

# AG

ADJACENT **GOVERNMENT** | August 2016



## 12 | HARNESSING THE POTENTIAL OF eHEALTH

**VYTENIS ANDRIUKAITIS, EU COMMISSIONER FOR  
HEALTH AND FOOD SAFETY HIGHLIGHTS HOW  
eHEALTH HAS THE POTENTIAL TO HELP EUROPE  
LIVE HEALTHIER AND LONGER...**

### ALSO IN THIS ISSUE

**97 | Investing in research  
and innovation in Ireland**

**Mary Mitchell O'Connor**, Jobs,  
Enterprise and Innovation Minister,  
discusses the Irish government's  
Innovation 2020 strategy

**150 | Gender equality:  
ambitious but attainable**

**Věra Jourová**, EU Commissioner  
for Gender Equality details the  
progress and the remaining  
challenges of gender equality

**334 | A European response  
to terrorism**

**Ard van der Steur**, Netherlands  
Minister of Security and Justice  
outlines how Member States are  
uniting to prevent terrorist attacks



# Reinventing the City Building on Creativity

Creativity, innovation and a strong focus on social and cultural aspects of sustainability are at the very heart of developing the City of Varberg to become the Swedish West Coast's Creative Hot Spot by 2025.

In our vision for the future, the City of Varberg has unique opportunities. Our aim is clear, and we are acting on it. We are building a community converging around means of public transportation in a rapidly expanding region. The railway, which has created a barrier between the seaside and the city centre, will now be relocated into a tunnel underneath the city, and the capacity for commuting will greatly increase. To expand on this opportunity we are moving the harbor to further free up land for the city to reclaim. For people living, working or visiting the City of Varberg, the change will enhance the freedom to experience the beautiful coastline. Places for eating and meeting, places to shop and work, comes as a bonus.

The City of Varberg has been awarded **Sweden's Best Place To Live** in both 2014 and 2015, and is nominated again this year. Our thriving city centre is nominated as third time finalist in **Sweden's City Centre of the Year** award. We welcome these awards and regard them as appreciative of our chosen path towards the future.

**Come to Varberg.** Share our vision.

**varberg**

[varberg.se](http://varberg.se)





# FOREWORD

**Markku Markkula**

**President**

**European Committee of the Regions (CoR)**

**T**he outcome of the UK referendum was another sure sign that the EU must change the way it does business. It needs to better demonstrate that it can and does bring tangible benefits to the lives of every citizen. For the European Committee of the Regions – the EU’s assembly of elected Presidents, Mayors and Councillors – this first and foremost means driving sustainable growth locally. But regional disparities continue to rise and investment has fallen by 15% since the outset of the economic crisis. This investment gap must be plugged not only for the sake

of creating new jobs, but to rebuild the loss of trust in the European Union.

Improving investment to reconnect Europe was the central theme of the European Summit of Regions and Cities on 8-9 July in Bratislava. During the Summit the Committee’s members adopted its ‘Bratislava Declaration’ which set out a vision for the EU’s future investment. It demands that investment, based on both results and solidarity, is delivered locally. Every cent of EU money must be used to benefit people and businesses in their daily lives.

**“Europe needs to swiftly change to maintain its competitive edge on the global market. This doesn’t mean tearing up EU treaties but building on what we have. We need to direct all EU resources to connect Europe’s people, places and resources and working in partnership.”**

This vision is based on the need to invest locally and regionally. It’s worth remembering that local and regional administrations account for around 60% of public investment in Europe, money that pays for vital services such as education, transport, housing and health. A lack of investment means reduced public services and a fall in local competitiveness. Yet it also is clear that there is huge untapped potential in our cities and regions which is vital to making our regional economies wealthier, healthier, greener and fairer.

To do this the EU must firstly retain, reinforce and improve its cohesion policy – regional funds amounting to €350bn between 2014 and 2020, which tries to tackle regional economic differences. After 2020 there will be a debate on potentially reforming this cornerstone of EU policy and it needs to change with the times which is why we need to simplify regulation and cut red-tape to improve delivery. Public funds are never enough which is why we fully support the European Commission’s €315bn Investment Plan for Europe launched last year which uses EU funds to attract private investment to deliver projects.

We also need to have a new vision on where we target investment if we are to make the structural changes needed to kick start our economy. The economist and social theorist, Jeremy Rifkin, told the Summit that we are at the start of a 'Third Industrial Revolution' and it holds true that the digitalisation of communication, energy and transport is opening up new avenues and improving economic activity. Investment is not just about transport and other infrastructure: it is also about investing in education, training and skills; in research and innovation; in smart energy networks;

Europe needs to swiftly change to maintain its competitive edge on the global market. This doesn't mean tearing up EU treaties but building on what we have. We need to direct all EU resources to connect Europe's people, places and resources and work in partnership. We need to create synergies in our policies and budgets at the EU, national and regional level to put an end to Europe being viewed as a top-down project. We need to recognise the added value cities and regional authorities bring to the European construction which means giving Presidents, Mayors and Councillors a greater say in EU laws and activities that directly impact their communities. This also means significantly changing the way the EU communicates – communicating Europe must start local and listen to citizens. If the EU is to become more dynamic and more citizen-focused, it needs better investment and better laws designed in partnership with the regions and its citizens. ■





**Laura Evans**  
Editor

**Production Coordinator**  
Nick Wilde

**Designers**  
Andrew Bosworth  
Ben Green

**Sales**  
Natalia Barbah  
Ray Buckley

The editor does not necessarily agree with or endorse any of the views or contents of the articles and features within this document. All articles and editorials remain the copyright of the authors, organisations and other relevant authorities by whose kind permission they are reproduced. All information has been checked and is correct at the time of going to press. The publisher will not be liable for any loss suffered directly or indirectly as a result of the use of or reliance on the information contained herein.

© Adjacent Digital Politics Ltd 2016

Adjacent Digital Politics Ltd and its suppliers collect and process personal information for the purposes of customer analysis and market research. Our group/affiliate companies may also wish to contact you about our products or services, or the products of carefully selected third parties that we think you may be interested in.



**Adjacent Digital Politics Ltd**  
Datum House  
Electra Way  
Crewe Business Park  
Crewe  
Cheshire CW1 6ZF

Registered in England & Wales.  
Company Reg No. 8667479.  
VAT Registration No. 169 9152 64.



Adjacent Government is an Open Access publication

# WELCOME

Since the last edition of Adjacent Government, some major changes have taken place in Europe, mainly in the UK. The result of the EU referendum meant that the UK will indeed be leaving the EU. As well as the Brexit, the UK now has a new Prime Minister. Following the result, David Cameron felt he could not lead the UK and stepped down, opening the door for Theresa May. The former Home Office minister stepped up to the mark and became the new PM last month.

Although a UK publication, Adjacent Government still intends to keep open the communication between the UK and Europe. And this August issue is no different. In what has been a wet summer, we highlight a number of key issues worldwide, including: eHealth; the future of agriculture; malaria transmission; security; water quality; and, heritage and culture.

The publication kicks off with a foreword from President of the European Committee of the Regions (CoR), Markku Markkula. The CoR co-hosted the 7th Summit of Cities and Regions in Bratislava last month, which I attended. In his introductory foreword, Markkula highlights the key aims from the summit and what Europe must do in order to reconnect cities and regions.

Our health section features a number of key articles, headed up by an exclusive piece from the Commissioner for Health and Food Safety, Vytenis Andriukaitis. In it, Commissioner Andriukaitis highlights to [Adjacent Government](#) how eHealth has the potential to help Europe live healthier and stronger. Professor Alan Johnson from Public Health England also told me in an interview feature

about Healthcare Associated Infections (HCAs).

The health section also looks at key issues such as: efficiency in the NHS; malaria transmission; environmental health; mental health in the workplace and paediatric diabetes.

We shine a light on quantum technologies in this edition. A number of articles look at the new industry, including an interview with Richard Murray from Innovate UK. We highlight how they can be used in different sectors, including defence and communications. An article from The Defence, Science and Technology Laboratory (Dstl), details new technologies in the defence sector, including quantum technologies.

Gender equality is looked at closely, with an exclusive article from the EU Commissioner for Justice, Consumers and Gender Equality, Věra Jourová. In her piece, Commissioner Jourová takes stock of the progress and the remaining challenges in the way of gender equality. Women in STEM and engineering is also celebrated, in an article from BSRIA, discussing National Women in Engineering Day and how there has never been a more exciting time to be an engineer.

As always, I hope that you find this summer publication of Adjacent Government informative and useful, and welcome any feedback you may have.

.....  
**Laura Evans**  
**Editor**

@Adjacent\_Gov

# CONTENTS

ADJACENT GOVERNMENT | August 2016



## HEALTH AND SOCIAL CARE

### 12 Harnessing the potential of eHealth to live longer and healthier in Europe

In an exclusive article for Adjacent Government, Vytenis Andriukaitis, EU Commissioner for Health and Food Safety highlights eHealth to have the potential to help Europe live healthier and longer

### 20 Ageing population brings social cohesion

Lambert van Nistelrooij, Dutch Member of the EPP group of the European Parliament outlines how an ageing population affects rural areas

### 24 Innovation in health and social care

John Bowis OBE, Honorary President of Health First Europe and former Member of the European Parliament, outlines how healthcare innovations are a key instrument to achieving sustainable healthcare solutions

### 28 Antibiotic resistance: a global threat

Ivo Holanec, Research Project Manager at the Institute and Faculty of Actuaries highlights a new report published regarding the significant problem of resistance to antimicrobials. This report examines the clinical implications, plausible effects on mortality and potential economic cost of antibiotic resistance

### 30 Understanding Parkinson's disease

The European Parkinson's Disease Association (EPDA) sheds light on the challenges of the disease and the My PD Journey project which focuses on ways to improve accessibility and treatment

### 38 The National Mental Capacity Forum

Prof Baroness Finlay of Llandaff highlights the work of the National Mental Capacity Forum and the key priorities it aims to tackle

### 40 Is your workforce mentally healthy?

Liz Skelton, Vice-President of the Institution of Occupational Safety and Health (IOSH), provides advice for employers on ensuring that workers are mentally healthy

### 44 Analytics on the frontline of saving lives

David Downing, Director of Health at SAS UK looks at how the NHS can embrace digitalisation and overcome some of its biggest challenges, highlighting the Carter Review

### 48 Productivity and efficiency in English acute hospitals

James Thompson, Senior Research Analyst at the King's Fund asks whether the Carter Review guides us to productivity and efficiency in acute hospitals

### 50 Preventing and reducing HCAIs

Professor Alan Johnson, Head of the Department of Healthcare-Associated Infection and Antimicrobial Resistance at Public Health England, explains to Editor Laura Evans about healthcare association infections and how they link to antibiotic resistance

