European Member States, three associated states and two international institutions. Observers from The Netherlands, Belgium, Bosnia and Herzegovina, Switzerland, Germany and Russia increase the influence and impact of the network.

The network started in January 2014 and has established all its basic implementation steps. A website that aims at spreading knowledge on forest challenges to a wider public has been created as part of the communication plan.

The project just finished a compilation of methodic approaches for gathering and comparing data on forestry-related research projects in all partner countries. Over 100 scientists across Europe took part in a survey on the prioritisation of future policy-related research needs in the forestry area. Together with industry and policy stakeholders, SUMFOREST partners discussed the results during a foresight workshop in Brussels.

Other works are preparing the ground for increased collaboration with the Eastern Partnership countries like Russia and a joint workshop with the ERA-NET Foresterra was held with the aim of harmonising activities and spreading the influence of SUMFOREST toward partners from the Mediterranean region.

### SUMFOREST's next steps: Mapping the European forest research landscape

- Mapping the national and EU forest-policy landscape
- Summarising the national and EU forest-research landscape (infrastructure capacities, staff, research budget, etc.)
- Prioritising research themes for the joint calls, funded by EU Member States
- Establishing relationships with Russia and the Eastern Partnership countries as well as with the Mediterranean forest-research and policy community.



### SUMFOREST

**Project coordinator:** Federal Ministry of Agriculture and Forestry, Austria

**Contact:** Scientific lead, Martin Greimel;  
Communications lead, Inga Bodeker

**Email:** [Martin.Greimel@bmlfuw.gv.at](mailto:Martin.Greimel@bmlfuw.gv.at) /  
[bodeker.sns@slu.se](mailto:bodeker.sns@slu.se)

**Website:** [www.sumforest.org](http://www.sumforest.org)



# BOOSTING GREEN COSMETICS

## OPTIBIOCAT: How optimised biocatalysts drive the beauty industry by introducing eco-friendly cosmetic processes and products

### OPTIBIOCAT: bioprocesses for lipsticks, liquids and lotions

When browsing the supermarket aisles, it becomes apparent that an increasing number of products bear labels such as 'natural', 'organic' or 'bio'. The 'natural' cosmetics market has shown incredible growth in recent years. But this is only the beginning. Consumers have also developed a keen interest in knowing more about the way beauty products like lotions, make-up products and colours, are made. Are the labels transparent enough? Do the artificial substances contain heavy metals which could stress the body and the environment? Or, does the processing of cosmetics demand excessive energy consumption? In future, the beauty industry will need to establish and demonstrate eco-friendly production processes and novel cosmetic ingredients with a lower environmental footprint.

The goal of the OPTIBIOCAT project is to offer alternatives to the chemical processes currently used for the production of cosmetics. Resource-, and energy-efficient biotechnological processes will be introduced in order to create better high-quality products. Novel enzymes capable of catalysing the targeted bioconversions form the basis, as they act as the catalytic drivers. The developed compounds will enable easier emulgation, stabilisation or conservation of cosmetic products. Animal testing will be avoided, and end-consumers can be assured of receiving products that meet eco-friendly production standards.

OPTIBIOCAT's results will directly advance the market development of biocatalysts and bioconversions, contributing to an increase in the number and variety of chemical transformations carried out by enzymes on an industrial scale.

### The products: An impressive portfolio of novel compounds and enzymes for cleaner production processes to boost quality cosmetics

Fungi and bacteria and their genomes are rich resources for the novel enzymes that will be developed by the project. The classic chemical cosmetic production to date comes with many side effects, such as unwanted residues or by-products stemming from the chemical conversion processes. Antioxidants are being used in an increasing number of applications, and their

market is growing at a considerable rate. OPTIBIOCAT intends to make a difference here: the project aims to change the chemical production processes of antioxidants, substituting them with biocatalyst-driven processes.

The advantages are: lower temperatures and fewer steps than are currently used in chemical processes; prevention of unwanted side effects; synthesis of one product instead of a mixture of esters; and the production of clean and high-quality substances for use in the cosmetic or pharmaceutical industry without the need to remove by-products and catalyst residues. Both producers and consumers will benefit from these developments.

