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HORIZON 2020

Research and Innovation to boost growth and jobs in Europe

Issue 2

Research and Innovation

EUROPEAN COMMISSION

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EUROPEAN COMMISSION

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FOREWORD

Horizon 2020 is the European Union's programme for research and innovation with a budget of around €80 billion.

Horizon 2020 has a single overarching objective: the achievement of scientific, technological and societal impact based on excellent research and innovation projects. It aims to achieve economic impact by supporting industrial competitiveness, economic growth and job creation. It aims to achieve societal impact by developing the means to respond effectively, quickly and efficiently to the urgent societal challenges (climate change, loss of biodiversity, ageing, etc.) Europe is faced with.

This brochure, which presents examples of research and innovation projects funded through past EU programmes and constitutes a record of impact, shows that the ambitious goals set for Horizon 2020 are fully justified.

From 2014 to 2020, Horizon 2020 brings all EU research and innovation funding together under a single programme with three key objectives:

- **Excellent Science:** Strengthening the EU's position as world leader in science and attracting the best talents to work together across Europe;
- **Competitive Industries:** Strengthening industrial leadership in innovation to get Europe back on the path to growth and job creation;
- **Better Society:** Innovating to tackle societal challenges shared by all Europeans, across seven key themes: Health, demographic change and well-being; Food security, sustainable agriculture, marine and maritime and inland water research and the bio-economy; Secure, clean and efficient energy; Smart, green and integrated transport; Climate action, environment, resource efficiency and raw materials; Europe in a changing world -inclusive, innovative and reflective societies; and Secure societies – protecting the freedom and security of Europe and its citizens.

By contributing to the European Commission's jobs, growth and investment package, Horizon 2020 provides a direct stimulus to the European economy. It will secure our science and technology base and our industrial competitiveness for future decades, promising a smarter, more sustainable and more inclusive society.

Horizon 2020 funds a stream of high-quality research that will improve lives and serve as the bedrock of new technologies and disruptive innovations. It bridges the gap between research and the market by helping innovative enterprises - with special attention to SMEs - to develop their scientific and technological breakthroughs into viable products and services with real commercial potential. Funding provided by Horizon 2020 is easier to access than previous programmes thanks to a simpler, streamlined structure and a single set of rules.

The European Commission is making every effort to ensure that Horizon 2020 is delivered as efficiently as possible so that researchers and innovators can get on with the job with the minimum of red tape.

The Commission is making major efforts to open the programme up to more participants from across Europe by exploring synergies with funds under the EU's cohesion policy. Horizon 2020 will identify potential centres of excellence in less performing regions and offer them policy advice and support, while EU Structural Funds can be used to upgrade infrastructure and equipment and build capacity.

International cooperation is also a major aim of Horizon 2020, in order to strengthen the EU's excellence and attractiveness in research, to tackle global challenges jointly with partners across the world, and to support the EU's international relations.

Building on the success of previous research framework programmes, this brochure presents a selection of results from EU funded projects that have shown great strides in innovation and will make a positive change in everyday life.

With Horizon 2020, we can achieve even more at European level, bringing our brightest and best people together to really tackle the societal challenges that we face, while making a major contribution to growth and jobs in Europe.

Carlos Moedas,
Commissioner for Research, Innovation
and Science.

Investing in European success

Supporting an **excellent science** base

ECRIN-IA

Creating a single European area for clinical research

Despite efforts to simplify regulations and procedures, most of Europe's investigator-driven clinical trials are conducted at national level. However, the European Clinical Research Infrastructure Network, ECRIN, is helping researchers overcome the hurdles to multinational trials.

The project integrates national clinical research facilities into an EU-wide network, able to provide support in any medical field.

The burden of recruiting and investigating the patients and volunteers, managing the trials, and meeting the legal requirements to ensure they are safely conducted means that often only the best-resourced groups can afford them. But a more appropriate European framework is being developed for researchers thanks to a European project that aims to facilitate multinational clinical studies and trials by providing specialised services and infrastructure.

The European Clinical Research Infrastructures Network (ECRIN) is designed to bridge the patchy organisation of European clinical research and to develop an integrated European Union (EU)-wide clinical research infrastructure. In November 2013 ECRIN was awarded a sustainable ERIC (European Research Infrastructure Consortium) legal status.

"ECRIN is part of the roadmap of the European Strategy Forum on Research Infrastructures (ESFRI) for a pan-European infrastructure designed to support multinational clinical research," says Jacques Demotes, the project coordinator and ECRIN-Eric Director General. "The aim is to make Europe a single area for clinical studies, taking advantage of its population size to access patients, and unlocking latent scientific potential."

Despite various EU-wide efforts to simplify regulations, Europe is still divided in the biomedical area and most investigator-driven clinical trials are conducted at national level. "Fragmentation of the health and legislative systems and funding sources in Europe represent major bottlenecks to multinational collaboration," says Demotes, who works at Institut National de la Santé et de la

Participants

***France** (Coordinator), Austria, Belgium, Czech Republic, Denmark, Finland, Germany, Hungary, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Spain, Sweden, Switzerland, Turkey, United Kingdom*

www.ecrin.org						
FP7	Proj. N°	284395	Total costs	€ 9.7 Mio	EU contribution	€ 8 Mio

Recherche Médicale (INSERM) in Paris. "But people now realise it is better to collaborate than compete. That would give better access to resources and expertise. And with 500 million people and high healthcare standards, Europe is potentially the best place in the world for clinical research."

ECRIN is currently supported by the ECRIN-IA project that involves networks from 23 countries, including an expansion of the consortium to 9 new countries. ECRIN-IA structures the capacity and provides services for multinational clinical trials on rare diseases, medical devices and nutrition. It also develops tools for risk-adapted monitoring and will upgrade data management tools. The four-year project is backed by a €8 million European Commission grant.

ECRIN contributes to the structuring of clinical research capacity both at the national and European levels by developing common standards and tools, and pushing towards better harmonisation of procedures. "Multinational cooperation in clinical trials requires not only generic tools to support study management, but also common procedures and standards," says Demotes. "We would like to develop a common pan-European culture among the clinical research professionals and patient communities."

This requires training and communication policies to build common awareness for a new generation of clinical research professionals. It should, Demotes says, be based on common tools for patient investigation, and require a disease-specific instead of a generic approach.

Demotes says that creating a single area for clinical research in Europe will ensure easy patient recruitment and allow industry to directly access multiple research sites. "It will strengthen the attractiveness of Europe for industry trials through the creation or maintenance of national infrastructures sharing common tools, standards and procedures," he says. "That will build up Europe's scientific competitiveness and improve healthcare", he adds.

OXYEVOL

How plants evolved and how this affects our food supply

An EU-funded project investigating how oxygen in the air millions of years ago might have affected the evolution of plants is making important discoveries. These results could inform our approach to climate change, space exploration and ensuring future food supplies.

Today, scientists in areas as varied as food security, climate change and space exploration need to know more about plants – how they live and grow and what effect environmental conditions can have on them. A key part of understanding plants is knowing how they evolved.

The EU-funded OXYEVOL project is investigating how variations in atmospheric oxygen levels over millions of years might have affected the appearance of new plant species.

"We are exploring the relationship between oxygen concentration and plant evolution," says University College Dublin's Prof. Jennifer McElwain, who received a European Research Council Starting Grant to undertake the project.

OXYEVOL's researchers are looking closely at the plant fossil record and comparing it to the known history of atmospheric oxygen content. Meanwhile, they are also undertaking a series of highly novel 'mini-world' experiments, in which living plant species with diverse evolutionary histories are being exposed to different atmospheric oxygen and carbon dioxide concentrations in a growth chamber.

The most significant result so far is the observation that greater numbers of plant species seem to have originated when atmospheric oxygen concentrations were highest.

We already know that the appearance of complex organisms over a billion years ago was linked to a rise in atmospheric oxygen levels. OXYEVOL's results suggest that oxygen has also been an important evolutionary driver for plants, as important perhaps as it was for the evolution of mammals.

Participants

Ireland *(Coordinator)*

www.ucd.ie/plantpalaeo/oxyevol.html						
FP7	*Proj. N°*	*279962*	*Total costs*	*€ 1.6 Mio*	*EU contribution*	*€ 1.6 Mio*

Broader relevance

OXYEVOL is aimed at helping scientists understand the environment and the living organisms around us. Fundamental research of this type can be driven by the simple desire to know, but throughout history, 'science for science's sake' has also led to important discoveries that can have a real effect on our daily lives.