### 58 Infection prevention and control: setting the right standards for patients

Gaynor Evans, Head of Infection Prevention and Control (North) at NHS Improvement details how the organisation helps the NHS to maintain high standards and encourage best practice for infection control in healthcare settings

### 60 Working to eradicate malaria worldwide

Adjacent Government highlights work by the National Institutes of Health (NIH) and the World Health Organization (WHO) to prevent and reduce malaria worldwide

### 66 Can data address the burden of childhood cancer?

Véronique Terrasse, Press Officer at the International Agency for Research on Cancer (IARC), outlines to Adjacent Government how high-quality data is critical for tackling childhood cancer globally

### 74 Improving the long-term health of childhood cancer survivors

SIOPE – The European Society for Paediatric Oncology highlights the importance of strengthening collaborations to ensure childhood cancer survivors lead a healthy life

### 80 Improving diabetes control in England

Dr Justin Warner, Clinical Lead for the National Paediatric Diabetes Audit at the Royal College of Paediatrics and Child Health, details how continued improvements in diabetes care for children is needed in England and Wales

### 83 Improving environmental health across Europe

The World Health Organization calls for greater reviews of environmental health in schools to prevent illness due to issues such as poor air quality





## RESEARCH AND INNOVATION

### 90 Stimulating productivity growth

Carlos Moedas, Commissioner for Research, Science and Innovation outlined in a speech last month in Lisbon, how public policy should play a role in productivity growth

### 97 Investing in research and innovation in Ireland

Minister for Jobs, Enterprise and Innovation, Mary Mitchell O'Connor, T.D outlines, how Ireland aims to become a global leader in innovation, research and development, highlighting the government's Innovation 2020 strategy

### 101 Long-term plan for research in Norway

As an area of great importance to the government in Norway, research plays a key role in the long-term welfare of the country. Here Adjacent Government highlights their long-term plan and how open access is seen as important

### 105 Diversity innovates

Martin Kern, Interim Director at the European Institute of Innovation and Technology (EIT) highlights the importance of open innovation

### 107 Innovation in Sweden

Adjacent Government highlights how Sweden is strengthening innovation in the country through programs run by VINNOVA – the Swedish innovation agency

### 110 The European Union's growing innovation divide

Reinhilde Veugelaers, Senior Fellow at Bruegel highlights the serious divide between EU member states in terms of their capacity to innovate

### 112 Amsterdam – the innovation capital of Europe

The City of Amsterdam highlights how the Dutch capital won the title of innovation capital of Europe and how innovation plays a key role in the city

### 115 The value of Horizon 2020

Amanda Crowfoot, Director of Science Europe, highlights to Adjacent Government, how Horizon 2020 is crucial for research organisations across Europe

### 119 Embracing Horizon 2020

The French National Research Agency explains their investment in Horizon 2020 in order to tackle societal challenges, such as climate change and food security

### 123 Supporting next generation scientists

Adjacent Government details how the Israeli Minister of Science, Technology and Space, Ofir Akunis is hoping to encourage more children into science

### 126 Space: A new frontier?

The European Space Agency has the ability to deliver innovative technologies and become a world leader in space sciences

### 130 The future of quantum technologies in the UK

In an interview with Editor Laura Evans, Richard Murray, Lead Technologist in Emerging Technologies and Industries at Innovate UK, highlights quantum technologies and the impact they hope to make on the UK

### 140 Boosting research and innovation in the UK

Adjacent Government looks at what Brexit means for UK science and research and how the Minister for Science Jo Johnson and EPSRC are working together to strengthen innovation capabilities in the country

### 146 The value of engineering

Tamzin Caffrey, Head of Communications at Engineering UK highlights how engineering is essential to sustaining the UK's long-term economic performance

### 148 How can we tempt more women into engineering?

Clair Prosser, Press Officer at BSRIA, highlights why there has never been a more exciting time to be an engineer – especially for females in the industry

### 150 Gender equality: ambitious but attainable

Věra Jourová, European Commissioner for Justice, Consumers and Gender Equality takes stock of the progress and the remaining challenges in the way of gender equality

### 156 Pioneering science the NSF way

Adjacent Government highlights the scope of the NSF in developing and promoting science across the US

### 160 Digging into data for research

Canada is proud to co-lead efforts to internationalise social sciences and humanities research across the Atlantic – and back again. Here Ted Hewitt, President of the Social Sciences and Humanities Research Council of Canada explains why to Adjacent Government

### 168 Protecting victims of crime in Canada

Adjacent Government highlights how the Ministry of Justice in Canada is helping to minimise trauma to children involved in criminal cases



**173** **An education for every child**  
The Ministry for Education in Ontario answers Adjacent Government's questions on the importance of every child in Canada benefiting from world class education

**180** **Embracing cultural values in Canada**  
The Department of Education, Culture and Employment, Government of the Northwest Territories details the importance of cultural and heritage values across the different regions of the country

**184** **Digitisation agenda in Slovenia**  
The Ministry of Culture of the Republic of Slovenia outlines how they are digitising their culture and heritage in line with the European Digital Agenda

**186** **Digitising cultural heritage for future generations**  
The Ministry of Culture in Lithuania highlights to Adjacent Government how they are supporting digitisation of cultural heritage in libraries, museums and archives

**187** **Elements of success in the Swiss education systems**  
In a speech at an International Congress, President Johann N. Schneider-Ammann, Head of the Department of Economic Affairs, Education and Research, outlines the importance of vocational and professional education and training

**EDUCATION AND CULTURE**

## ENVIRONMENT




**THE BUILT ENVIRONMENT**

**196** **Europe – invest and connect**  
Adjacent Government attended the 7th European Regions and Cities Summit in Bratislava. Here we report on how investment and collaboration is key for Europe to move forward

**202** **Regenerating local communities**  
David Pipe, Practice and Policy Officer at the Chartered Institute of Housing outlines the importance of regeneration schemes for local communities

### **206** Without the zero carbon homes standard can we achieve carbon reduction?

The vision of zero carbon homes is not all lost according to Mike Foster, CE at the Energy and Utilities Alliance (EUA)

### **210** Shining a light in a dark corner: district heating systems

Bill Watts, Senior Partner at Max Fordham discusses district heating systems in new-build developments

### **212** Accessible housing standards: confusion could lead to a lack of delivery

Jean Hewitt, Director of the Centre for Accessible Environments returns to the subject of accessible housing standards and how easy it is to confuse the categories

### **218** Verification of BIM Level 2 capability for design and construction from BSI

BSI's verification and training solutions help underpin the BIM curve as explained here by Charlotte Broady, UK Propositions Manager, Construction and Personal Safety at BSI Group



## 224 A softer footprint in the Arctic snow

Karmenu Vella, EU Commissioner for the Environment details why a stronger and more focused approach is needed to protect the Arctic

## 234 Climate change and its impacts on the ocean

Dr Michael A. Ellis, Science Director of Land, Soil, and Coast at the British Geological Survey outlines the impacts of global warming on the ocean, drawing from both its present state to lessons learned from the past

## 240 Why monitor water quality?

Donna N. Myers, Chief of the Office of Water Quality at the U.S. Geological Survey highlights the importance of monitoring water quality to better protect human health and the environment

## 242 Illegal, unreported and unregulated fishing – A global fight worth fighting

Honourable Dominic LeBlanc, Minister of Fisheries, Oceans and the Canadian Coast Guard highlights the devastating effects of illegal and unreported fishing

## 244 Europe's transition to a circular economy has started – let's speed it up

Cillian Lohan, environmental scientist and a member of the European Economic and Social Committee (EESC), outlines why we must push ahead with the transition to a circular economy

## 248 A rare opportunity to 'turn the tide'

Oliver Johnson, Policy Executive at Environmental Industries Commission outlines the challenges caused by flooding and highlights details from the Turning the Tide report

## 250 How will Brexit affect the UK's shale gas industry?

Claire Brook, Partner at law firm Bond Dickinson, asks how the UK's regulatory regime for unconventional hydrocarbon development might be impacted post-Brexit

## 252 Working together to tackle disasters worldwide

Addressing Members of the Board of the World Food Programme (WFP), Christos Stylianides, European Commissioner for Humanitarian Aid & Crisis Management highlights the excellent work of the WFP and how Europe should tackle crises together



## AGRICULTURE

## 259 The future of agriculture and sustainable development

Phil Hogan, EU Commissioner for Agriculture and Rural Development looks at how the Commission is supporting Europe's farmers to succeed and be resilient

## 264 The environmental aspect of agriculture

Czesław Siekierski, Chairman of the Committee on Agriculture and Rural Development at the European Parliament, outlines how agriculture can benefit the environment

## 269 Tackling AMR – the Danish way

Esben Lunde Larsen, Danish Minister of Environment and Food explains why a united Europe is needed to lead the fight against AMR

## 272 Harnessing opportunities for agri-food in Ireland

Michael Creed, Minister for Agriculture, Food and the Marine in Ireland highlights the Food Wise 2025 strategy and its aims to tackle the challenges facing the Irish agri-food sector

## 274 Creating climate solutions for agriculture and forestry

Adjacent Government Editor, Laura Evans speaks to Rachel Steele, National Climate Hub Coordinator at the U.S Department of Agriculture about how they are helping to reduce the impacts of climate change for farmers and foresters



## ENERGY

## 280 Delivering a sustainable and low carbon economy

At the 7th Summit of the Regions and Cities in Bratislava last month – of which Adjacent Government was in attendance – Vice-President of the European Commission with the responsibility of the Energy Union, Maroš Šefčovič spoke about the role of cities and regions in the transition towards and sustainable and low carbon economy

## 287 European energy policies in light of climate ambition

Jukka Leskelä, the incoming CEO of Finnish Energy discusses European energy policies and how they must work towards climate targets

## 289 What's the return on investment in solar PV?

Ben Robinson, Business Development Manager at BayWa r.e. Solar Systems, shares his thoughts on the return on investment you can expect to see when installing a solar PV system

## 291 A carbon capture and storage reset

Judith Shapiro, Policy and Communications Manager at the Carbon Capture and Storage Association outlines to Adjacent Government what the focus needs to be for CCS in the upcoming months

## 292 Is CCS an affordable route to carbon reduction targets?

Andrew Green, Programme Manager at the Energy Technologies Institute, outlines the possible role of carbon capture and storage in meeting the UK's carbon reduction targets

## 296 A data drive for energy efficiency

Luke Smith, Principal Energy Specialist at the National Energy Foundation details how by using well-honed data, Suffolk County Council is able to effectively target domestic energy efficiency programmes and campaigns

## 300 Is now the right time for variable surge pricing?

Bill Watts, Senior Partner at Max Fordham talks about the role variable surge pricing could have in the energy sector



## TRANSPORT

### 303 A vision for transport investment in Europe

In a speech at the European Parliament, Commissioner for Transport, Violeta Bulc highlighted her key priorities and vision for investment in transport