The main concept behind the project is the use of the synthetic capabilities of the enzymes feruloyl esterases (FAEs) and glucuronoyl esterases (GEs) to produce antioxidants by enzymatic esterification. An impressive portfolio of novel biocatalysts and antioxidant compounds will be developed.

The biocatalysts will include novel enzymes based on 50 fungal and 500 bacterial esterases, as well as 25 site-directed and 20 best-directed evolved mutants.

Among these, optimised biocatalysts will be selected for the production of biologically active compounds in the rigors of the industrial environment. Their features include higher operational stability and recyclability; higher thermo-resistance and resistance to solvents; higher yield and higher productivity.





**The main targeted biological active compounds will show enhanced antioxidant activity.**

A library of 60 novel compounds belonging to the classes of phenolic fatty esters and phenolic sugar esters fully characterised for their antioxidant activity will complete the project's work.

The innovative ingredients will improve the hydrophilicity or hydrophobicity of the products, providing creams, lotions and make-up products with new properties.

**The end-users: Beauty industry, biotechnology industry and cosmetic consumers**

The works of the project are strongly industry driven. The main end-users belong to the industrial biotechnology and cosmetic sectors. They include those working with industrial enzymes, antioxidants and cosmetics in the manufacturing process. The fact that OPTIBIOCAT's industry partners have related, but mainly different, business activities and target markets in diverse geographical areas, will ensure an efficient exploitation of the project outcomes.

Consumers will see new green cosmetic products with greater eco-friendliness and animal welfare results. Thus, OPTIBIOCAT contributes to the improvement of citizens' quality of life.

**Development stage: Gene mining and bioengineering of basic substances, proof of principal properties, heading towards demonstrators**

The four-year OPTIBIOCAT project began one year ago and is therefore still at the beginning of its work. The main products and results achieved so far include: 1636 putative fungal fatty acid esterases (FAEs), 166 fungal glucuronylesterases (GEs) and 500 bacterial FAE protein sequences identified by genome mining and gene model correction for 54 fungal FAEs and 20 fungal GEs; cloning and recombinant expression of 30 fungal FAEs and 20 fungal GEs; development of a system for directed evolution for at least three FAEs; three different immobilisation systems in development; proof of the synthetic ability of at least five FAEs already available within the consortium; and a synthesis of a new substrate for easily assaying FAE activity.

**The inventors: Academic researchers, SMEs and a large company**

The concept was devised by an international and interdisciplinary consortium composed of 16 partners from eight different countries. The variety of tasks involved a highly skilled partnership including five universities, two research organisations, eight SMEs and a large company.

The coordinator is an academic group with many years experience coordinating national and international research programmes. A full list of tasks and main project ideas is available from the coordinator, Vincenza Faraco from the University of Naples 'Federico II' (see info box).

**Policy impact: Key enabling industrial technologies increase international competitiveness of the EU economy**

OPTIBIOCAT contributes to the objectives of industrial and innovation policy in the EU. It will develop Key Enabling Technologies (KET) in the field of industrial biotechnology, namely reactions catalysed by novel, energy-efficient industrial biocatalysts and processes for their production. The OPTIBIOCAT KETs will improve the EU industrial capacities and will enhance the competitiveness and sustainability of the EU's economy.

**Next steps: Selection of new and active fungal enzymes: patenting of innovative results**

The main steps to be achieved in the next year are: the selection of new fungal enzymes endowed with 50% more activity than those enzymes already available within the consortium; 500 bacterial enzymes expressed and characterised; libraries of at least 150000 evolved mutants of esterases; four immobilised esterases; and a library of hundreds of synthesised compounds.

The expected project outcomes are extremely industry driven, and the exploitation of the results will be in line with the partners' own development strategies.

Patent applications will be made for relevant innovative procedures and products, and the costs will be shared according to percentage ownership.

The consortium policy will be to patent all innovative results that could be exploited with respect to the internal rules regarding intellectual property rights (IPRs).