For example, Prof. McElwain says: "A major challenge for the society of the future will be food production for an ever increasing population. The early results of our experiments could help direct future strategies for enhanced agricultural crops."

Meanwhile, she says, the project's studies of plants in super-elevated CO2 atmospheres will provide critical information on possible feedback effects of vegetation on the climate system, at a time when atmospheric CO2 is rising at the highest rate in the Earth's history.

Finally, OXYEVOL could even have an impact on the cultivation of plants in space.

"The human exploration of planets like Mars," she says, "will require a certain level of self-sufficiency, meaning food production will have to be undertaken during long space flights. Our experiments could help us better understand how to do this."

The project has already made a real contribution in terms of education, providing downloadable course materials on plant science for school-age children, launching a summer programme for teachers, and providing PhD and post-doctoral training for young scientists in cutting edge technology platforms within the research project itself.

McElwain says her ERC grant has enabled her to undertake 'big question' research with the potential to reach people in previously unforeseen ways.

MIMIC

Saving time, saving lives: monitoring cancer treatments

Is a cancer treatment working? Often doctors won't know for months. By developing a new technique that quickly reveals a tumour through its metabolic consumption of glucose, an EU-funded project has reduced that delay. This gives doctors precious time in which to switch to a more effective treatment if necessary – potentially saving lives.

Not all cancer treatments work in every case. Ideally, a tumour might shrink rapidly after a procedure, yet more typically, assessment is complex. Some therapies may kill the cancer without reducing tumour size. Measuring size can present another difficulty, as certain cancers visually blend into their surroundings. Delays in confirmation mean that by the time physicians try the next treatment, the patient may be weaker and the cancer more advanced. Clinicians want to know immediately whether a cancer is affected by a treatment, not by measuring size, but via metabolic indicators. The EU-funded project Imaging Lymphoma developed such an assessment.

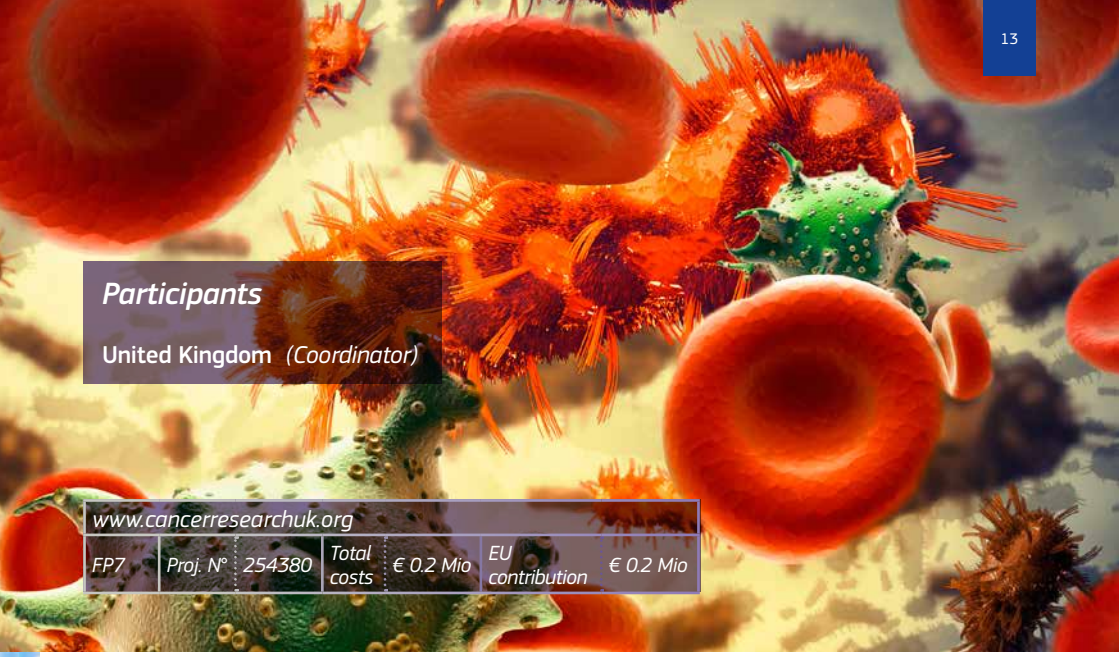
The technique relies on tumours consuming huge amounts of glucose compared to other tissues. Scans of that consumption show tumours as hot spots. If a treatment is working, 'before' and 'after' pictures of the same tumour would show an almost immediate reduction in activity.

Cancer Research UK hosted the project at Cambridge University, in the laboratory of Professor Kevin Brindle. The two-year grant supported the molecular imaging work of senior research associate Tiago Brandão Rodrigues, a former recipient of an EU Marie Curie research fellowship.

Hyperpolarised magnetic resonance

Magnetic Resonance Imaging (MRI) scanners use strong magnetic fields and radiowaves to produce high-resolution views of internal body parts. However, MRIs, while yielding pictures of tissue anatomy and thus indicating the presence of tumours, offer little other information about a tumour's activity.

Rodrigues, who is from Portugal, attacked



Participants

United Kingdom *(Coordinator)*

www.cancerresearchuk.org

FP7	*Proj. N°*	*254380*	*Total costs*	*€ 0.2 Mio*	*EU contribution*	*€ 0.2 Mio*

this challenge with a technique called hyperpolarisation, which can be used to massively increase (by more than 10 000 times) the sensitivity of an MRI scanner. A hyperpolarising machine accomplishes this using extremely low temperatures. A hyperpolarised glucose mix is quickly and harmlessly injected into a patient. Metabolism takes up the glucose but does not affect hyperpolarisation. The state wears off naturally after a few minutes, during which lactate produced from the treated glucose will also be hyperpolarised and becomes highly visible in a magnetic resonance image.

The novel combination of techniques effectively maps glucose consumption, which amounts to showing tumour activity as a brightness map. The first scan establishes a standard. Following successful treatment, the hyperpolarisation scan can be repeated. In a best-case scenario, the second MRI will show reduced glucose consumption at tumour locations, meaning the therapy is killing cancer cells.

The most obvious clinical benefit for patients is precious saved time. Yet the technique is also valuable for fundamental research, as it illustrates how cancers and other tissues operate biochemically.

"This is the first time someone has been able to see complete chemical pathways operating in the body, without an invasive technique, and in real time," says Rodrigues. Cancer is the most important application, though for now limited to testing lymphoma in mice. Currently the work is in the pre-clinical stage, laying the foundation for human trials. The project's developments are also relevant to many other kinds of cancer.

"Right now we're working on brain tumours and pancreatic tumours," Rodrigues continues, "and we will soon begin work on breast cancer."

The technique is also applicable to neurodegenerative diseases. Establishing the chemical pathways of disease is a step towards finding treatments.

For his work, the International Society of Magnetic Resonance in Medicine awarded Rodrigues its British Chapter Prize. The research was also published in the prestigious journal Nature Medicine.

Investing in European success

Building **industrial leadership** in Europe

MATERIALISE

3D printing technology in the clinic and on the catwalk

Dutch designer Iris van Herpen is famous for her use of 3D printing technology in her fashion collections, designs printed by Belgian company Materialise. These designs are made using cutting-edge applications of 3D printing, which are creating a small revolution in fashion and design in the same way that they have already revolutionised medicine.

Active in both revolutions is Materialise, a pioneer in Additive Manufacturing (AM) software and solutions, more commonly known as 3D printing, a company which has grown in size from a university spin-off to a multinational thanks in part to EU research funding.

Speaking about working with Iris van Herpen Sven Hermans, Account Manager for Materialise said: "We have worked with Iris van Herpen to realise a total of eleven dresses to date. Each dress works to push the boundaries of what is possible with 3D printing technologies and materials. Together with her, we have created not only the world's first fully flexible 3D printed dress, but in 2013 we also produced a hybrid creation incorporating unique, transparent bone-like structures produced with Mammoth Stereolithography.

Thanks to 3D printing the dresses are seamless and made to measure. It is exciting working with Iris van Herpen to bring her complex geometrical designs to life; 3D printing does what no other form of clothing manufacture can do when complex shapes need to be created quickly and as one piece."