### 308 Driving innovation in European transport

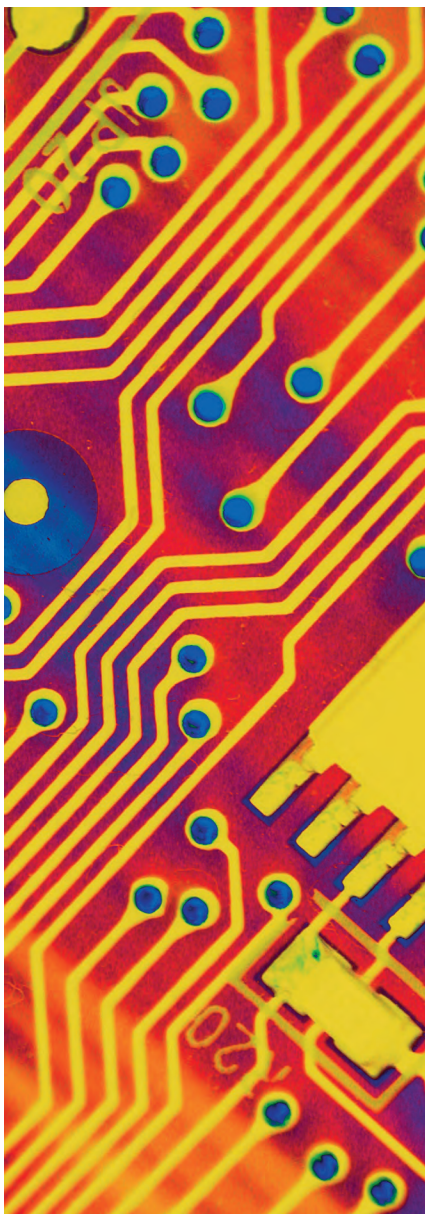
Maria Kelly Communications Officer at Shift2Rail outlines how the partnership aims to tackle the challenges of changing EU transport needs

### 310 European rail supply industry

Natasha Marie Levanti, Association for Consultancy and Engineering discusses the European rail supply industry and outlines what the new EU resolution means for the sector



## DEFENCE AND SECURITY



## ICT AND DIGITISATION

### 313 Europe: The digital revolution

At the 360 Europe Event in Brussels, Günther H. Oettinger, EU Commissioner for Digital Economy gave a keynote speech to share his thoughts on Europe achieving a digital revolution

### 319 Digital economy: Why a brighter future could be in our pocket

The digital economy is here, and growing every day, sometimes in surprising ways. As ministers gather for major meetings in Paris and Cancun, Andy Wyckoff, Director of the Directorate for Science, Technology and Innovation at OECD outlines how government leaders should be in no doubt about the key role they must play in securing the digital economy's future, as a driver of productive and inclusive progress

### 322 Digitalising services to strengthen communities

Dave Langhorn, Head of Regional Business and Regional Public Sector at Vodafone UK discusses how communities can be strengthened by digitalising services

### 324 Creative solutions for forward thinking local governments

Darren Hunt, Director of Public Sector at SAP, examines how technology is transforming local government and services

### 326 Holding down the public sector fort

Gerry Kelliher, EMEAR Sales Director, Kodak Alaris outlines how digitisation is transforming the public sector and lifting the paper weight its been carrying

### 328 IT fighting the good fight

Mav Turner of SolarWinds highlights how far IT security has come and how nearly 40% of UK companies are more secure than a year ago

### 330 Harnessing new technologies for the defence sector

Professor Neil Stansfield, Quantum Programme Strategic Lead at The Defence Science and Technology Laboratory, explains how new technologies such as cryogenics are making game-changing impacts in the Defence sector

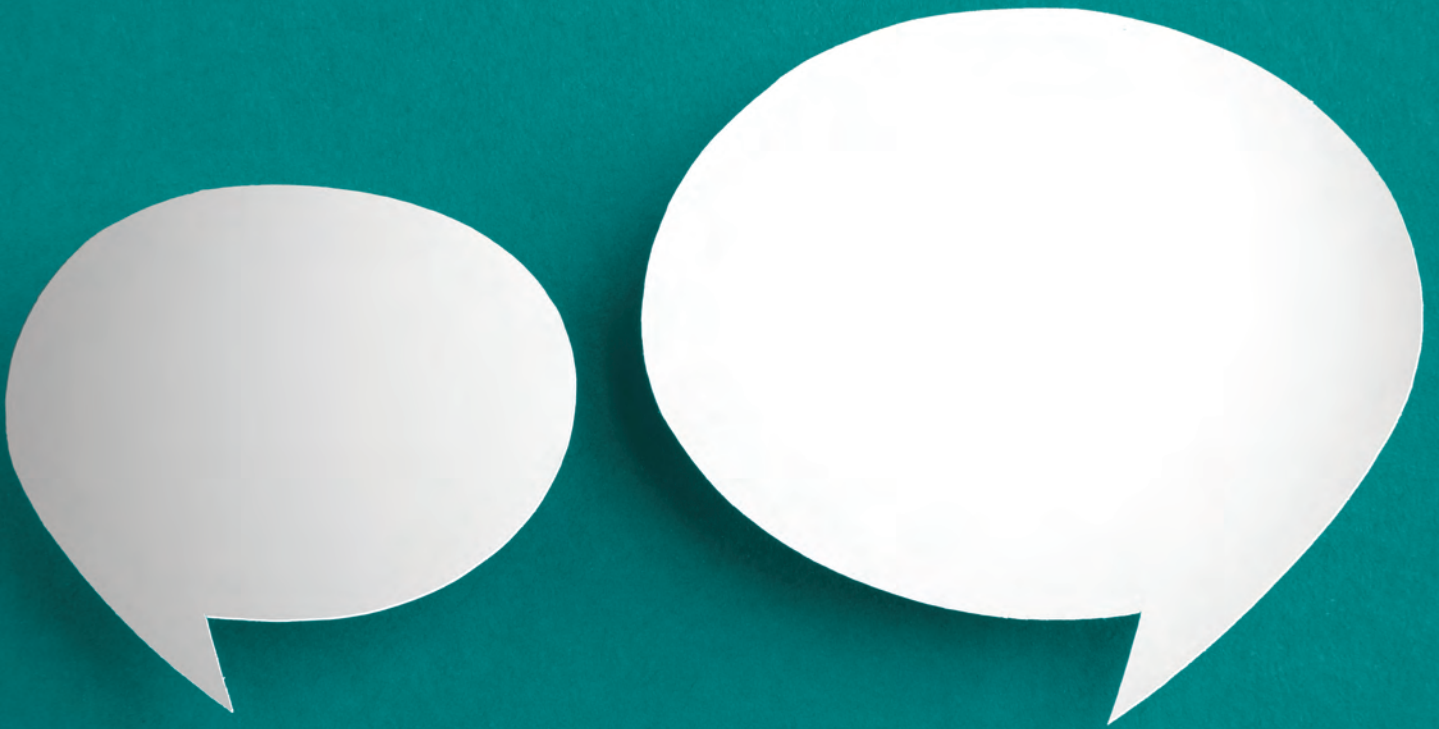
### 334 Advancing technology – keeping our airports safe

With the amount of terror attacks taking place globally in recent months, it is safe to say that the importance of effective aviation security is at an all-time high. Here, James Kelly, Chief Executive of the British Security Industry Association (BSIA), discusses some of the key elements involved in protecting our airports

### 341 A European response to terrorism

Ard van der Steur, Minister of Security and Justice in the Netherlands outlines how Member States are coming together to work as one, in order to prevent terrorist attacks





# YOUR OPINION MATTERS

Whether you agree, disagree, or have another viewpoint with any news and features on our website, we want to hear from you.

Leaving a comment on any item on our website is easy, so please engage and join the debate today.



# Harnessing the potential of eHealth to live longer and healthier in Europe

In an exclusive article for Adjacent Government, Vytenis Andriukaitis, EU Commissioner for Health and Food Safety highlights eHealth to have the potential to help Europe live healthier and longer...

Europe is turning increasingly silver. According to estimates, the number of people in the EU aged 65 and over is set to double between 1990 and 2050. However, although we are living longer, the number of years lived in good health remains unchanged – we spend on average over one fifth of our lives in poor health. Chronic diseases already account for 70% to 80% of healthcare costs in the EU. With an ageing population, rates of chronic diseases will continue to rise, putting a strain on the capacities and budgets of health systems in the 28 Member States.

Collaborating at EU-level to solve this common dilemma can reap benefits for all EU countries. Much can be achieved through sharing expertise and best

practice and working together in collaborative projects and joint actions. However, we also need to go beyond the tried and tested – we need to support new, innovative solutions for health.

As a former medical doctor, I am fascinated with innovative solutions that are part of today's medical toolbox, particularly digital solutions such as eHealth. The more I learn about eHealth, the more convinced I am that it can enable better health promotion, patient empowerment, independent living, and more efficient, sustainable and cost-effective healthcare systems.

The digital trend is growing in all aspects of our daily lives, as evidence by this publication. The growing digital





someone needs medical care while abroad, the doctor in the country of treatment has an electronic overview of the patient and his or her medical information. With ePrescriptions patients can get the medication they need anywhere in the EU, which is particularly important for people with chronic medical conditions.

revolution in health has led to new eHealth tools such as mobile health apps that motivate to keep us fit, inform us about screening and vaccination campaigns and remind us to take our medicine. Increasingly, patient's electronic health records are shared between GPs and specialists in electronic form, and our consultations with health professionals take place over the internet.

**“The more I learn about eHealth, the more convinced I am that it can enable better health promotion, patient empowerment, independent living, and more efficient, sustainable and cost-effective healthcare systems.”**

In Europe, the interoperability of eHealth systems is the current pressing issue. The Directive on patients' rights in cross-border healthcare established an eHealth Network, through which national authorities have been working together on a voluntary basis to establish common orientations in eHealth. The Network plays a central role in solving interoperability challenges between electronic health systems.

Two tangible results of collaboration through the eHealth Network are, patient summary guidelines and ePrescription guidelines, and both are a boost to patients' safety. Patients can, as early as 2018 request to have a summary of their electronic health record when visiting another EU country. This means that if

The EU is also making a considerable financial investment to make sure that Europe's eHealth systems can 'speak' to each other. The Connecting Europe Facility (CEF) is financing, amongst other things, the building of an EU digital infrastructure for eHealth. To date, 20 Member States have applied for funding under this project to build up concrete capacity to exchange health data, at first e-prescriptions and patient summaries.