**OPTIBIOCAT**

Project coordinator: University of Naples 'Federico II', Italy

Contact: Prof. Vincenza Faraco

Email: vfaraco@unina.it

Website: [www.optibiocat.eu](http://www.optibiocat.eu)



# TOMORROW'S FOOD FACTORY COMBINES ROBOTS, SENSORS AND HUMAN CREATIVITY

## PicknPack: Flexible robot systems for automated adaptive packaging and processed food products

The robots are coming... and they will revolutionise the way we pack food! According to technologists, the food factory of the future is packed with intelligent assembly lines, flickering sensor lights, 3D simulation screens, and robot arms that rotate, grip, process and pack. Robots will unload and transport the food, strip down and slice parts, place them and trace them. The goal of the robot team is to pack fruit, vegetables, meat and canned or frozen food in a clean, safe, sustainable and presentable way.

The design of such a food factory lies at the heart of the PicknPack project, which will drive food processing toward intelligent-machine and automated solutions, making European food manufacturers competitive with their counterparts in other parts of the world. The main goal of PicknPack is to make systems flexible and robots adaptable to new products and packages. Robots can do different tasks. PicknPack wants to make the machines adaptable and easily programmable in order to meet versatile needs. The multi-purpose adaptability will be a future advantage to the robot systems users.

One of the hottest topics in this field is robotic grippers. No robot can work effectively without the right product gripper. The part needs to provide sufficient support to pick, transfer and place the product without disrupting the packaging material. Nowadays the gripper is a copy of human or animal body parts. An intelligent translation of human biology – the fingers, arms and shoulders – into a flexible machine solution can fulfill the same functions as a human worker. These developments are called the 'bionic revolution'.

### Urban populations ask for more fresh protein and ready-to-eat food

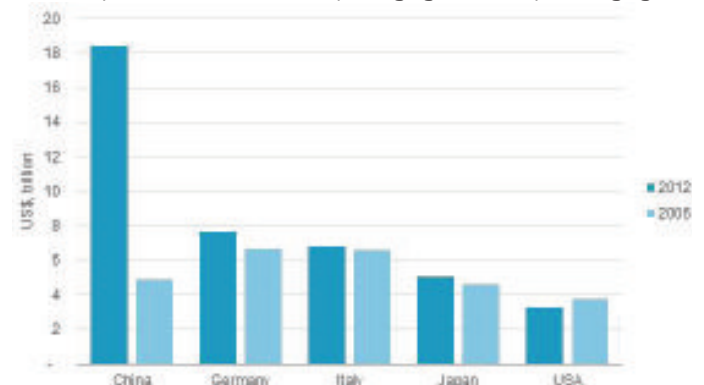
The need for further evolutions in food packaging was demonstrated at several workshops during PicknPack events. A rapidly growing urban global population has to be fed in a different way, as they move from agrarian based consumption to global consumer societies using prepared, convenient, processed and packed produce. This brings rapid changes in food tastes and cultural eating habits. With urbanisation, market observers see significant shifts towards more 'western', protein-rich diets with meat, poultry, fish and dairy consumption rising.

The globalisation of food production led to the widespread adoption of global packaging formats. Early adaptations included slimmer "to-go" bottles, "modern-looking" can formats and stand-up multi-pack pouches. Europeans are faced with an increasingly competitive global market for food and packaging machinery, with China now the largest manufacturer of packaging equipment. Germany is still the largest exporter of packaging manufacturing and packaging

machinery, followed by Italy.

### The products: Individual handling of food packaging in integrated machinery lines

Lifestyle trends toward increased consumption of convenience foods and ready meals will affect food packaging machinery. Packaging will



Growth of food packaging manufacturing volumes in billion dollars per country

need to serve and incorporate various forms and functions: portion control; multi-use packs; twin packs; eat-me-keep-me formats; recloseability; ease of opening; in-pack cooking; microwaveable; oven safe; grill safe... The environmental impact of the packaging must also be considered. The PicknPack project is striving to integrated solutions of adaptive packaging robots and machine lines which can be easily programmed respectively to various needs.

Through data collection and individual branding, food packaging will become more personalised. Brand owners and retailers want to target their marketing efforts at individuals on their databases rather than engage in blanket communication. Personalised packaging is one way of achieving this.