How it works

For Iris van Herpen, the design is first created in collaboration with an architect skilled in computer design, with collaborations having already taken place with Daniel Widrig, Isaïe Bloch, and Julia Koerner. The design is then optimised for 3D printing using Materialise's software under guidance of experts within the company. At this point flaws or obstacles are fixed before work continues and the design was sent to the printer. The design

Participants

Belgium *(Coordinator), Austria, Denmark, Finland, France, Germany, Greece, Italy, Netherlands, Portugal, United Kingdom*

www.materialise.com						
FP4	Proj. N°	BRRT985051	Total costs	€ 1.2 Mio	EU contribution	€ 1.2 Mio

is then brought to life using a 3D printer, such as Materialise's own Mammoth Stereolithography machines, which creates objects layer by layer. In the case of the Mammoth machines, UV lasers scan the design into a liquid resin that hardens wherever the laser hits and 3D objects, up to 2 meters in length, gradually come to life.

Materialise supported by EU

Materialise was founded as a rapid prototyping service bureau in 1990 by their current CEO Wilfried Vancraen. As the company evolved, it also began developing software and providing surgeons with highly accurate models of their patients' anatomy after performing CT or MR scans and transforming that information into printable models. The models have improved both diagnosis and surgical planning considerably. Through on-going research and a strong focus on innovation supported by the European Union, the applications of the technology continued to evolve and diversify and are today accessible to the medical, automotive, design and consumer market segments. The company is now a technological leader in 3D printing, employing more than 1000 people, boosting European industry and creating jobs. Wilfried Vancraen, founder and CEO of Materialise, said: "Materialise would never have become what it is without European backing. It gave a small company the chance to do longer-term development."

3D printing has long been an important prototyping technology, producing one-off models of newly designed products efficiently by giving feedback to the development engineers and designers in the design stages. Future of 3D printing in design and manufacturing 3D printing has evolved and is being increasingly recognised as a complete manufacturing technology.

The advantages and potential of the technology are multiple: stock is not necessary as you print what you need, the time-to-market is very short (once you make a design modification to a 3D file you can continue producing), the technology allows for mass-customisation and the creation of many unique products. You can also make very complex shapes that are impossible with conventional techniques.

RAPIDCOOL

Save energy: commercial cooler chills beverage in just 50 seconds!

Commercial fridges and freezers keep food fresh and beverages cool. They are vital to modern commerce but troublesome for the environment. European industrial researchers set out to turn these power-hungry machines into a green technology of the future. The trademarked 'V-Tex' cooler they developed can chill a standard-sized beverage in under a minute. This is super-fast and means small quantities can be chilled on demand, saving huge amounts of energy.

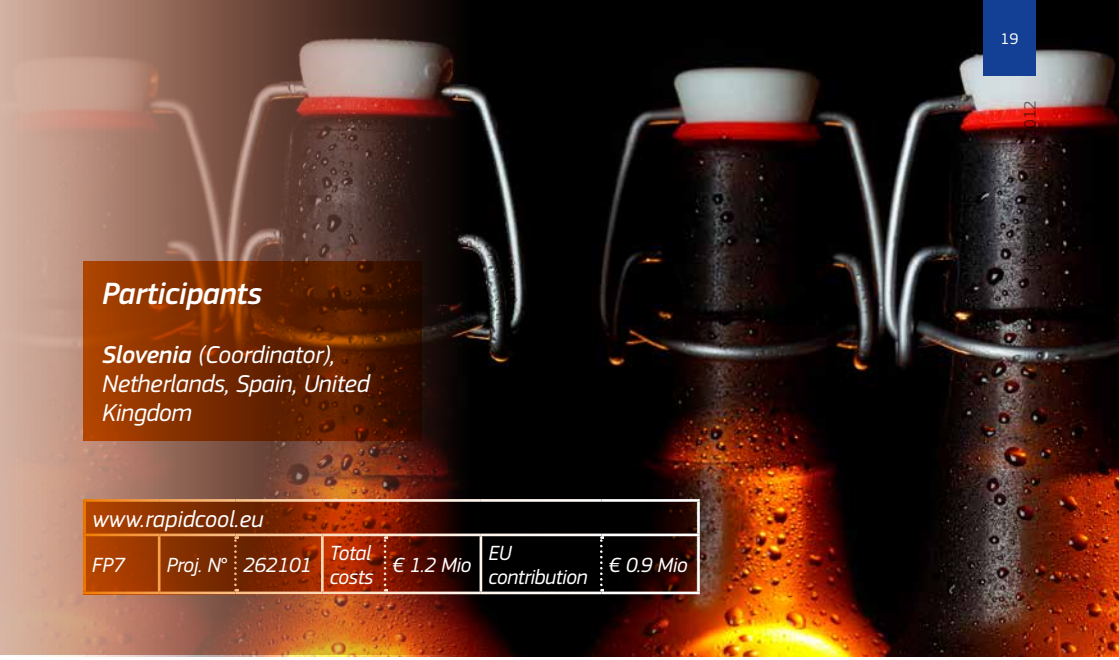
Supermarkets, convenience stores, service stations, restaurants, hotels … wherever you find people with money to spend, you will find fridges, freezers and chilled vending machines filled with goods to sell. They are convenient and essential for preserving and serving food and beverages that meet the expectations of customers and relevant authorities. But there is a big problem with these handy machines – they consume massive amounts of power.

That whirring sound coming from the corner of a convenience store is a drinks fridge struggling to cool itself when the door is continually opened or new stock is added that needs chilling. The vending machines and open refrigerated cabinets in supermarkets are also working overtime trying to keep their contents at recommended temperatures to preserve the quality.

Combined, commercial refrigerator/freezers like these are estimated to consume 85 TWh (terawatt hours) of electricity every year. That is roughly equivalent to the total yearly output of eight or nine late-generation nuclear power plants. This places a huge burden on power grids and the environment, and does not appear to be slowing.

The fact is, advances in refrigeration technology have struggled to offset the increasing number of units being introduced each year. For example, vending machine sales in Member States are expected to continue growing, from 126 000 in 2009 to 200 000 in 2020.

This is where the EU-funded RapidCool project stepped in to tackle the challenge by developing a new technology for cooling beverages efficiently and rapidly which



Participants

Slovenia *(Coordinator), Netherlands, Spain, United Kingdom*

www.rapidcool.eu						
FP7	Proj. N°	262101	Total costs	€ 1.2 Mio	EU contribution	€ 0.9 Mio

has attracted considerable interest from beverage-makers. The team realised the key to reversing this trend would be to break away from the traditional approach.

RapidCool focused on the problem of chilling small quantities on demand, taking away the need for heavily stocked chillers to run continuously in order to supply 'cooled' drinks during business hours. The technology developed delivers considerable energy savings while, at the same time, keeps up with growing consumer demand.

Game-changing green technology like this could have a direct impact on the EU's 2020 commitment to reducing energy use and greenhouse gas emissions while improving overall energy security, the team suggests.

Up to 90% energy saving

RapidCool developed an autonomous, modular-cooling apparatus for cooling drink cans and bottles from room temperature to around 4°C in some 50 seconds. The project's trademarked V-Tex technology recorded energy savings of 80-90% compared with open-front commercial refrigerators. Their modular system is easy to clean (and thus to meet hygiene standards), simple to use, and has enhanced safety functions.

Although designed to work as a stand-alone unit, the cooling chamber can also be integrated into existing self-serve chillers. This has proved a real innovation, according to the team, and could potentially replace most, if not all, open-cabinet-style drinks fridges used around the world.

With V-Tex, notes the team, you get a cold drink every time with considerable reductions in energy use, therefore V-Tex not only matches but surpasses existing consumer expectations. It meets a broad spectrum of end-user requirements and has thus gained considerable interest from major corporations, including a leading global distributor of beer. New innovations within the industry only come about every twenty years or so and white goods industry leaders are considering V-Tex as revolutionary as when the microwave oven was first introduced to the world, and have indeed dubbed V-Tex as a 'reverse microwave'.

FALLWATCH

New fall detection device to improve safety of elderly people

For elderly people living on their own, or even in individual rooms in residential care homes, falls are an ever-present risk. A fall can leave them incapacitated or unconscious, unable to summon emergency help. Being able to call for immediate medical help after a fall is critical. Every minute matters. In some cases, it can literally be a matter of life or death.