Such EU collaboration and connectivity in the area of eHealth makes us all winners. It means savings and greater efficiency for our health systems, and healthier, more empowered and independent Europeans all along our life cycle. I am pleased to witness eHealth increasingly being used. I want to seize the opportunities offered by the emerging European Digital Market and ensure that we create an environment in which practical, innovative, and cost-effective eHealth solutions can thrive. ■

.....  
**Vytenis Andriukaitis**

**EU Commissioner for Health and Food Safety**

European Commission

[http://ec.europa.eu/commission/2014-2019/andriukaitis\\_en](http://ec.europa.eu/commission/2014-2019/andriukaitis_en)

[www.twitter.com/V\\_Andriukaitis](http://www.twitter.com/V_Andriukaitis)

# Social Innovation on active and healthy ageing for sustainable economic growth

Dr Elena Urdaneta from the Basque Culinary Center-SiforAGE Project highlights how the projects aims to strengthen cooperation among the stakeholders working on active and healthy ageing...

**S**iforAGE – Social Innovation for Active and Healthy Ageing-project pursues to strengthen cooperation among the stakeholders working on active and healthy ageing. We aim to put together scientists, end-users, civil society, public administrations and companies in order to improve the competitiveness of the European Union regarding the promotion of research and innovative products for longer and healthier lives.

The **SiforAGE** consortium is integrated by a wide range of stakeholders along the value chain of innovation, such as private foundations, care centers, civil society associations – representing aged people, universities, public policy makers, think tanks and experts at European and International level, in order to bridge the existing fragmentation among them.

Within this social incubator, examples of good practice across Europe are collected and analysed. These examples of good practice are subsequently disseminated amongst all stakeholders involved in Active and Healthy Ageing (AHA), through 5 dynamic documents – Knowledge Management Units (KMUs) – that relate to 5 key issues for AHA:

- How to increase healthier living years (KMU1);

- How to enhance autonomy and decision-making for older people, particularly for those suffering from Alzheimer's (KMU2);
- How to enable the older to be active in society (KMU3);
- How communities and the private sector can promote an “age-friendly” environment (KMU4);
- How new services and technology can help in promoting a better ageing experience at home (KMU5).

## Aims and objectives

The general aim of this KMU1 is to identify interventions which will support healthy life expectancy and empower people to be responsible for their own healthy ageing.

A broad and relatively open definition was used in assessing whether any intervention is a ‘social innovation,’ KMU understands that this is a term which until now, has not been widely used. The social innovation concept applies to a wide range of established activities; the challenge was not to seek out those projects which label themselves as social innovations, but to identify any interventions which met the core criteria “an innovation which creates social change”.

As well as successes (good practice), failures (bad practice) will also be of value.

## Healthy ageing concept in SiforAGE

To build upon this ‘state of the art’ provided by FUTURAGE, we sought to pick up on these themes and issues and use them for a basis for the work on the healthy ageing concept. This involved 2 specific objectives: (1) to map the key concepts which underpin “healthy ageing for healthier living years”, and (2) to understand the barriers to increasing healthy ageing and healthy life expectancy.

## The healthy ageing concept

The experts understood healthy ageing from multiple perspectives. There was an emphasis on enjoyment and pleasure, but balancing this with self-care and healthy behaviours. Staying intellectually engaged was also mentioned, so as long as this is not an obligation, but enjoyable engagement. Some respondents emphasised the pleasurable aspects of ageing i.e. that people should do what they enjoy as they age. One respondent phrased this as “adding life to years rather than years to life”.

Several experts focussed on the issue of functionality. As one put it:



## PROFILE

Healthy ageing is building and maintaining the functionality to enable older people to be and do the things that are important to them.

It was suggested that functionality has 2 components: the capacity of the individual, as well as the environment in which they live. Still further distinctions were drawn within individuals, so that healthy ageing is viewed both in terms of physical and cognitive function. Similarly, physical health, as well as mental health was discussed. Another respondent expanded this to state that ageing should be about physical, mental and also social health.

In relation to the healthy ageing concept:

- There was a recognition that we need to understand the complexity and diversity in healthy ageing, the modalities of age as one person put it. Culture plays an important role. The healthy ageing concept can be tailored to address this diversity. Including older people themselves in research was also seen as crucial.
  - In line with current trends, a life-course and cross-national framework for future research was emphasised.
  - Healthy ageing should be balanced with pleasurable or enjoyable ageing – people should enjoy what they do as they age in as healthy ways as possible. However, too much of a focus on healthy lifestyles can result in forgetting personhood.
  - An important dimension of healthy ageing is functionality, both physical and cognitive. However there should be less individual focus and
- more focus on how society can adapt to reduced functionality e.g. in terms of housing, transportation, and healthcare.
  - Ageism was felt to be an important topic to address since it inhibits a detailed nuanced understanding of older age. This should be a focus of future research.
- In relation to social innovations for healthy ageing:
- There appear to be 3 central aspects to innovations: providing social support, social cohesion, social networks, or combating loneliness; improving the health and well-being of older people; helping older people engage in enjoyable or productive activities.
  - People take part in innovations mainly because they view them as a positive way to spend their time doing enjoyable activities, and to mix socially with other people. These 2 aspects might be emphasised in future innovations to maximise participation. Innovators felt that participants sometimes downplayed the social aspects in explaining why they take part, but actually that this is the main reason.
  - In addition, participants highly value choice in which aspects they take part in, and a safe environment for participation e.g. a safe way to go on trips.
  - The value of innovations is clearly evident from the research. All participants reported positive effects, and most made lasting friendships. Social, emotional, and practical benefits were reported. One thought

that the innovation had been a life saver. The KMU concludes that it is vital that social innovations are funded and supported if we wish to encourage healthy ageing.

- Key barriers to participation in programmes are work commitments and perceptions of ageing e.g. reluctance to engage with an innovation about the elderly. Innovations might therefore have different groups according to these dimensions to maximise participation.
- Relatedly, stigma remains a key barrier to realising social innovations. In particular, there is stigma around not only participating in innovations, but also around staff who work with older people, which is a disincentive to potential staff, and also results in a lack of opportunities for development and training. There should be specific opportunities and funding targeted at people who might work in innovation-based settings.



### **Dr Elena Urdaneta**

Basque Culinary Center-SiforAGE Project

Tel: +34 943 57 45 92

[eurdaneta@bculinary.com](mailto:eurdaneta@bculinary.com)

[www.siforage.eu](http://www.siforage.eu)



Health Consumer  
Powerhouse

**Leading independent European  
providers of Healthcare System  
Assessment since 2004**



#### Europe

- Euro Health Consumer Index 2005, 2006, 2007, 2008, 2009, 2012, 2013, 2014
- Euro Consumer Heart Index 2008
- Euro Diabetes Care Index 2008, 2014
- Euro HIV Index 2009
- Euro Patient Empowerment Index 2009
- Nordic COPD Index 2010
- Tobacco Harm Prevention Index 2011
- Euro Headache Index 2011
- Euro Hepatitis Index 2012
- Euro Vision Scorecard 2013
- Euro Pancreatic Cancer Index 2014

#### Sweden, others

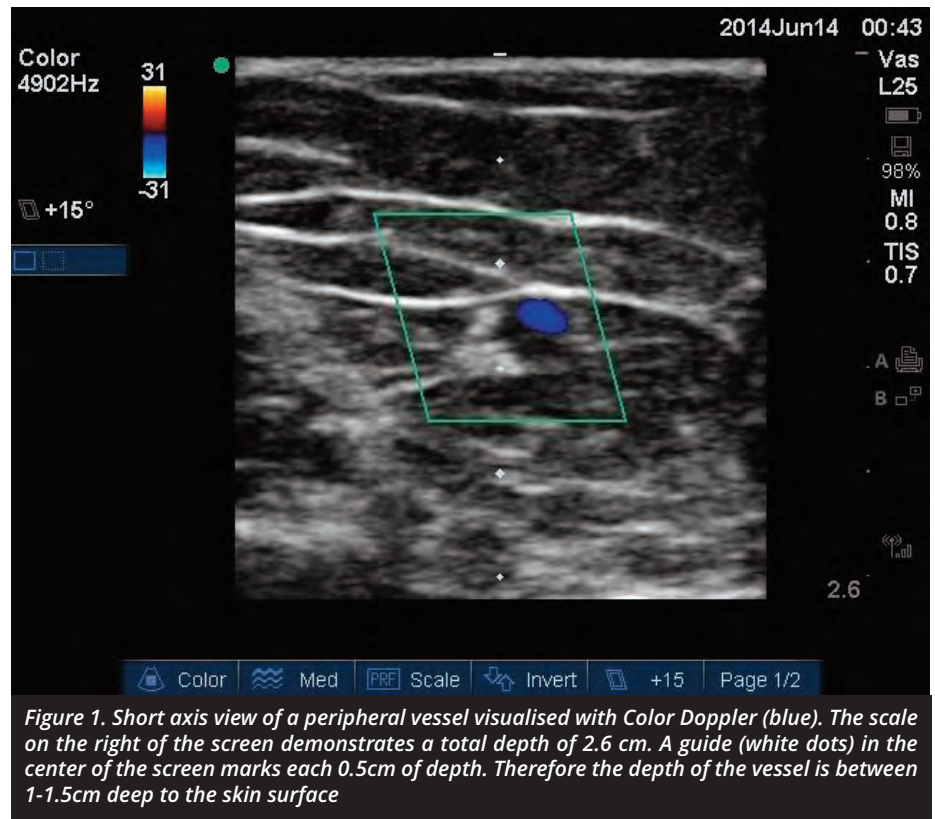
- Health Consumer Index Sweden 2004, 2005, 2006
- Diabetes Care Index Sweden 2006, 2007, 2008
- Breast Cancer Index Sweden 2006
- Vaccination Index Sweden 2007, 2008
- Renal Care Index Sweden 2007, 2008
- Smoke Cessation Index Sweden 2008
- COPD Index Sweden 2009, Nordic 2010
- Advanced Home Care Index Sweden 2010
- Euro-Canada Health Consumer Index Canada 2008, 2009
- Provincial Health Consumer Index Canada 2008, 2009, 2010
- All Hospitals Index Sweden 2011

- › Comparing healthcare systems performance in 37 countries from a consumer/patient view.
- › Since 2004, more than 40 index editions, available for free.
- › Index projects financed through unconditional development grants, similar to medical faculty sponsored research.