There is significant growth in discounters and retailers with own labels asking for individualised packaging solutions and smaller, more flexible batches. The growth of internet shopping and smaller retail formats highlights the possibility of all retailers potentially requiring slightly different packaging formats or shelf-ready packaging (SRP) formats or sizes. The flexible robot generations of the future will need to answer to the demand of personalized and individualized packs by offering economic, sustainable and flexible solutions by improved packs which at the same time allow to extend shelf-life of the product.

Traceability in food is a priority. Current technology did not stop the food fraud associated with the horsemeat scandal. More developments are likely in this area in the near future. Although there is widespread routine use of metal detection and checkweighing equipment, after the horsemeat scandal brand owners are keener than ever to protect their brands and to guarantee product and pack quality, and are increasingly vigilant about meeting legislative requirements. There is an increasing use of X ray as an alternative to metal detection. It can identify a wider range of smaller contaminants and work around things like foil trays. Leak detection in modern food packing machinery is also in demand, with a wider use of various technologies to catch leaking food packs at the source, as they can lead to food wastage, customer complaints and retailer fines.

The PicknPack concept offers the food industry the benefits of automation – cost reduction, increased hygiene and more efficient use of resources – combined with the unique ability to adapt to the product and batch size at hand. At the centre of the project lie the following functions: quality assessment and sensing; traceability; robotic product handling; adaptable packaging; fresh and processed food production lines; hygienic food handling; and life cycle assessments. The key aspects of the concept will use novel instrumentation for quality control and new data structures for data acquisition and supply-chain management

**The end-users: Manufacturers, food packaging producers, software engineers**

Trends in packaging machinery over recent years show a 4% increase in robot orders from the worldwide food and beverage industry in 2012, reaching almost 4900 ordered units. Easy to use and easy to integrate, robots will open up a wide range of new customer applications.

Machine manufacturers and food manufacturers, particularly in the production of fresh and chilled products, are searching for safer, more intelligent solutions. Lower prices will be the end result of the PicknPack innovations. The introduction of the robotic food factory will lead to the replacement of human workers and to new safety issues, so acceptance and economic studies will be conducted. The breakthrough of the human-machine collaboration is just beginning. Safety continues to be a critical issue, because the worker is working alongside the robot without any protective division. Lightweight robots with integrated vision guidance and better sensor integration are more adaptable to their environment. A natural human interface is needed (e.g. understanding human-like instructions by voice or gesture), and this is to be provided by software engineering.

**Development stage: Proof of concept, Pilot stage**

The envisaged development of tools for large-scale data processing will have an impact on manufacturing efficiency, supply-chain management, product traceability and the ability to respond to a fragmented and volatile market place. The objectives of the demonstration work package are: to demonstrate the viability of the PicknPack results in the food packaging business; to reduce resistance to the adoption of robotics in the food packaging industry; to solicit feedback from potential users of PicknPack project results.

**The inventors: Academics, technologists, industrialists and retailers**

The project is basically an integration process focusing on a range of technologies. Robotic instrumentation, data processing to address the challenge of flexible food assembly and the packaging aspects of instrumentation and laser sealing are breakthroughs in packaging technology. The main goal is to develop a flexible robot-based machinery for a multitude of tasks to meet different demands with an easy-to-handle equipment.

The challenges of PicknPack can only be met by an excellent consortium that works closely with the industry and has expertise in all the related fields. The PicknPack consortium has been set up in such a

way that all the necessary expertise and capabilities are available for the execution of the project and the achievement of these goals. The consortium consists of 14 participants from university and research-and-technology institutions, laboratories, the food manufacturing and packaging industries, and retailers.

**Policy impact: Reducing waste and the carbon footprint, enhancing work safety for human-robot environments**

The project will pursue the Courtauld Commitments:

COURTAULD COMMITMENT 1 (2005-09) focuses on new solutions and technologies to reduce the amount of food and packaging waste.

COURTAULD COMMITMENT 2 (2010-12) built on phase 1 with a major emphasis on food waste but still aims at reducing packaging, plus secondary and tertiary packaging supply-chain waste. It represents a switch in emphasis from just reducing weight to reducing the carbon impact of packaging.