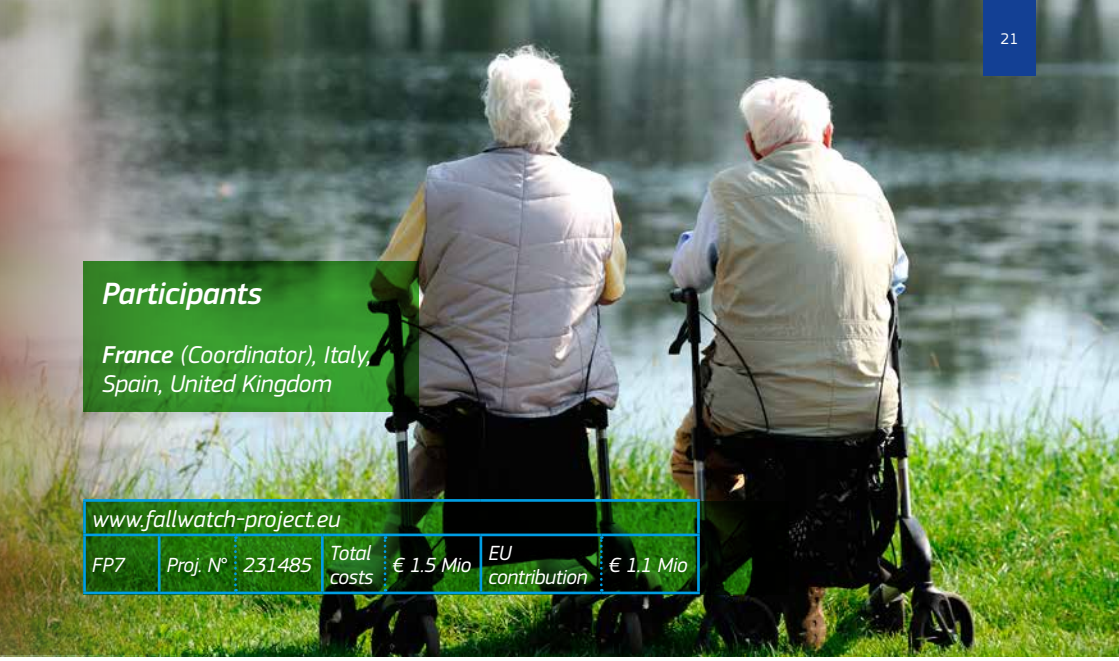
As a result of the work of a European Union (EU)-funded research project, called FALLWATCH, a solution to the problem has now been developed - the world's first miniaturised, wearable, telecommunicating fall detection device. Triangular in shape, measuring just 5cm along each side and less than 2cm thick, the 'patch'-type device is attached to the user's skin with special medical adhesive film and can be worn for up to 2 weeks before changing it. It thus overcomes one of the crucial disadvantages of existing alarm systems, namely the fact that they need to be worn as bracelets or as necklaces and are all too often left unworn on the bedside table.

Functioning fully automatically, the miniature device provides the answer to another drawback of existing systems. Many of them depend on the user being able to press the alert button manually - something they may be incapable of after the fall.

Already in commercial production under the name Vigi'Fall®, and put into operation by Europ Assistance, one of the FALLWATCH consortium members, the new device marks a major step forward in ensuring that help arrives as promptly as possible after a fall. Nor do its capabilities stop there. As a result of being attached directly to the skin, the patch is able to monitor the patient's heartbeat and relay this information to the medical team as well.

Backed by €1.1 million funding provided under the European Union's 7th Research Framework Programme (FP7), the two-and-a-half year FALLWATCH project was based on an original concept developed by a doctor working in the emergency department of the Cochin Hospital in Paris, Dr Jean-Eric Lundy.

In close cooperation with Professor Norbert Noury, of University Joseph Fourier, Grenoble,



Participants

France *(Coordinator), Italy, Spain, United Kingdom*

www.fallwatch-project.eu						
FP7	*Proj. N°*	*231485*	*Total costs*	*€ 1.5 Mio*	*EU contribution*	*€ 1.1 Mio*

Dr Lundy was inspired to invent a new fall-alert device after regularly treating elderly patients following a fall, many of whom had been lying undiscovered for hours and sometimes days.

The device is based on a sensor system. One sensor is contained in the patch worn by the user, while other sensors are wirelessly attached to walls around the house, much like domestic burglar alarm sensors. If the user suffers a fall, the wall-mounted sensors detect the sudden and unusual movement and wirelessly relay a signal to a central control box, also located within the house.

The control box connects automatically, via telephone, to a call centre. In order to distinguish between real falls and false alarms, the device is equipped with data-fusion software which allows it to analyse the nature of the fall, including the speed of the fall and the resulting posture of the patient. As a second line of verification, operators at the call centre attempt to contact the user by telephone. If no reply is received to this call, a medical rescue team is immediately mobilised.

Working on Professor Noury's and Dr Lundy's initial concept, the key challenges for the FALLWATCH consortium were to miniaturise the system and to make it easily wearable. For this reason, the consortium drew together partners with a broad range of highly specialised skills ranging from personal security to microelectronics, from biomaterials to nanotechnology and from medical adhesives to high performance military and aerospace batteries.

Wearable even in the shower and charged by high-powered, long-lasting batteries, the patch – once in place on the skin - can simply be forgotten about, with the user secure in the knowledge that, should a fall occur, help will be instantly on its way.

SOMABAT

Novel method to produce cleaner and safer batteries

A range of safety and environmental issues are associated with lithium-ion batteries, including the potential risk of sudden explosions when used in electric vehicles and the disposal of toxic materials. To address these issues, the European Union (EU)-funded SOMABAT project developed innovative strategies for producing lithium-polymer batteries that are cleaner, safer and better performing than conventional lithium-ion batteries.

The research team demonstrated the feasibility of using recyclable and synthetic materials for the battery components (anodes, cathodes and electrolytes) in the lithium-polymer batteries - advanced type of batteries in which the electrolyte is a solid, polymer composite rather than a liquid.

These novel synthetic and recyclable materials were produced using new synthesis and processing methods that enabled the research team, led by the Spanish Instituto Tecnológico de la Energía, to engineer their various properties.

The project team also investigated new ways of recycling the different components of the battery and performed life cycle analyses. "We conducted a complete analysis, from the raw materials to the final battery, to try to identify the processes that are not environmentally friendly, nor sustainable," explains SOMABAT project manager Leire Zubizarreta of the Instituto Tecnológico de la Energía in Spain.

SOMABAT researchers developed the first cell prototypes in the first half of the project. "We are finalising the tests with these first prototypes in order to develop, as a second step, improved 2nd generation prototype cells," says Zubizarreta. The prototype battery cells contain the optimised materials produced during the project, leading to battery cells that have optimal energy density and a long lifetime.

Using the new synthetic and recyclable materials significantly reduces the likelihood of the battery short circuiting, overcharging or over-discharging as well as the impact following critical failures such as crushing

Participants

Spain *(Coordinator), Austria, Belgium, Denmark, France, Germany, Luxembourg, Romania, Ukraine*

www.somabat.eu						
FP7	Proj. N°	266090	Total costs	€ 5 Mio	EU contribution	€ 3.7 Mio

the battery. Moreover, potential risks from exposure to fire are lowered as well. Such improvements in safety are particularly relevant to manufacturers of electric vehicles. "Users must feel that they are safe in these vehicles. It is well-known that some explosions could be related to the lithium batteries of electric cars. However, batteries that do not contain free liquids are safer," explains Zubizarreta.

Cost is also a key issue to greater electric vehicle uptake, and safer batteries are expected to reduce the amount of resources spent on ensuring a vehicle's safety.

The SOMABAT research team involved experts in the field and experts with complementary R&D expertise across Europe. The European component of the project was integral to its success. "For developing an innovative product such as lithium-polymer batteries you need experts in different areas – materials, batteries integration and simulation, battery management system and recycling. These experts are very difficult to find in one country," adds Zubizarreta.

In order to facilitate comparisons of the batteries developed and between these and conventional batteries the project team created a model to predict the behaviour of the battery cells. In addition, the recycling companies involved in the project collected data from the materials and battery developers to assess which are the best processes for recycling.

Industrial involvement was crucial for the project. The industrial partners are now investigating ways to make the new batteries commercially available. Moreover, several SMEs are working in a range of areas, such as battery management system development, cell integration and recycling.

Last but not least, the project benefitted from a high participation of women in a variety of roles as well as part of the coordination team. "This fact illustrates the encouraging increase in the number of women in a business that is largely dominated by men," concludes Zubizarreta.

COELUX®

Switch on sunligh for a brighter future

COELUX®, a new technology developed by an Italian start-up in the framework of EU-funded project, recreates the physical and optical effects of natural light by reproducing indoors the diffusion and transmission of sunlight through the atmosphere.