# Point-of-care ultrasound for intravenous access

Patients presenting to the Emergency Department (ED) may have characteristics that impede intravenous (IV) access. Such characteristics may include hypotension, dialysis dependence, morbid obesity, or a history of diabetes, sickle cell disease, or IV drug use. One prospective observational study identified nearly one in every 9 to 10 adults presenting to an urban ED had difficult venous access requiring 3 or more IV attempts.<sup>1</sup> If peripheral IVs are not established, patients may need a central venous catheter placed for life saving medications to be administered. In addition to requiring physician skill, central venous catheter insertion carries a risk of complications including infection, arterial puncture or aneurysm, and pneumothorax. Ultrasound-guidance for peripheral IV placement (UGPIV) has prevented the need for central venous catheter placement in 85% of patients with difficult IV access.<sup>2</sup> UGPIV has been performed by Emergency Medical Technicians (EMTs) in prehospital settings, as well as nurses and physicians. Patients who have been identified as having difficult access, have higher patient satisfaction scores when ultrasound is used in peripheral IV access attempts.<sup>3</sup>

Frequently, the large veins of the antecubital fossa are sufficient to place large bore peripheral IVs needed for resuscitation. The brachial and basilic veins are easy to locate. The brachial artery is typically flanked by 2 smaller veins and the median nerve. Anatomically, these structures are medial to



the insertion of the medial biceps tendon. This tendon is palpable in the antecubital fossa as the patient flexes the elbow. The basilic vein is located medial to the brachial vessels. Generally, it is more superficial, larger, and does not have an accompanying artery or nerve at the level of the antecubital fossa. As you move proximally up the arm (towards the head) the basilic vein dives deeper toward the humerus bone, and longer angio-catheters may be required for cannulation.

When considering vascular access, there are 2 views, a short and long axis view. A short axis approach “looks” at a cross section of the vessel. Long axis uses an “in plane” approach

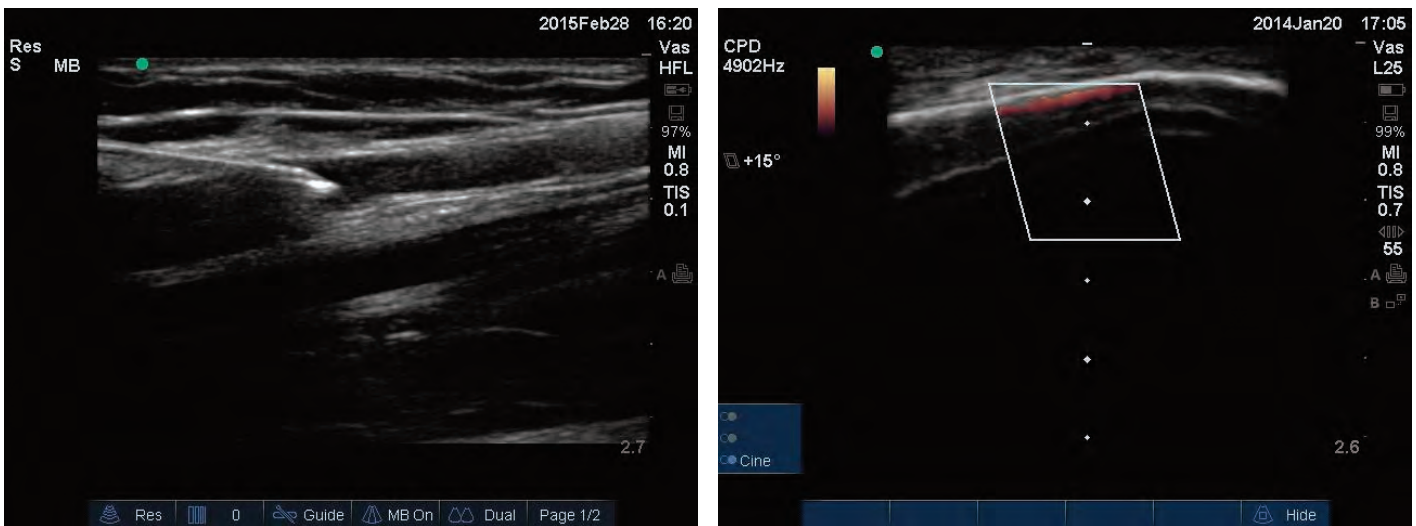
with the needle entering from the probe marker end, and “looks” along the length of the vessel. Figure 1 identifies a vessel using color Doppler in the short axis view. Figure 2 demonstrates a long axis view with the needle and tip seen in the vessel. While both short and long approaches may be used for UGPIV placement, the benefit for the short axis is the ability to identify target veins as well as accompanying non-target (arteries and nerve) structures.

## Identify the Vein: Remember the C’s

The two C’s to remember for UGPIV access or for central venous cannulation are Compression and Color (or Power) Doppler. Veins are thinner-walled and



## PROFILE



**Figure 2. (Left) Long axis view of a peripheral vessel. The hyperechoic needle is visualise approaching from the top left of the screen into the vessel lumen. Figure 3. (Right) Power Doppler (orange) confirms placement of an intraosseus line within the distal tibia. The bright white line of the tibia cortex (in long axis view) is visualised at the top of the screen, with flow confirmation from a 10cc saline flush immediately distal (below) to the hyperechoic cortex**

more easily compressed than arteries. This author advocates for finding a vessel first in the short plane, and compressing the vessel to ensure it is indeed a vein, rather than a less compressible artery. Color or Power Doppler may be utilised to determine if pulsatile flow is consistent with an artery or vein. Color Doppler uses red and blue to determine flow towards or away from the probe respectively. Power Doppler detects flow without concern for direction. Color should not be relied on alone to determine arterial or venous flow due to the color scale setting that can be flipped or reversed, or aliasing can occur. Arterial flow is more pulsatile than venous. Venous flow may require distal augmentation (by squeezing the forearm distal to the probe) to appreciate the blush of color.

Once the target vein is identified, the depth from the skin surface should be noted. A common mistake is to use an angio-catheter that is too long or too short. A general rule of thumb is to use a catheter length that is more than twice the depth of the vessel to ensure at least half the catheter lies within the vein. Sterile

ultrasound gel should be used, with a covered probe to prevent infection. To prevent the risk of multiple punctures, it is recommended to first bounce the needle on the skin over the point of entry. The tissue should deform at the top of the screen, and confirm the needle is over the target vessel. Once the skin is punctured, the needle tip is kept in view by angling the ultrasound probe until the target vessel is punctured.

To confirm placement, either a “bubble study” with agitated saline may be performed or Color (or Power) Doppler utilised to visualise saline flow through the cannulated vessel. A vessel that is not properly cannulated will demonstrate extravasation of saline around the vessel into the tissue before the tissue swells to a degree which is palpable on the surface of the skin. Figure 3 demonstrates confirmation of intraosseous (IO) lines utilise Power Doppler. A 10cc saline flush is rapidly pushed through the line, and flow is demonstrated beneath the bony cortex in this adult tibia. If the line is improperly placed, the blush of color using Doppler would appear in the soft tissues.

For further information about UGPV placement, visit: <http://rmgultrasound.com/piv-access/>

<sup>1</sup> Fields, J.M., Piela, N.E., Au, A.K., Ku, B.S., Risk factors associated with difficult venous access in adult ED patients. *Am J Emerg Med.* 2014 Oct; 32(10):1179-82.

<sup>2</sup> Au, A.K., Rotte, M.J., Gzybowski, R.J., Ku, B.S., Fields, J.M., Decrease in central venous catheter placement due to use of ultrasound guidance for peripheral intravenous catheters. *Am J Emerg Med.* 2012 Nov;30(9):1950-4.

<sup>3</sup> Schoenfield, E., Shokoohi, H., Boniface, K. Ultrasound-guided peripheral intravenous access in the emergency department: patient-centered survey. *West J Emerg Med.* 2011 Nov;12(4):475-7.



**Virginia M Stewart**  
**MD RDMS RDCS RDMSK**  
**Emergency Ultrasound Director,**  
**Emergency Ultrasound**  
**Fellowship Director**  
 Department of Emergency Medicine  
 Tel: (757) 594 2000  
[www.rmguultrasound.com](http://www.rmguultrasound.com)

# Ageing population brings social cohesion

Lambert van Nistelrooij, Dutch Member of the EPP group of the European Parliament outlines how an ageing population affects rural areas...

In 2060 there will be 2 people employed to the ratio of one pensioner, compared with 4 to one in 2012. Above that the differences are tremendous: cities grow while rural areas are shrinking. This is already affecting everyday life in rural areas. In these regions the social safety net to protect the elderly is getting weaker, because a large amount of youngsters are leaving. They search for jobs in cities and elsewhere in Europe. I believe that the empowerment of the elderly in combination with solidarity between generations is the way forward. Whether we live in rural areas or cities, whether we are 15, 40, 70, or even 100, managing the upcoming demographic changes is key.

The upcoming demographic shift affects the relationships among generations and the way our society is functioning. We have to value the contribution of all age groups in society. Therefore inclusion and participation is necessary, especially in the shrinking regions. This approach of a territorial focus is in the light of the UK referendum even more important.

## The debate is open

Unfortunately, policymakers still see demographic change as a burden, rather than a chance. Yes, we have to pay all our attention to the negative challenges of ageing, for example increasing pensions and higher healthcare costs. However, it is also our duty to see demographic change as an opportunity and as a chance. For instance, to lower costs of healthcare, we have developed new innovative solutions like eHealth. These solutions will reach the remote areas, provide us with care for a better quality of life and will lead to a higher degree of social inclusion.

These new developments will also bring forward jobs for the younger generation, in the service sector or care sector. This will create new chances for Europe's



*Lambert van Nistelrooij, Dutch Member of the EPP group of the European Parliament*

regions and rural areas. In the European Union we want to bridge the digital divide, assist older people to develop digital skills and create better infrastructure and services at a local level. As a consequence, I hope more younger people will stay in the rural regions to start their own enterprises or find a job there. A better balance must be reached. Europe has clear opportunities to invest and innovate in rural areas, also after 2020. Because of the UK referendum, this is all at stake in the UK.

## The importance of volunteers

As well as the formal work, informal work is just as important. For a higher degree of social inclusion,





volunteers play an important role. Solidarity between generations is all about a better understanding, helping and supporting each other. Volunteers have proven to be necessary in building inclusive and active communities. They have already developed neighbourhoods that make it possible for citizens of all ages to take part. A good example is 'Generation Games', an intergenerational event in Rotterdam in the Netherlands, which makes the connection between people of all ages possible through sports. Europe needs to stimulate the continuation of these initiatives.

### Lifelong learning

These local communities are also very important for learning and teaching. For the transfer of skills and good practices. In the EU, only half of the people between 55 and 64 are in employment. This generation has still a lot to offer both to the young and older people: a large amount of experiences, transferrable skills, knowledge, and, let's be old-fashioned, wisdom. It is about how we value their capacities, both in voluntary and formal jobs. Every generation has their contribution to society. We should not forget this.