COURTAULD COMMITMENT 3 (2012 to present) is concerned with sustainable growth, saving money and reducing environmental impact through a further reduction in food and drink wastage. It aims at reducing food wastage in the home and in the supply chain via packaging designed to avoid food wastage. It aims at reducing retail and manufacturing waste by preventing and reducing grocery-ingredient and product waste. Improved packaging design should help consumers to reduce waste and make it easier to recycle and to increase recycled content. The goal is to reduce household food and drink wastage by 5% by 2015.

SAFETY STANDARDS: The International Organization for Standardization (ISO) is working on a technical specification for collaboration between humans and industrial robots in order to provide reliable safety.

**Next steps: Dissemination, patenting, studies**

PicknPack technology transfer workshops with industry, retailers, analysts and other stakeholders have been held in order to exploit and maximise the use of the project results in the food packaging industry. Project results that can enhance the economic impact of the project will be patented.

Ensuring follow-up on results by the industry to create new economic activity will be one of the future tasks.

Analysis of the parameters, and the economic viability, of the robotic packaging systems will be conducted, including a study of the impact (technical, social, etc.) of the robotic systems on the food sector. PicknPack ensures the maximum use of the results with committed exploitation plans.



**PICKNPACK**

Project coordinator: Wageningen University and Research Centre, The Netherlands

Contact: Erik Pekkeriet

Email : erikpekkeriet@wur.nl / John.gray-2@manchester.ac.uk

Website: [www.picknpack.eu](http://www.picknpack.eu)





# NATURAL PLASTICS FOR FOOD PACKAGING AT COMPETITIVE PRICES

## How SUCCIPACK will introduce bio-plastics on a large scale

From farm to fork, food packaging plays a crucial role in preserving the quality and safety of food during distribution and storage, but it also generates waste. To stay competitive in the global market, the European food packaging industry needs to combine sustainable food packaging materials with flexible packaging technologies. New, intelligent, sustainable and consumer-oriented solutions have to ensure the safety and quality of food, reduce food losses, and reduce the environmental impact of food packaging. SUCCIPACK intends to demonstrate the industrial applicability of the research, together with a positive impact on the environment, via a Life Cycle Assessment of the whole value chain, carried out according to the International Reference Life Cycle Data System (ILCD) Handbook.

So far, bio-plastic solutions are very promising, but, compared to petroleum-based plastics, they often lack competitiveness as their production costs remain high.

### **Wheat, maize and beetroot as bio-resources to produce polymers**

SUCCIPACK can make a difference, because it will use the platform chemical 'succinic acid', which can be produced on a large scale. However, succinic acid is usually produced by petrochemical routes. Here, the basic idea of the project is to make succinic acid from the glucose fermentation of bio-resources in order to produce an environmentally friendly polymer and 100% bio-resourced packaging. SUCCIPACK's sustainable and intelligent packs will be created from cellulosic material originating from renewable plant biomass sources such as wheat, maize and beetroot.

### **New properties: extending the shelf life of products by new coatings on the plastic films**

This new packaging will be able to replace existing petrochemical-based packaging with the same, or improved, barrier properties in all food industry sectors. Succinic acid is used in the food and beverage industry, primarily as an acidity regulator. Green polybutylene succinate (PBS) is expected

to become an important source of bio-based material for food packaging in the coming years. PBS is produced with monomers obtained by bacterial fermentation: succinic acid and 1,4-butanediol, which can be synthesised from succinic acid. The annual production capacity of bio-based succinic acid is expected to reach 200000 tonnes by 2015. This growth can be attributed to advances in industrial biotechnology that seek to replace petroleum-based chemicals in industrial applications.

The main expected impact of SUCCIPACK is the adoption of active, intelligent and sustainable packaging materials and flexible packaging technologies by the food industry. New product properties such as antimicrobial coating and improved barriers (against gases, vapors and aromas) will be tested.