The system reproduces the effect of natural sunlight, a clear blue sky and its infinite space. One distinct "sun" bursts down into the scene through the openings. Objects shine in the exceptional light and cast sharp and blue-toned shadows, coloured by the sky.

In the CoeLux integrated ceiling, a myriad of nano-particles faithfully reproduce Rayleigh scattering, a natural phenomenon present in our atmosphere, creating the celestial blue we see in our sky. CoeLux has created a complex optical system, coupled to a set of illuminators, recreating a unique sun source that follows visitors in their movements just as the real sun does. The experience of the CoeLux sun and sky is further enhanced by the resulting perception of infinite space; the feeling you have when you lay on the ground and look up into a bright blue that goes on forever and ever.

This phenomenon has been proven to have a positive impact on comfort and wellbeing experienced in indoor and underground environments.

By incorporating the latest energy-saving LED technology with a sophisticated optical system using nanostructured materials into a high-tech window system, COELUX® therefore not only has the potential to be a revolutionary innovation for the contemporary lighting and design industry, but also to boost the well-being of citizens in Europe and beyond.

Growing recognition of the impact of light on health and well-being

Warm, artificial, direct sunlight illuminates and enhances objects, making domestic and public spaces more attractive and welcoming. The play of light and shadow gives them volume and shape and alters the way people react and interact with their surroundings.

Participants

***Italy** (Coordinator), Austria, Lithuania, Romania, Spain, Switzerland*

www.coelux.com

FP7	*Proj. N°*	*262539*	*Total costs*	*€ 1.6 Mio*	*EU contribution*	*€ 1.2 Mio*

The COELUX® light diffusing technology will benefit anyone who does not get enough sunshine. It has been designed with a focus on the healthcare industry, but can be applied many other environments. Those working or living in underground spaces, either due to space restrictions or as a way of coping with extreme climates, are set to benefit greatly from the technology. The same is true of residents of countries located furthest from the equator, who often experience very little natural light for long periods during the year.
How it works

COELUX® combines three key elements: the latest LED technology which reproduces the sunlight's spectrum; a sophisticated optical system that creates the sensation of the distance between the sky and the sun; and nanostructured materials, only a few millimetres thick, which recreate the entire Rayleigh scattering process which occurs in the atmosphere. These elements are incorporated into a "high-tech window" system offering an enormous range of opportunities and design possibilities for indoor architectural spaces.

Product development and commercialisation

The COELUX research project, together with the follow-up demonstration project "DEEPLITE", received about €2.5 million in EU-funding under the FP7. Prof. Di Trapani, founder and CEO of the start-up, confirms that "the EU funding was essential to allow us to invest in research and development and cover demonstration costs. It was invaluable in helping to convince other investors to join and support us. We strongly encourage other SMEs to apply for EU funding as it opens windows of opportunity."

The COELUX technology is already on the market and constitutes an important business opportunity for the project partners and network of European enterprises which will be involved in its production, demonstration and implementation. The global lighting market is estimated to be worth €58 billion and this game-changing innovation is well positioned to take a share of that market, boosting European competitiveness and creating jobs, contributing even further to the wellbeing of European citizens.

Investing in European success

Tackling societal challenges for a **better society**

APO-DECIDE

At the threshold of personalised cancer treatment

New tumour profiling methods developed by EU-funded researchers aim to help doctors adjust treatments for colorectal cancer to the specific needs of an individual patient. The methods are currently at the trial stage and could be in use in clinics within three years.

Worldwide, colorectal cancer is responsible for around seven hundred thousand deaths each year, according to the WHO. Decision making on treatment in the clinic currently depends largely on factors such as how much the tumour has grown and the age of a patient. As each patient is unique, the success of such treatments is largely unpredictable. To replace the 'one size fits all' approach, the APO-DECIDE project, led by Professor Jochen Prehn at the Royal College of Surgeons in Ireland, is developing new clinical decision-making tools to help doctors categorise patients on the basis of their individual biological and genetic characteristics.

"There are numerous genes and pathways altered in human cancers, and no single patient is like another," says Prof. Prehn. "We now need to employ computational approaches to understand the complexity of genes and protein altered in individual cancer patients." Such computational approaches use mathematics to explore how proteins interact with each other, and how these interactions produce a biological, clinically relevant effect. The crux of cancer treatment lies with apoptosis, or programmed cell death. Current chemotherapy treatments increase apoptosis in the tumour or nudge the cells along the path to self-destruction. Using the APO-DECIDE system, an oncologist will be able work out the dose of apoptosis promoter required on an individual basis, meaning the patient receives a dose best suited to treat their tumour right from the start.

"The tools developed in APO-DECIDE will deliver the right chemotherapy to the right patient at the right time, hence avoiding unnecessary side-effects and accelerating access to better treatments," says Prof. Prehn.

Understanding the patient – and the tumour

Tumours can become unresponsive to chemotherapy. They are made of different

Participants

Ireland *(Coordinator), France, Germany, Israel, United Kingdom*

www.apodecide.eu

FP7	*Proj. N°*	*306021*	*Total costs*	*€ 3.9 Mio*	*EU contribution*	*€ 3 Mio*

types of cells and many develop resistance to chemotherapy drugs. For example, for one particular type of colorectal cancer, up to 50-60 % of patients prove unresponsive to a commonly used treatment regime.

To get the treatment right, APO-DECIDE is not only considering differences between patients – it is also analysing the cancer at a molecular level. This information will then be used to identify weak spots in the tumour that can then be targeted with new drugs that reprogramme tumour cells to respond to treatment.

This strategy avoids a situation in which a patient who is not responsive to the drugs has to endure harsh chemotherapy treatment needlessly. Analysing the chemical pathways (strings of biochemical reactions) in a tumour prior to therapy and knowing that the tumour will be responsive also reduces uncertainty, and means that scarce resources can be used to maximum benefit.

Extending the technology to other cancers

Prof. Prehn says researchers now widely accept that the chemical roots of a tumour resistance to treatment are shared by most cancer cell types. As common pathways are responsible for a tumour not responding to chemotherapy drugs, the results of APO-DECIDE may be helpful in the battle against many other types of cancer.

And the results will help to do more than personalise treatment. As well as using knowledge about the biochemical pathway to re-sensitise cancer cells, APO-DECIDE is also making the reverse possible. A new process can de-sensitise normal cells vulnerable to damage during chemotherapy, such as bone marrow stem cells. Trials are underway, involving 600 patients. If they go as expected, doctors could be using the APO-DECIDE technology in clinics in three years' time.

APO-DECIDE's research stands to provide real benefits for cancer patients. Prof. Prehn summarises the impact on clinical practice: "Such a systems-wide model approach can deliver a new generation of patient analysis tools that inform oncologists and health care providers about the type and dosage of chemotherapy that is best suited for individual patients."

BIOCOPAC

Tomato skin - a natural lining for metal cans

The packaging industry is under pressure to improve its environmental performance and become more competitive. In addition, food packaging safety has come under more scrutiny. An innovative EU-funded project has addressed all three of these objectives at once, with a straightforward yet potentially revolutionary solution using tomato skins.

The BIOCOPAC project developed a novel bio-lacquer for metal food packaging designed to meet current demand for sustainable production and safety. The project team expects their innovation will increase the competitiveness of the EU's metal cans industry, cut unnecessary waste and better protect consumers. The natural lacquer was developed from tomato skins, a by-product that food processors treat mainly as waste. The lacquer can be applied to the internal and external surfaces of cans used for foodstuffs.

Three challenges for Europe

From the very beginning, the BIOCOPAC team sought to address three key challenges facing Europe: unnecessary waste, consumer safety and industrial competitiveness. The project has made important steps forward in all three areas.

"With regards to the environmental challenge, the development of new food contact packaging bio-lacquers from the by-products of tomato processing will promote the exploitation of waste by reusing it," explains project coordinator Angela Montanari of Stazione Sperimentale per L'industria delle Conserve Alimentari in Italy. "The bio-lacquer will increase the sustainability of metal cans, promoting their recyclability and decreasing the environmental impact of packaging and waste."

Food safety was another key priority. Natural bio-lacquers designed specifically for food contact packaging should help ensure that there is no chance that food will be contaminated by the migration of synthetic substances from the packaging to the product. The innovation is expected to provide can manufacturers with an environmentally friendly solution they can offer to food processors worldwide.