### Let's step up our game

Rural areas are at a clear disadvantage unless we encourage the debate on increasing cohesion all over Europe. The intergenerational dialogue to engage young and old people. As the Coordinator of the Intergroup Active Ageing in the European Parliament, I think it is very important to create the awareness. We need to empower the elderly, improve solidarity between generations and take the chances that demographic change has to offer. ■

---

### Lambert van Nistelrooij

#### Dutch Member of the EPP group

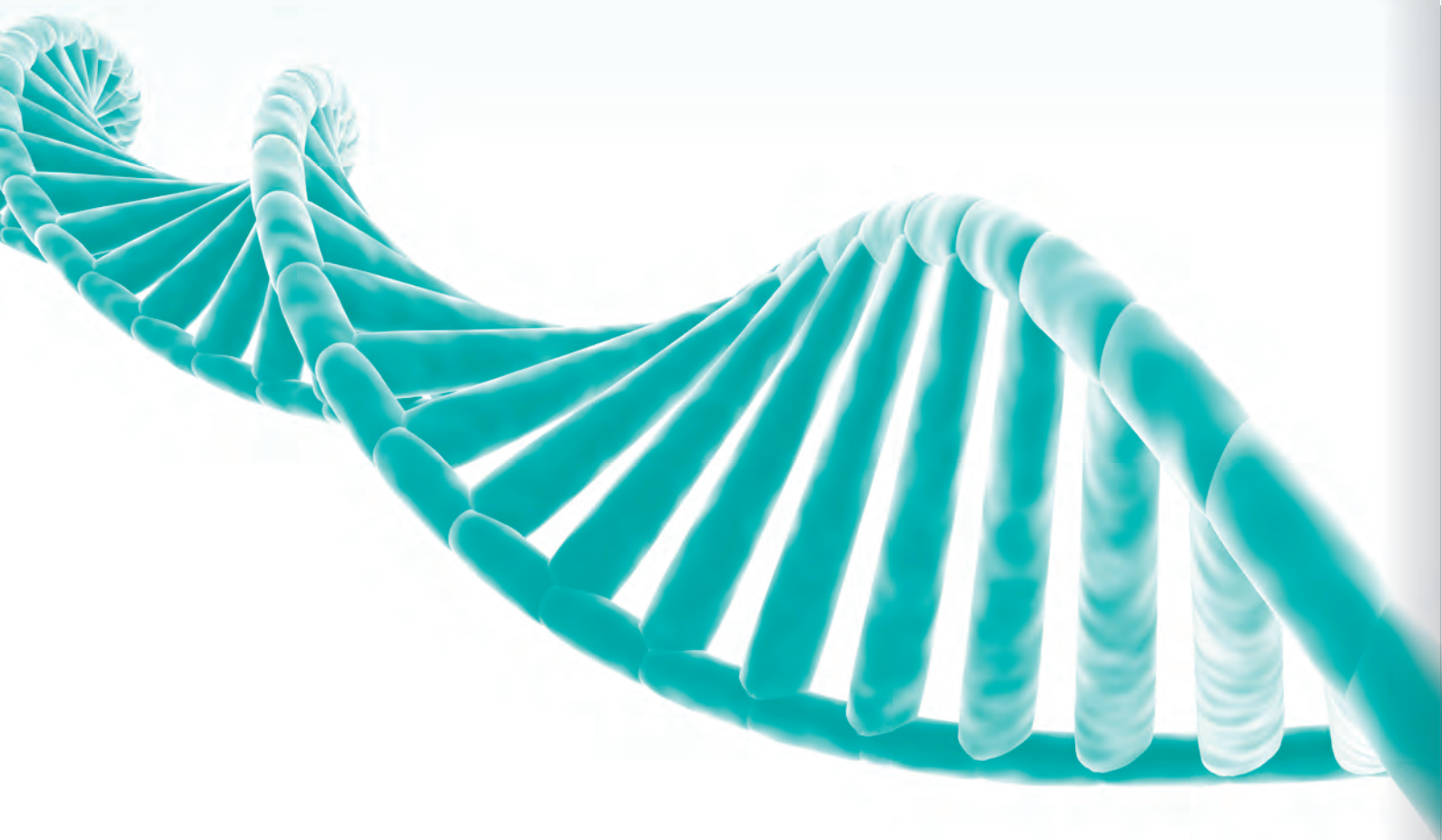
European Parliament

[lambert.vannistelrooij@europarl.europa.eu](mailto:lambert.vannistelrooij@europarl.europa.eu)

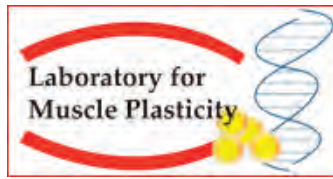
[http://www.europarl.europa.eu/meps/en/28165/LAMBERT\\_VAN+NISTELROOIJ\\_home.html](http://www.europarl.europa.eu/meps/en/28165/LAMBERT_VAN+NISTELROOIJ_home.html)

[www.twitter.com/LvNistelrooij](https://www.twitter.com/LvNistelrooij)

# A Quest into Muscle Plasticity







## The Balgrist

Muscle weakness and associated poor fatigue resistance is a major challenge to modern Western Society. It arises due to a reduction in the force producing capacity of skeletal muscle with prolonged unloading due to inactivity (disuse), injury or disease.

This eBook details more about the quest into muscle plasticity, and how the laboratory of muscle plasticity at Balgrist University Hospital aims to expose the molecular and cellular mechanisms underpinning muscle affections in a clinical situations.



To read the digital ebook

# Innovation in health and social care

John Bowis OBE, Honorary President of Health First Europe and former Member of the European Parliament, outlines how healthcare innovations are a key instrument to achieving sustainable healthcare solutions...

“Health care providers are currently faced with an extremely complex challenge characterised by rising demand, increasing cost and insufficient funding. In light of this, European health systems must consider innovation as a key instrument in achieving sustainable and efficient solutions, while respecting the fundamental values of universality, equity, solidarity and delivery of high quality, effective and safe health services”<sup>1</sup>. With this call for action – addressed to the European and National policy makers – the Expert Panel on Effective ways of investing opened its Final Opinion on Disruptive Innovation published in April 2016.

## Patient's expectation for cost effective innovation

EU health systems are constantly confronted new challenges such as an ageing population, rising expectations of citizens, and the mobility of patients and health professionals. Moreover, in recent years, the economic crisis has limited the financial resources available and thus aggravated Member States' difficulties in ensuring their health systems' sustainability.

There is a need to look at the economics of public health expenditure, particularly how to reduce waste in health spending. Modern health systems need to be resilient: they must be able to adapt effectively to changing environments, tackling significant challenges with limited resources. Expenditure is a reflection of both affordability and preferences – which makes measuring innovation very difficult. I believe that any national reform should put the patient at the center and focus on better use of resources. We need to work more and together to provide citizens with the best quality healthcare, taking full advantage of the new technological innovations in the sector without compromising the healthcare national budgets.

As any patient in Europe, I have seen how technological innovations have added value to the health system across countries. Wearable devices can help physicians give more specific diagnosis, and patients in helping them in creating a thorough medical history. At-home remote monitoring tools for cardiac health in rural areas can save lives. Rapid screening technologies for appropriate antibiotic prescribing can reduce medicines misuse. So why aren't these innovations invested in more broadly?

## European Parliamentary Interest Group on innovation in health and social care

Health First Europe launched the European Parliamentary Interest Group on innovation in health and social care in November 2014, aimed at improving patient access to innovation in health and social care by influencing EU policy. The interest group – chaired by MEP Kay Swinburne (UK, ECR), MEP Marian Harkin (Ireland, ALDE), MEP Karin Kadenbach (Austria, S&D) and MEP Cristian-Silviu Busoi (Romania, EPP) – has as principal objectives to:

- Ensure public health is a European Parliament priority;
- Ensure innovation is prioritised on the EU health and social care agenda;
- Raise awareness of patient-centric solutions for sustainable, accessible and resilient health systems;
- Stress the need for urgent actions and foster concrete actions for change<sup>2</sup>.

As Honorary President of Health First Europe, I have worked with our MEP co-chairs to understand the needs of patients, carers and professionals who are facing the current healthcare reforms and to showcase



how existing examples of innovation (for instance newborn screening for early diagnosis) can improve patients' lives and the role of the EU in advancing innovation. During the last meeting – which took place in June 2016 – we have finalised, with the support of experts from the European Commission, a list of policy recommendations for the European and national policy makers to support the translation of innovation in health and social care into healthcare reforms. Bearing in mind the critical role of innovation in improving patient lives, I reckon it is necessary to work together to motivate Member States to invest in cost-effective innovation by giving access to proper insurance for all citizens, enhancing patient roles in the healthcare reforms, sharing best practices, investing in training for the healthcare workforce.

**“As any patient in Europe, I have seen how technological innovations have added value to the health system across countries. Wearable devices can help physicians give more specific diagnosis, and patients in helping them in creating a thorough medical history.”**

### Promoting innovative healthcare reforms

Healthcare systems are complex and include a myriad of stakeholders who have conflicting goals, such as access to services, profitability, high quality, cost containment, safety, convenience, patient-centeredness, and satisfaction. In order to improve healthcare systems for patients' benefits, it is essential to build a better partnership between business, academia and regulatory authorities. Silos needed to be broken down through stronger partnerships and multidisciplinary. Integrated approaches between health and social care need to be in place to build flexible, as well as patient and results oriented healthcare systems.

Bearing in mind that healthcare system reform is a national competence, the EU can support these efforts through stronger country assessment, benchmarking, reference networks, knowledge exchange and technical assistance. The European Commission following up its 2014 communication on building more effective, accessible and resilience health care systems in

Europe<sup>3</sup> is engaged in several activities, such as the coordination of the Health System Performance Assessments Working Group, to identify useful methodologies and tools to support policy makers to strengthen effectiveness, increase accessibility and improve resilience of health systems. The patient safety and quality of care working group, the Expert Panel of effective ways of investing in health which aims at providing useful methodologies and tools to support policy makers to strengthen effectiveness, increase accessibility and improve resilience of health systems.