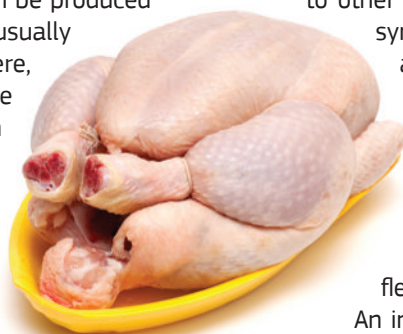
### **The products: green plastic films, trays, pouches and active antimicrobial food packs integrated in existing packaging production lines**

The project supports European industry efforts to introduce bio-based PBS as a new material on the food packaging market.

Its main advantage is that it has complementary properties to other bio-based polymers like polylactic acid. PBS is synthesised by the polycondensation of succinic acid and butanediol, both identified as key 'building blocks' from renewable resources that will be produced on a large scale in the coming years.

SUCCIPACK aims at developing food packaging materials based on green PBS that can be flexibly used by packaging and food industries. An initial stage is the optimisation of the synthesis and compounding of polymer and copolymer grades for industrial plastic transformation processes in order to obtain films, trays and pouches. Tailored packaging functionalities will be obtained by flexible in-line surface treatments to control gas barrier properties and to introduce antimicrobial activity.

SUCCIPACK aims at facilitating the introduction of new packaging materials in existing food packaging production lines. Thus, the use of the new material in existing processes should require only limited investments. To achieve this, dedicated PBS grades and formulations for injection, moulding,



extrusion film blowing, and thermo-forming will be developed.

### **Bio-plastics for Mediterranean cuisine with marinated vegetables and fish preparations but also tofu or seitan**

The flexibility of the technology will be assessed by the participating SMEs, who will be testing the materials in their production lines. Initial tests of the bio-based packaging with ricotta cheese have been completed successfully. Testing with other food products, such as ready-to-eat-vegetables, fish products and preparations as well as vegetable protein products such as tofu, will follow.

### **The end-users: packaging providers, SMEs, the food industry, consumers**

The results of SUCCIPACK's research will be of interest, and potential benefit, to SMEs. A strong participation of SMEs in the project helps to contribute to the realisation of those advantages. The European added value lies in the combination of lower environmental impact with the improved competitiveness of European packaging and food industries, including SMEs.

### **SUCCIPACK outcomes will directly benefit:**

Packaging providers, by creating new packaging material that is easy to produce and demands no difference from the production systems of current and existing packaging; it can be integrated easily into existing production lines;

Food producers, who will use bio-resourced and more sustainable packaging at a competitive price compared to existing packaging, with at least identical, and quite often better, barrier properties than current packaging and that can be used for all kinds of food products;

European consumers, through their use of bio-resourced and sustainable packaging, which is eco-friendly compared to existing solutions.

Development stage: demonstrator and technology assessment of properties and recycling routes, intelligent labels to monitor degradation

The performance and safety of the novel packaging materials are being assessed for selected food products, representative of different food categories and preservation technologies. Special efforts are put into exploring PBS recycling routes, including chemical recycling by monomerisation. An original intelligent labelling function will be added to monitor material degradation and recondensation during shelf life and recycling. The development and demonstration stage is ongoing.

### **The inventors: research organisations, SMEs, large-scale industry**

SUCCIPACK will help European industry, especially SMEs, to strengthen their competitive advantage over the fast expanding, green PBS developments in the US and Asia. The cooperation between seven research organisations, one large industrial player and ten SMEs will facilitate an effective uptake of the results by the food and packaging industry. In total 18 partners are collaborating in the project.

Policy Impact: serving the needs of new bio-based solutions for packaging

Current legislation is pushing new proposals for, and solutions to, packaging that is bio-resourced and/or biodegradable. The new solutions proposed must preserve food integrity, security and quality in the same way that current existing packaging does. SUCCIPACK is affording a new solution to packaging while respecting these different criteria.

The production of succinic acid has a reduced impact on the environment for two main reasons:

(1) It is obtained from glucose fermentation originating from bio-resources such as wheat, maize and beetroot. Its environmental performance will improve in the coming years with the introduction of second-generation glucose from lignocellulosic resources;

(2) Its environmental performance is an improvement on that of lactic acid by the fact that its synthesis involves the consumption of atmospheric CO<sub>2</sub>, the production of succinic acid has a lower carbon footprint than lactic acid.