Participants

Italy *(Coordinator), Czech Republic, France, Greece, Liechtenstein, Spain*

www.biocopac.eu/en

FP7	*Proj. N°*	*286446*	*Total costs*	*€ 1 Mio*	*EU contribution*	*€ 0.8 Mio*

"In the past few years, growing demand for environmentally friendly products has encouraged the development of the biopolymer and bioplastics sectors," says Montanari. She says the BIOCOPAC solution will provide packagers with an alternative to Bisphenol A, a carbon-based compound used to coat many food and beverage cans. Bisphenol A has come under public scrutiny over claims it affects health.

The new BIOCOPAC lacquer will also be trademarked, making its use immediately recognisable to consumers.

Good use of waste

BIOCOPAC's research began with an analysis of tomato waste, and continued with the development of an experimental method of extracting cutin (a waxy 'polymer') from tomato peel. "We then studied different formulations of bio-lacquers suitable for metallic materials," says Montanari.

Extracting raw cutin from tomato peel proved highly successful in terms of yield and applicability on an industrial scale. Different formulations of lacquer containing from 10 % to 100 % cutin were prepared and studied to find the ideal formulation for the final bio-lacquer.

"The more promising formulations were then applied to different metallic substrates – tin plate, tin-free steel and aluminium," continues Montanari. "Properties such as the degree of curing, appearance and sterilisation resistance were measured. Compliance with National and European regulations were verified."

From the initial lacquered sheets, the team was able to produce two- and three-piece cans, crown corks and caps. In every case, the lacquer demonstrated an excellent performance, she says. "This experience has been wonderful," says Montanari. "It has given me the possibility to work in the EU with European partners in a very professional way, and at the international level. Moreover, this project has provided me with an opportunity to see and understand that collaboration between industries and research centres can lead to positive results, even in low-technology sectors such as metallic packaging."

PERFORMANCE

3D food printing technology to help people with dysphagia

Food is an important part of any person's well-being. However, for people who might suffer from chewing or swallowing difficulties, eating a nutritious and balanced diet that is also appealing could be a challenge.

For example, most retirement homes serve nondescript mashes to people with chewing problems every day, for every meal. Loss of appetite and malnutrition is a common and critical consequence and those affected begin to dread rather than look forward to their next meal.

To improve the situation, the European Union (EU) funded the project PERFORMANCE which has been working on making personalised meal plans an affordable option for any person affected by mastication (chewing) or swallowing problems. To achieve this goal, the project team is developing an innovative form of 3D printing. "Basically we want to industrialise a concept we refer to as smoothfood," says Matthias Kück, PERFORMANCE project coordinator.

Kück is the owner of the German food company Biozoon, which develops innovative food products. In 2010, Biozoon co-founded the smoothfood - concept for people with impaired mastication or swallowing ability.

The idea behind smoothfood is to deconstruct a dish to the point where it is safe to ingest even without chewing and then reconstruct it into its traditional form using a plant-based solidifying agent. For instance, a carrot would be cooked, puréed and strained, mixed with the solidifying agent and then poured into a carrot-shaped silicon mould. "The look and taste of the end product matches the original food item," explains Kück. "But the texture is soft and gel-like. It dissolves easily in the mouth so that it is safe to eat for people with mastication or swallowing problems," he adds.

Now PERFORMANCE has brought together ten private partners and four research institutions to develop a 3D printing process, where the printing head would deposit the liquid food layer by layer and thus create the individual

Participants

Germany *(Coordinator), Austria, Denmark, Italy, Netherlands*

www.performance-fp7.eu

FP7	*Proj. N°*	*312092*	*Total costs*	*€ 4 Mio*	*EU contribution*	*€ 3 Mio*

food items, which would be held together by a solidifying agent currently in development.

PERFORMANCE technology would mean a significant step forward from the mash of blended foods typically served. “We found that because the meals are more appealing in terms of appearance and taste, people look forward to eating again,” mentions Kück. In addition, nutritional supplements can be directly mixed in to accommodate individuals’ specific dietary requirements. However, the preparation of these handmade smoothfood meals requires more time than simple mashes. Some care facilities have therefore been reluctant or unable to introduce smoothfood into their meal plans. “This is why PERFORMANCE wants to bring the smoothfood concept to the next level and industrialise it. Only then we can also make it available for home care”, says Kück.

Once completed, Kück feels sure PERFORMANCE will be well received. Already now over 1,000 retirement homes in Germany have implemented the smoothfood concept. For larger nursing homes, PERFORMANCE would make their job easier. “This is the time to focus our efforts on projects like PERFORMANCE,” says Kück. “Because demographic development means the number of people who would benefit from its outcome is growing larger and it is up to us to ensure they get the quality of life they deserve,” he concludes.

WESENSEIT

Putting the citizen at the centre of flood prevention

Social media has broken down barriers between information providers and consumers. An EU-funded project is seeking to capitalise on this by enabling citizens to monitor and report on their own environment, and thus become the first line of defence against flooding.

Recent events in Europe have once again underlined the human and economic costs of flooding. The number of people who will be affected is predicted to double over the next 70 years, with annual damages increasing up to EUR 15bn. Europe's ability to mitigate and adapt to the effects of climate change is therefore one of the challenges of our time.
The EU-funded WeSenseIt project aimed of strengthening Europe's response to water management and to directly engage with citizens and communities on the front line to monitor water levels.

A citizen's observatory

When it comes to floods, citizens have often been thought of as mere consumers of information; potential threat warnings would trickle down from authorities to those living in areas at risk. But couldn't citizens and communities be given a more active role and become part of the solution to better water management?

This is why WeSenseIt developed the concept of a citizen-based water observatory, where communities form part of a two-way information chain. The advent of mobile phones and social media means that citizens can be fully active in capturing, evaluating and communicating valuable information on water levels, creating cost efficiencies and acting as early warning systems for over-stretched local authorities.

"There are so many rivers that it would be impossible to monitor them all with sensors," explains project coordinator Fabio Ciravegna from the University of Sheffield in the UK. "Not all necessary information can be captured with sensors. Moreover, cost is a major issue: often the cost of the communication infrastructure to transmit data dwarves the cost of the sensors themselves."

Citizens – such as volunteer flood wardens in the UK or civil protection volunteers in Italy

Participants

United Kingdom *(Coordinator), Italy, Netherlands, Poland, Spain, Switzerland*

www.wesenseit.eu

FP7	*Proj. N°*	*308429*	*Total costs*	*€ 7 Mio*	*EU contribution*	*€ 5.4 Mio*

– can help by taking measurements using new apps currently being developed by the project and sending information and images by phone.

They can also help by reading existing sensors and sending authorities the data via mobile apps. The collected data will be made available through the Global Earth Observation System of Systems (GEOSS). New technologies and approaches to water management are being tested and validated in three EU countries: the UK, the Netherlands and Italy. "For example, we are developing mobile apps so that flood wardens in the UK can walk along river banks, and take tagged pictures if think there is something of concern," says Prof Ciravegna. "We have already received hundreds of pictures from Doncaster."

In Italy, an evaluation involving some 500 volunteers simulating a flood in the city of Vicenza was already completed. The project has also been asked to provide assistance in supporting the city of Vicenza during the evacuation of some 50 000 people, in order to allow an unexploded World War Two bomb to be diffused.

Sensing business opportunities

WeSenseIt tool, which carries out large scale social media analysis to help emergency responders during large scale floods, found an application in monitoring large city wide events in England. Events involving over 600 000 citizens were monitored with excellent results, reflecting the breadth of potential applications of this kind.

Overall, the citizen observatory concept will provide solid infrastructure within which SMEs can create and test applications and services at low cost, in a project setting that will give them high visibility.

"The long term impact of this project will be the development of a new way of understanding the environment; that it is something shared by us all," says Prof Ciravegna. "The real lesson here is that it is not just about monitoring emergencies, when everyone wants to help; monitoring and measuring on a daily basis enables preparation, prevention and understanding. I think, with this project, we are getting there."