There is no one-size model which can fit for European healthcare, Member States need to look to their own health systems and structures and see which areas can be innovated. To help patients to benefit from innovative healthcare solutions, it is essential to have innovative reforms. Cost-effective innovation for patients benefits is not only about new technologies and new products, but it is also about new structures, new delivery model, new processes, new services, new financial mechanisms, new pricing mechanisms, and also workforce skills. What we need is a mix of all these innovative elements. ■

<sup>1</sup> Disruptive Innovation. Considerations for health and health care in Europe – Final opinion, 09 April 2016. [http://ec.europa.eu/health/expert\\_panel/opinions/docs/012\\_disruptive\\_innovation\\_en.pdf](http://ec.europa.eu/health/expert_panel/opinions/docs/012_disruptive_innovation_en.pdf)

<sup>2</sup> European Parliamentary Interest Group on Innovation in Health and Social care, <http://www.healthfirsteurope.org/supporters/ep-interest-group-on-innovation-in-health-and-social-care>

<sup>3</sup> COMMUNICATION FROM THE COMMISSION On effective, accessible and resilient health systems, 4 April 2014. [http://ec.europa.eu/health/health-care/docs/com2014\\_215\\_final\\_en.pdf](http://ec.europa.eu/health/health-care/docs/com2014_215_final_en.pdf)

.....  
**John Bowis, OBE**  
**Honorary President**

Health First Europe  
[info@healthfirsteurope.org](mailto:info@healthfirsteurope.org)  
[www.healthfirsteurope.org](http://www.healthfirsteurope.org)

# The global electronic health record debacle

What has become painfully clear to every Patient, Doctor, Manager, Insurance company and government official around the world, is that the EHR (Electronic Health Record) systems in use today are basically “Broken”. This is the results of decades of essays to take advantage of the accompanying computer age, in a concerted effort to augment, improve, and extend quality medical care to the global population. The problem as a result is the misalignment of foundational, security, communications and integrational technologies. Political infighting, as well as commercial self-interests, have contributed extensively as well. When one considers the legal compliance, reporting, and regulatory environment of today, it’s easy to see why matters are deteriorating. We will attempt to review some hard learned experiences and explore new concepts so that it is possible to both alleviate and resolve these issues here.

The Broken nature of these systems extends to the financial arena, especially the continual reduction of available patient services, not to mention exposure to thousands of fraudulent schemes of one sort or another. One of the most intriguing, if not completely arcane magical parts of the EHR world is the coordination of insurance medical codes and corresponding performed medical services, in order for payments to actually occur. Entire organisations exist simply to proffer new requirements and codes each successive year, and new industries are forming around them.

This situation is and has continued to create increasingly expensive options for patients, and patient care.

The core of these difficulties lies in the foundational data management & computer science that is in use today. EHR, like any other application is simply that, an “application”, and it depends on a database solution from a selected vendor (Oracle, Microsoft m IBM etc.). These database technologies have an inherent flaw, they completely fail to communicate and interoperate with each other, even from the same vendor. The one common feature they inherit is that they are known as “relational” database technology, dating back to 1971. The very nature of the complexity of EHR necessitates a far more flexible and dynamic approach than made available by “relational” technology.

Today Atomic Information Systems is introducing an “old” new data management solution known as “Associative” technology. We say “old” simply because the technology known as “Associative” information management was first imagined and created in the early 1960s and was clearly seen as the future of data management, but due to the disparity of available hardware and the hardware requirements at the time, the potential was never fully realised. At its core “Associative” data technology is essentially “object oriented” data management, the long sought Holy Grail of computer science. The object oriented approach to application development is the one reason, unlimited complexity is viable

and available, and by extending this to the database layer we resolve relatively all of the issues surrounding EHRs today, and make available new services and research capabilities.

The very nature of migrating from one EHR system to another is itself a tragically difficult and expensive proposition, so many medical institutions continue to stay tied to relatively ancient solutions or attempt to integrate new modules or technologies into the old, further raising costs. What is being proposed is a singular co-existing approach, allowing for, what amounts to a universal medical data warehouse that operates in concert with existing disparate systems. This approach allows for the continued use of existing EHR systems, no matter how many, while enabling the use of new capabilities with a minimum of upgrade costs and training, furthermore, migration costs are nearly eliminated.

## Current EHR challenges

The existing EHR provider applications (totalling about 900) and all delivery systems have the following critical issues and serious problems:

- Physicians, hospitals and other healthcare workers complain that the applications are limited in reporting the overall condition of patients and cannot accommodate what all healthcare workers see, hear, feel and sense what is going on with their patients, the history of all ailments and how diagnoses are influenced by other conditions and



## PROFILE



medications. These are categorised as EHR application operational problems;

- Physicians complain that the applications are time consuming, cannot be matched against prior ailments and older visits and take valuable time away from patient care;
- The intraoperative capabilities are non-existent;
- There are documentation, privacy and security failures that lead to compliance concerns;
- Patients cannot see and review their health files, nor request that they be sent to other physicians, clinics or hospitals;
- Death and maiming is continuing to occur at alarming rates;
- Loopholes have driven costs to unheard of levels because of unneeded and unwarranted tests and procedures by hospitals;
- The single major problem with all EHRs is interoperability.

### UNIEHR & AtomicDB

We believe that UNIEHR (Medical Record System) brings significant additional value to the entire data centre ecosystem far beyond traditional value proposition. The global UNIEHR community works together to build the world's leading open source

enterprise electronic medical record system platform.

AIS Corp. will be integrating AtomicDB with UNIEHR. The global UNIEHR community works together to build the world's leading open source enterprise electronic medical record system platform. Its mission is to contribute to the improvement of health care delivery and the health of communities.

This would allow seamless integration of multiple data systems into an EHR practice access system accessible instantly by many different medical professionals & medical groups.

The UNIEHR Universal EHR Solution offers a range of intelligent solutions and services that support the clinical, financial needs of organisations of all sizes, including hospitals, physician practices, laboratories, ambulatory centres, behavioural health centres, cardiac facilities, radiology clinics, surgery centres, extended care facilities, retail pharmacies, and employer sites.

One of the very powerful yet simple concepts to be introduced will be the Horizontal Screen Navigation capability. One of the more aggravating operational problems most doctors face is the endless switching between different screens in a vertical manner. Our new design will allow caregiver to have a 'birdseye' view of all the screens simultaneously.

### UNIEHR & AtomicDB Architecture

With the integration of AtomicDB into UNIEHR, we will be able to offer a totally secure solution allowing for the evaluations, correlation and analysis of all potential effects on the patients as well as monitoring cost and performance metrics on the fly. The truly amazing thing here, is the system is completely and totally customisable on the fly, as well and can integrate with any known systems including outside security systems, network, management, order and delivery schedules, human resources, accounting, billing, insurance correlation, payments taxes and even the dramatic justification and simplification of research grant and or construction grants.



**Jean Michel LeTennier**

**CEO**

Atomic Information Systems Corp

Tel: +1 917 751 3131

jm@aisys.us

www.aisys.us

www.twitter.com/AtomicDB

# Antibiotic resistance: a global threat

Ivo Holanec, Research Project Manager at the Institute and Faculty of Actuaries highlights a new report published regarding the significant problem of resistance to antimicrobials. This report examines the clinical implications, plausible effects on mortality and potential economic cost of antibiotic resistance...

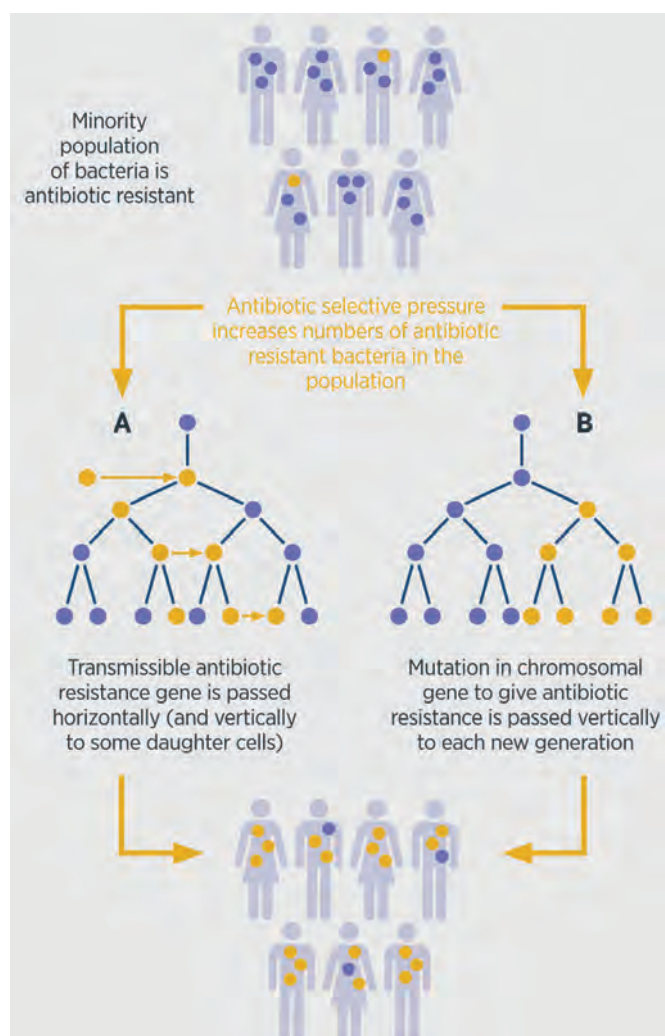
**A**ntibiotics have been central to modern healthcare since their introduction into medicine in the 1940s. Their role has expanded from treating infections to preventing infections in surgical patients, protecting cancer patients, as well as people with compromised immune systems. They have also been used to prevent disease in livestock and other food animals.

Now, however, once-treatable infections are becoming difficult to cure and patient mortality is rising with costs to both individuals and society. Decreasing antibiotic effectiveness has risen from being a minor problem to a broad global threat, regardless of a country's income or sophistication of healthcare system. Antibiotic resistance is a direct result of antibiotic use.

## What is antibiotic resistance?

Resistance is a natural biological phenomenon. It develops when bacteria are exposed to the antibiotics, through a process of natural selection where the bacteria which are immune to the antibiotics are the ones that survive, and then pass on the resistant genes. This process speeds up with repeated exposures. The spread of antibiotic resistance in populations is further illustrated in Figure 1.

However, antibiotic resistance is by no means a 21st century phenomenon. Resistance to penicillin was first identified in 1940, and Alexander Fleming himself predicted the likely hazardous consequences of mass use of antibiotics. A number of different factors are implicated in the modern, rapid development of antibiotic resistance which includes: inappropriate antibiotic prescribing; overuse of antibiotics in vulnerable populations; wide spread of resistance strains of bacteria due to global travel; and increasing use of antibiotics in husbandry.



**Figure 1. How antibiotic resistance arises and spreads in bacterial populations. Produced for Media Planet**

## Why is antibiotic resistance so important?

An estimated 50,000 people die each year in Europe and the US due to infections that have become immune to antibiotics used to treat it. Global consumption of antibiotics rose by 36% between 2000 and 2010, largely as a result of increased access in the developing economies such as Brazil, India, China and South Africa



(Van Boeckel et al., 2014). Antibiotic-resistant infections also contribute to the financial burden on healthcare systems. The estimated cost arising from antibiotic resistance in Europe is £1.2bn annually, which includes healthcare expenditures and productivity losses (ECDC, 2012).

Concerned about increasing antibiotic resistance, the UK government set up a 5 year strategy in 2013, which set out actions to slow the development and spread. The government's report predicts that by 2050 the deaths attributable to antibiotic resistance will rise to 10 million each year, with a cost to the global economy of £66 trillion (O'Neill, 2014). However, return to the infectious disease mortality of the pre-antibiotic era is unlikely. Quite apart from the increasing focus on new antibiotic development and other areas, such as hospital hygiene, some of the decline in infectious disease mortality is attributable to improved vaccination programmes, enhanced living standards and personal nutrition.