### **Next steps: promotion towards packaging producers**

After the complete and successful realisation of the demonstration step, the future development will consist in advertising SUCCIPACK packaging to packaging producers. Then, packaging producers will introduce SUCCIPACK packaging into the food industry by acknowledging its advantages over existing packaging solutions.



### **SUCCIPACK**

Project coordinator: ACTIA, France  
Contact: Christophe Cotillon, ACTIA  
Email : C.COTILLON@actia-asso.eu  
Website: www.succipack.eu



# ENSURING THE SAFETY, QUALITY AND AUTHENTICITY OF FOOD

## FOODINTEGRITY: RESEARCH AND TECHNOLOGY FOR ASSURING THE INTEGRITY OF EUROPEAN FOOD AND FIGHTING FOOD FRAUD

Due to the global nature of food supply, consumers rarely know where their food comes from or who supplies it. They have to rely on the product labels to guide them with their purchases. During food incidents such as the horsemeat scandal, when food was mislabelled, consumer confidence suffers. The situation is exacerbated when consumers hear that the problem was not caused by accident or negligence, but by criminally motivated food fraud. This was the case during the olive oil scandal when so-called 'native' olive oils were blended with nut oils or other cheap products in Southern Europe. Lack of consumer confidence in food supply undermines not only the food industry, but the generally trusting European economies and societies.

### **The EU agri-food economy is under constant threat from fraudulently labelled imitations**

The keystone of the EU agri-food economy is the production of added value food products within the confines of a world-class food production and retail system. This added value is under constant threat from fraudulently labelled imitations so there is a need to develop integrated capacities for ensuring the integrity (safety, quality and authenticity) of the food supply. The project FOODINTEGRITY will respond to that need by offering intelligence, counsel, risk-assessment tools, detection technologies, and study results to governments, food analysts, industry and other stakeholders.

The FOODINTEGRITY project will be an international focal point for the harmonisation and exploitation of research and technology aimed at ensuring the integrity of European food.

### **FOODINTEGRITY starts with knowledge sharing**

FOODINTEGRITY will facilitate the sharing of information between stakeholder groups regarding European food integrity. The project will establish a knowledge base comprising: information needed to authenticate food products and ingredients; processes for harmonising and exploiting existing databases; a community of acknowledged experts in food authenticity and scientific opinion on major issues that impact on the ability to detect and prosecute food fraud;

a fit-for-purpose methodology to address stakeholder needs. Moreover, EUR 3 million funding will be procured and used to identify and address research gaps through commissioned pilot projects.

### **The products: Early warning systems for food fraud, rapid detection methods and new verification procedures**

The early identification of potential fraud will be made possible through a self-sustaining early warning system for food fraud. It will be one of the major achievements of the project's research and development arm. This will be followed by the set-up of a self-sustaining worldwide network of stakeholders to ensure maximum uptake of the project's legacy.

There will be scrupulous verification procedures for three key commodities: olive oil, spirit drinks and seafood. This improvement of existing verification procedures will be of great interest to food control and industry stakeholders.

In addition to this, a study in China will assess consumer attitudes in the face of substantial counterfeiting of European food.

Finally, the FOODINTEGRITY project will establish expert food authenticity platforms that will supply independent expert opinion on food authenticity/food fraud to the European Commission, Codex and other national and international bodies

### **The end-users: Government bodies, food analysts, industry and consumers**

The strategic objectives of the FOODINTEGRITY project are threefold. The project will provide Europe with a state-of-the-art, integrated capability for detecting fraud and ensuring the integrity of the food chain. FOODINTEGRITY will provide a sustainable body of expertise that can inform high-level stakeholder platforms on food fraud/authenticity issues and priorities. FOODINTEGRITY will act as a bridge to link previous research activities, assess capability gaps, commission research and identify Horizon 2020 research needs.