CHESS

Making museums a mobile, personalised and interactive experience

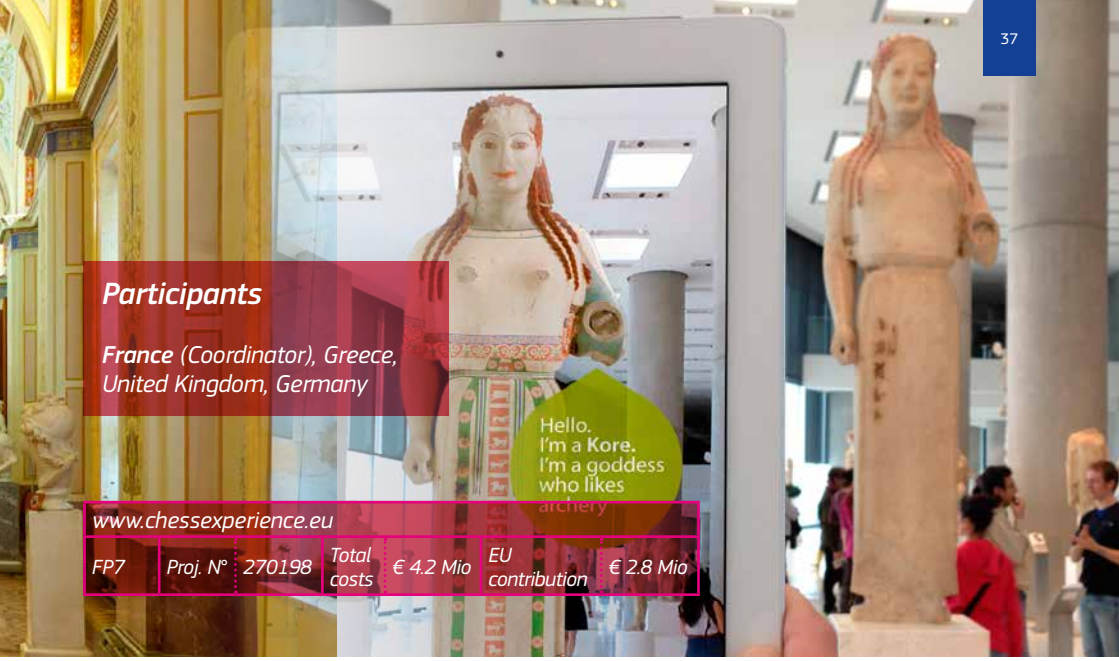
Visitors to museums across Europe may soon be able to shape their own cultural experience before even leaving home or getting on a plane thanks to an innovation which uses mobile, augmented reality and geo-localisation technologies to turn an ordinary museum visit into a personal, interactive storytelling experience.

A consortium of academic, industrial and cultural organisations across Europe have used EU investment to create and develop mobile technology that will enable visitors to enhance their cultural experience by participating in a personal, tailored itinerary and interactive experience created by museum sites. The CHESS App, for smartphones and tablets, aims to bring the past alive, at users' fingertips, making culture and history engaging and available to everyone.

"A guided tour is a linear experience where the visitor remains rather passive. With CHESS the museum visit is likened to a gaming experience, making visitors active and engaged in cultural heritage. Visitors are informed but also challenged, teased and entertained. This is vital to hold the interest of visitors, in particular the younger generations who are immersed in games on their consoles, smartphones and tablets" said Dr Olivier Balet from DIGINEXT, the French company coordinating the project.

How it works

The 'Cultural-Heritage Experiences through Socio-personal interactions and Storytelling' (CHESS) project is supported by more than €2.8 million in EU-funding and aims to make the museum experience an attractive, more engaging one for all. CHESS has built a number of innovative tools that achieve just this by focusing on the visitors and allowing cultural heritage sites to easily create and publish experiences tailor-made for them. With the online 'CHESS visitor survey', people can register their interests, likes and dislikes. This tool permits museums to create surveys with single- or multiple-choice and to link answers with a persona, i.e. a character representative of the visitor's profile. The 'CHESS authoring tool' then enables non-IT professionals such as museum curators and staff to easily develop multi-path dynamic storylines integrated with advanced multimedia content such as mobile games, and augmented reality.



Participants

France *(Coordinator), Greece, United Kingdom, Germany*

www.chessexperience.eu

FP7	*Proj. N°*	*270198*	*Total costs*	*€ 4.2 Mio*	*EU contribution*	*€ 2.8 Mio*

Finally, the 'Storytelling engine' runs the story according to the paths defined but also personalises and dynamically adapts the story being told according to the visitors' individual choices, updating their profile right through the course of the story.

Unlike traditional museum guides, the CHESS App tells each visitor a dedicated story, focused on the exhibits most relevant to their interests and mood, with as few or many details as preferred. Stories can be enhanced with multimedia, 3D and 'augmented reality' games and in some cases objects talk and invite visitors to interact with them.

When leaving the museum, visitors will find souvenirs, i.e. a video or a picture, from their own story on the museum website, thereby having a personal memory to share with family and friends. According to Dr Maria Roussou of the University of Athens, CHESS has the potential to revolutionise the way in which we behave and engage when visiting museums.

"CHESS aims to enhance and personalise the experience of each and every visitor by creating a tailored experience, aimed at an individual's likes, hobbies and interests. By directing the visitor to the artefacts of most interest to him or her, and offering interactive content such as quizzes or games, we can greatly enhance the user experience. Not only is this of benefit to the user, but also to the museums, which want their visitors to have the best experience possible and to keep coming back," said Professor Yannis Ioannidis of the University of Athens.

Product Development and commercialisation

The CHESS product was trialled at the Acropolis Museum in Athens, Greece and at the Cité de l'Espace Park in Toulouse, France, over six months in 2013 to great success.

Dr Balet said "Without EU funds this initiative would have not been possible. It really required the combination of world-class expertise in multiple domains, which is generally not available at a national level in Europe. With 55,000 museums worldwide, the opportunities for growth are on a global level".

TABULA RASA

EU-funded project to take biometric security systems to the next level

In recent years we have seen face, voice and fingerprint identification software move from Sci-Fi films into real life affordable devices, such as smartphones and tablets. The TABULA RASA consortium, which is supported by EU research and innovation investment, has set out to identify just how well this new software works, in particular against the growing phenomenon of "spoofing" i.e. using everyday materials such as make-up, photographs and voice recordings to subvert or directly attack biometric systems.

Biometric systems have proven to be one of the most efficient security solutions available today. However, some biometric sensor vulnerabilities still exist, including some which have been well publicised in the International media. The TABULA RASA consortium worked together to develop countermeasures accordingly and ultimately a new breed of safer biometric systems.

In the course of its research, TABULA RASA hosted a "Spoofing Challenge," which invited researchers from around the world to develop attack plans and to attempt to deceive various biometric systems. Participants showed that there are many different and creative ways to attack the systems. The most innovative attack proposed during this challenge used make-up to spoof a 2D face recognition system and succeeded in being recognised as the victim. Other contestants used well-known attacks such as photographs, masks or fake fingerprints ("gummy fingers") to successfully spoof the systems.

Dr Sébastien Marcel, Coordinator of the TABULA RASA project, said: "It would have been impossible to conduct such large scale research and to collaborate with so many EU partners without the investment from the European Union. As well as more secure devices and information, the improved software will offer quicker logins to IT equipment and faster more accurate border control and passport verification. We believe that many different organisations will be interested in our research including technology companies, post offices, banks, manufacturers of mobile devices or online service providers."

Participants

Switzerland *(Coordinator), China, Finland, France, Italy, Spain, United Kingdom*