The following key outputs will benefit governments and the EU Commission, providing expert networks, food analysts, the food export industry and consumers with:

- A knowledge base for analytical methodology for the EU Commission/DG-SANCO, industry, and food analysts;
- An expert network in which all the users will be all

stakeholders;

- An early warning system that will be exploited commercially to service all stakeholders;
- Rapid detection methods to be implemented in the spirit drinks sector;
- Mass balance approaches as a risk-assessment tool for implementation by government and industry;
- A Chinese consumer-behaviour study, the results of which will inform industry export strategies and risk management.

#### **Development stage: Studies and exploration of methodologies for detection methods and early warning systems**

The FOODINTEGRITY project will achieve these aims by the following means:

Establishing an international network of expertise to inform regulatory and industry stakeholders about food authenticity issues and to inform Horizon 2020 programmers on future research needs;

Consolidating available information on existing datasets, polling available methodology and establishing a tangible and accessible knowledge base that will facilitate data sharing between European stakeholders;

Prioritising research requirements to fill the commodity, method, reference data and intelligence gaps;

Commissioning research and development studies to address the gaps identified;

Developing fit-for-purpose verification methods and systems for the three food commodities that are most significantly affected by adulteration and fraud (olive oil, spirits and seafood);

Investigating consumer attitudes and perceptions regarding food authenticity and traceability, and towards European products, in home and emerging markets (using China as a case study);

Developing and testing an early warning system for use by stakeholders that can identify potential food fraud events;

Providing practical tools and systems that can be integrated into food industry production-and-supply chains for ensuring the integrity of food;

Planning the distribution of knowledge-transfer activities to spread FOODINTEGRITY outputs and initiatives around the food industry, regulatory, enforcement, research and consumer stakeholders.

#### **The inventors: Academics, governments, industry, analytical and testing institutions**

The consortium of the FOODINTEGRITY project joins together 39 partners from 18 EU countries and China.

The partners started the project collaboration in spring 2014. They come from industry, academia, research institutions, government agencies, ministries, and analytical institutions as well as from the fields of certification, testing and communication.

FOODINTEGRITY has been specifically designed to maximise the impact of EU research on food authenticity and quality over the last 20 years. Its main purpose is to consolidate existing

research and to become an international focal point that will drive the research and implementation of a transparent food assurance process for European products.

#### **Policy impact: A valuable body of help and advice for key European agencies fighting food fraud and detecting counterfeiting practices**

FOODINTEGRITY will enhance the value of the European agri-food sector by providing a globally visible food assurance infrastructure endorsed by major stakeholders. Not only will European producers be able to provide authentic, high-quality food from sustainable production, but they will be able to document this authenticity with reference to accepted and transparent paper-trail and analytical methods. This visibility will not only ensure that European food products are protected from counterfeiting and fraud due to state-of-the-art systems and processes, but will also ensure that the legacy of the world's leading food safety and quality systems is preserved and enhanced.

The project will not only assist in driving FOODINTEGRITY as a concept, but it will also provide a valuable body of help and advice to key European agencies on how to formulate a European strategy for ensuring the integrity of the food chain.

The FOODINTEGRITY Network will work to provide regulatory bodies with better access to information on food fraud incidents and ensure more efficient use of the means of detecting fraudulent practices.

#### **Next steps: ensuring the sustainability of the outputs and implementation by industry**

FOODINTEGRITY has, from the start, engaged directly with all the major stakeholders in the project. For example it has liaised closely with the lead DG for food fraud, DG-SANCO. Similarly, organisations representing industry and consumer interests, such as FoodDrinkEurope, are members of the project's advisory board. Such is the interest in the subject that the project has enjoyed excellent stakeholder links. This bodes well for the sustainability of some of the project outputs after the project comes to an end.

In addition, a dedicated work package led by industry is looking at how the project outputs will be implemented by the food industry.

All stakeholders in the food chain are invited to join FOODINTEGRITY!



#### **FOODINTEGRITY**

**Project coordinator:** Food And Environment Research Agency (FERA), York, UK

**Contact:** Paul Brereton, FERA York, UK

**Email:** [FoodIntegrity@fera.gsi.gov.uk](mailto:FoodIntegrity@fera.gsi.gov.uk)

**Website:** [www.foodintegrity.eu](http://www.foodintegrity.eu)