www.tabularasa-euproject.org

FP7	*Proj. N°*	*257289*	*Total costs*	*€ 5.6 Mio*	*EU contribution*	*€ 4 Mio*

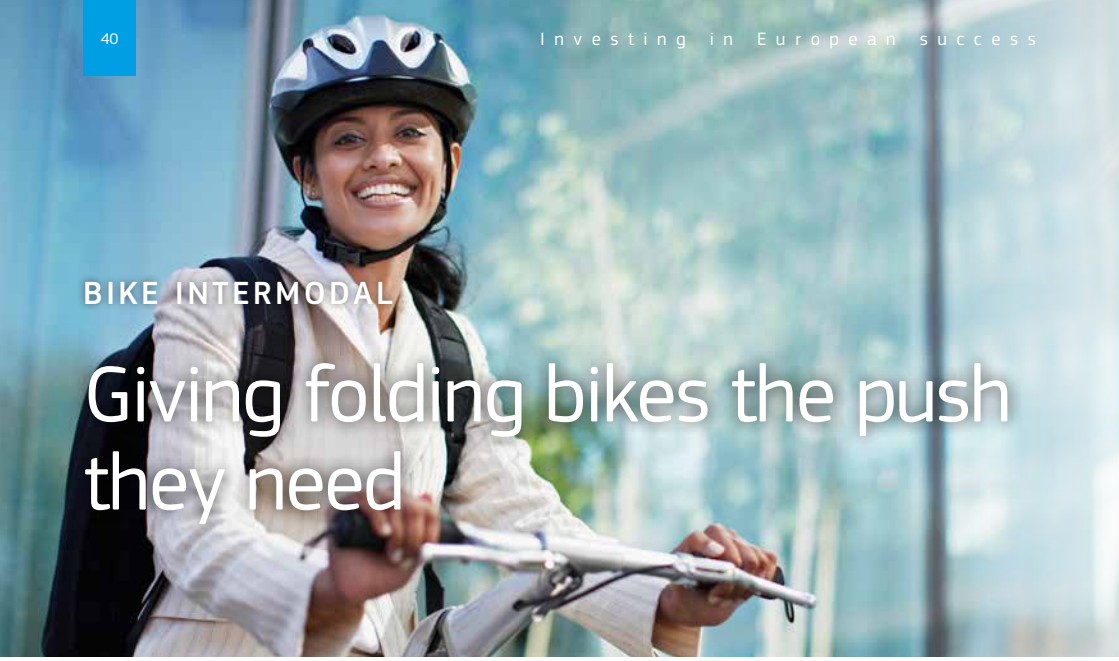
The EU invested €4.4 million in the TABULA RASA project, which was used alongside a €1.6 million investment by the Consortium to carry out the extensive research and testing involved.

The TABULA RASA research project has made an extensive list of possible spoofing attacks, evaluated the vulnerability of biometric systems to such attacks, and developed countermeasures that for instance detect signs of "liveness" (e.g. blinking, perspiration) and improve security of biometric systems. TABULA RASA has already transferred five of these countermeasures to companies. This in-depth knowledge about spoofing attacks allows European industries to maintain their leadership by improving conception of future spoofing proof biometric sensors, thus opening up the huge potential of biometric technology.

Ryan Heath European Commission spokesman responsible for the Digital Agenda and digital technologies said; "Many of us keep personal and confidential information on our smartphones and tablets, so we need to have confidence that we can fully rely on these biometric tools. The European Commission is pleased with TABULA RASA's success so far. No other research group has achieved such advanced results in biometrics to date."

TABULA RASA has shown that the most accurate biometric systems are also often the most vulnerable to spoofing. Moreover, the anti-spoofing measures decrease the vulnerability of the biometric systems to spoofing attacks but at the price of increased False Reject Rates (FRR) and that current countermeasures don't generalize yet to unseen attacks or to new realization of know attacks.

In the light of research findings, TABULA RASA advocates for more research in the field of biometric spoofing and anti-spoofing for instance in the context of border control or access control (mobile and cloud biometric computing).



BIKE INTERMODAL

Giving folding bikes the push they need

For the past few decades, the promise of folding bikes has been true urban mobility. They were supposed to become the perfect supplement to public transportation – light and small enough to be taken on any bus, metro or car, even during rush hour.

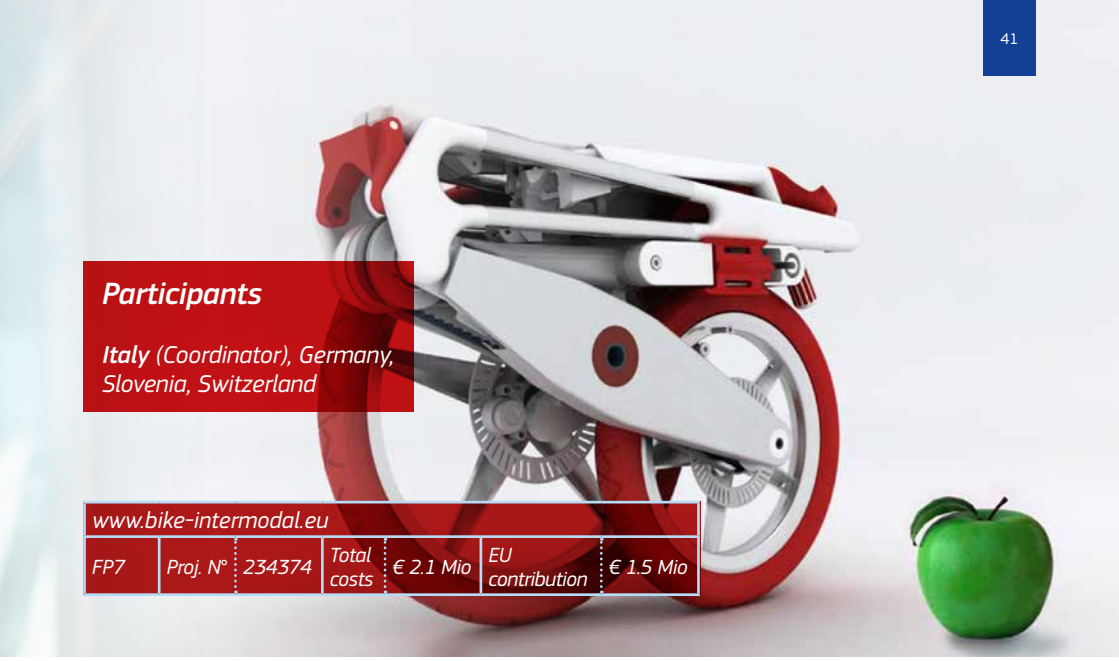
But current models have an average weight of 12-15 kg and an average size of 150 litres when collapsed (around the same as a large suitcase). The weight can become an issue and, for many people, the size is not quite compact enough. Not to mention that the collapsed bike's volume actually exceeds the baggage limit on buses or metros in some cities.

Enter BIKE INTERMODAL, a project funded by the European Union (EU). 'Intermodal' means combining two or more modes of transportation, in this case, cycling with public commuting or driving. "The challenge for bike research is that the bicycle industry is relatively poor and extremely fragmented," says BIKE INTERMODAL scientific coordinator, Alessandro Belli of Tecnologie Urbane in Italy.

Single producers rarely have the resources to fund innovative research. In addition, because the same manufacturers make folding bikes and full-size bikes, the two formats share components and standards. "This makes progress difficult. However, thanks to the EU funding we received, we had the freedom we needed to really push folding bikes forward," explains Belli.

The seven-partner project team realised that significantly improving folding bikes would mean rethinking both their technology as well as their design. "The key to our success was switching to the technologies and supply chain of the automotive industry," points out Belli, "defining a new, open "development platform", alternative to the existing one based on bicycle industry, and perfect to profit from many technologic advancements for decades to come.

The frame of the new cycle is a combination of die-cast magnesium parts, held together by tensioning cables to create a very rigid, hinged structure, which collapses and



Participants

Italy *(Coordinator), Germany, Slovenia, Switzerland*

www.bike-intermodal.eu						
FP7	Proj. N°	234374	Total costs	€ 2.1 Mio	EU contribution	€ 1.5 Mio

unfolds in a single step – just like an airplane landing gear. All the key components -brakes, transmission and controls- are designed ad-hoc to fit the whole. In addition, the project team's intermodal bikes come equipped with electrical power assistance applied to the rear wheel. The miniature motor was custom made for the project by the Swiss partner, Maxon Motor.

"It only takes a few seconds to unfold or collapse our bikes, with no screwing necessary. But what is really exciting about them is their size and weight," remarks Belli. In their collapsed form, the intermodal bikes have a volume of 30 litres.

By comparison, the top folding bike competitor collapses to 90 litres, while all other brands measure between 150-210 litres. In terms of weight, non-power-assisted folding bicycles are between 12-15 kg heavy. Those with a motor generally weigh more. Yet the intermodal bike is only 7, 5 kg.

Currently, the compact, lightweight bicycle is still a prototype. However, the project already won the Gaetano Marzotto Award for start-ups "From the Idea to Enterprise" and the UniCredit Bank sponsored prize "The Talent of Ideas" in November 2013. "As soon as the EU research is completed our partners are determined to go into production," says Belli.

European industry is expected to benefit from the highly regulated automotive-style supply chain manufacturing method of BIKE INTERMODAL, both in terms of job creation and greening the production.

In addition, the product could make transport systems more efficient. "Beyond that, the folding bikes would fill a growing demand," adds Belli. More and more people who previously never saw themselves as cyclists are becoming convinced of the more eco-conscious and healthy "two wheels better" ethos.

"This was always supposed to be the purpose of folding bikes – to enable a fluid synergy between cycling, driving and public transportation. With our design that is finally possible," concludes Belli, adding that "last but not least, they are really fun."

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