### What steps should be taken?

Since the 1940s, the availability and efficacy of antibiotics have been taken for granted, but it is clear that we are now entering an era in which antibiotic resistance will have a material impact on mortality. However, antibiotic resistance is a natural phenomenon that cannot be stopped. Anywhere that antibiotics are used, drug-resistant bacteria will arise.

Research and development into diagnostics, new drugs and vaccines is crucial to combat the effect of antibiotic resistance. However antibiotic resistance is developing faster than new antibiotics are being developed. Since 1987, no new class of antibiotics has been discovered that is available for treatment of bacterial infections (Mandell et al., 2015). As of September 2015, an estimated 39 new antibiotics with the potential to treat serious bacterial infections are in clinical development. This includes 2 new classes of antibiotics – Teixobactin and Brilacidin. Nevertheless, only 1 out of 5 drugs that reach the initial phase of testing in humans will receive approval.

Doctors and health care professionals are being urged to prescribe antibiotics only when absolutely necessary and only for bacterial infections. Quickly diagnosing the cause of most infections is difficult and doctors urgently need new tests to help them decide when to use antibiotics and which types to use. Until such tests are available, it is essential that spread of infections between people, animals, and the environment is prevented.

The IFoA's report on antibiotic resistance further highlights the expected impact on surgical procedures, longevity improvements and alternative approaches to antibiotics. You can download the report here: <http://bit.ly/297XS5y> ■

### References

- ECDC – European Centre for Disease Prevention and Control (2012) Gonococcal Antimicrobial Susceptibility Surveillance in Europe. Stockholm.
- Mandell, G.L., Bennett, J.E., Dolin, R. (2015) Principles and practice of infectious diseases. Elsevier, Eight Edition, Churchill Livingstone
- O'Neill, J. (2014) Review on antimicrobial resistance – antimicrobial resistance: tackling a crisis for the health and wealth of nations.
- Van Boeckel, T.P., Gandra, S., Ashok, A., Caudron, Q., Grenfell, B.T., Levin, S.A., Laxminarayan, R. (2014) Global antibiotic consumption 2000 to 2010: an analysis of national pharmaceutical sales data. *Lancet Infect. Dis.* 14, 742–750. doi:10.1016/S1473-3099(14)70780-7

### Ivo Holanec

#### Research Project Manager

Institute and Faculty of Actuaries

[www.actuaries.org.uk](http://www.actuaries.org.uk)

[www.twitter.com/actuarynews](https://twitter.com/actuarynews)



# Understanding Parkinson's disease

The European Parkinson's Disease Association (EPDA) sheds light on the challenges of the disease and the My PD Journey project which focuses on ways to improve accessibility and treatment...

**P**arkinson's disease is a progressive, chronic and complex neurodegenerative disease (NDD) that affects all aspects of daily living; it is the second most common NDD condition after Alzheimer's. The effects of Parkinson's invariably involve the physical, cognitive and psychological domains, and impact across nearly every cultural, social and economic boundary. Parkinson's occurs as a result of the destruction of nerve cells in the brain that produce the neurotransmitter dopamine. Due to this lack of dopamine, messages in the brain fail to transmit smoothly to the muscles, resulting in difficulties controlling movement.

Parkinson's symptoms differ from person to person. Parkinson's is associated with motor symptoms such as tremor, rigidity, bradykinesia and postural instability but also symptoms that are not directly related to movement including loss of sense of smell, sleep disturbances, swallowing disorders, gastrointestinal complications, anxiety, depression, sexual dysfunction, and dementia.

Today there are 1.2 million people living with Parkinson's disease in Europe, a number that is expected to double by 2030. Most people are diagnosed around the age of 60; nonetheless, one in ten patients is under 50. Currently there is no cure for Parkinson's disease, and individualised care, which is essential as the disease affects each patient differently, faces multiple challenges.

## Major challenges

Treatments are available for a number of aspects of Parkinson's but are not yet accessible for all. Inaccurate and delayed diagnosis pose significant obstacles in individualised care, as treatments need to be reviewed constantly and consider the patient's symptoms as a whole. Even people who are correctly diagnosed will need medication for the rest of their lives; however, these treatments can lose their effectiveness with time, and often cause unpleasant side effects. The lack of a holistic approach to treatment is also a significant hurdle to overcome. It is clear that there is a need to

enhance health professional awareness and understanding of Parkinson's as well as strengthen research efforts related to new treatments.

The economic impact of the disease also needs to be addressed. The cost of treatment in Europe is approximately €11,000 per patient with the total cost of Parkinson's disease amounting to €13.9bn annually<sup>1</sup>. The need for hospitalisation and care, especially as the illness progresses, as well as the inability of some patients to work and live independently, dramatically raises the cost of the disease.



### My PD Journey project

The [European Parkinson's Disease Association](#) (EPDA), the only European Parkinson's umbrella organisation, is a non-political, non-religious, and not-for-profit organisation aimed at enabling all people with Parkinson's to live a full life while supporting the search for a cure. To do so, the EPDA raises awareness for Parkinson's by providing information to the wider community through a number of projects including [Parkinson's Life](#), an online 'lifestyle' magazine for people affected by the disease, and [Parkinson's 100 Challenge](#), a fundraising challenge, and through its [33 member organisations](#). The EPDA also leads [My PD Journey](#), a multi-stakeholder initiative for people with Parkinson's disease in Europe involving representatives across the entire Parkinson's disease community. My PD Journey mainly focuses on finding ways to improve accessibility to appropriate diagnosis, treatment, and care for people with Parkinson's disease.

My PD Journey consists of three initiatives: the [European inventory](#), a research project completed in 2015 and due to be published in 2016 that aimed to determine the gaps in current Parkinson's care management and demonstrate good practices across Europe; a new [composite scale](#) developed by Parkinson's clinicians, which is a tool to help physicians take into account the full complexity of the condition when evaluating the status of patients with Parkinson's; the creation of [national coalitions](#) of Parkinson's stakeholders across

Europe that address country-specific challenges faced by national healthcare systems. Research findings from the European inventory demonstrate the need for a personalised approach and quick access to specialised treatment and care, enhanced coordination between primary and secondary healthcare professionals, additional training of professionals, and better information management.

### Policy recommendations

In an attempt to raise awareness among European decision-makers, the EPDA used the above research findings as a starting point to propose further policy recommendations on how to better address current challenges linked to Parkinson's disease across Europe.

First, Parkinson's disease needs to be identified as a priority public health challenge at both European and national levels and ideally be included on 2017 European political agendas to mark the bicentenary of the disease's discovery and encourage European countries to take action in this field.

The improvement of data collection systems regarding Parkinson's disease is also of vital importance. The development of disease registries could also serve as a starting point for effective knowledge transfer.

Last but not least, funding for added value projects, such as the EPDA's "My PD Journey", should be actively supported as could funding for the training on Parkinson's disease for healthcare professionals through European and national public health programmes. ■

1 Gustavsson A, Svensson M, Jacobi F, Allgulander C, Alonso J, Beghi E, et al. Cost of disorders of the brain in Europe 2010. *European Neuropsychopharmacology* 2011;21(10):718-79.



European Parkinson's Disease Association (EPDA)  
info@epda.eu.com  
www.epda.eu.com



# The silent progression of Parkinson's disease

## Time for rethinking causes and treatments

It is highly unlikely that James Parkinson (1755-1824), who first described the “paralysis agitans” in his ‘An Essay on the Shaking Palsy’ in 1817 (years later rebadged by Jean-Martin Charcot as Parkinson's disease), could have imagined that the disorder that today bears his name would become the second most important neurodegenerative disorder in the elderly population, after Alzheimer's disease. With a prevalence ranging from 35.8 per 100,000 to 12,500 per 100,000, and annual incidence estimates ranging from 1.5 per 100,000 to 346 per 100,000 in different countries, Parkinson's disease represents today a major age-related problem of health. Meta-analysis of the worldwide data indicates a rising prevalence of Parkinson's disease with age (41 per 100,000 at 40-49 years; 107 at 50-59 years; 173 at 55-64 years; 428 at 60-69 years; 425 at 65-74 years; 1,087 at 70-79 years; and 1,903 per 100,000 at over age 80), also reflecting a characteristic distribution by geographic location (a prevalence of 1,601 per 100,000 in patients from North America, Europe and Australia, and a prevalence of 646 per 100,000 in Asian patients). Parkinson's disease is more prevalent in males (1,729 per 100,000, more than 65 years) than in females (1,644 per 100,000), with a peak prevalence in the age group of greater than 90 years (4,633 cases per 100,000), and a mean prevalence of 1,680 per 100,000 in people older than 65 years of age. Prevalence and

incidence Male/Female ratios increase by 0.05 and 0.14, respectively, per 10 years of age. Incidence is similar in men and women under 50 years (M/F ratio <1.2), and over 1.6 times higher in men than women above 80 years. Furthermore, PD coexists with dementia in over 25% of the cases and with depression in over 30% of the cases in some countries.

Associated with different potentially pathogenic risk factors (toxins, drugs, pesticides, brain microtrauma, focal cerebrovascular damage, genomic defects), Parkinson's disease neuropathology is characterised by a selective loss of dopaminergic neurons in the substantia nigra pars compacta, with widespread involvement of other brain structures and peripheral tissues. Pioneers who contributed to understanding the pathology of Parkinson's disease in the first quarter of the 20th century were Frederick Lewy, who identified neuronal cytoplasmic inclusions (Lewy bodies) in a variety of brain regions in 1912, and Tertiakoff, who observed the loss of neurons in the substantia nigra in 1919.

Parkinson's disease-related neurodegeneration is likely to occur several decades before the onset of the motor symptoms (rigidity, bradykinesia, resting tremor, postural instability). As in other prevalent age-related neurodegenerative disorders, it is plausible that the confluence of genomic vulnerability with diverse environmental

factors may be responsible for the growing impact of Parkinson's disease in our society.

Different genes distributed across the human genome have been associated with Parkinson's disease. All these genes are under the influence of the epigenetic machinery that regulate their expression in different tissues and may contribute to selective nigrostriatal dopaminergic neurodegeneration.

The introduction of L-DOPA in the 1960s represented a breakthrough in the treatment of Parkinson's disease, and it continues to be the most effective symptomatic therapy in Parkinsonian disorders. Levodopa (L-DOPA) is the natural isomer of the amino acid D,L-dihydroxyphenylalanine which was isolated from the bean of *Vicia faba* in the early 1910s by Torquato Torquati. Its chemical structure was defined by Markus Guggenheim in 1913; and in 1938, Peter Holtz discovered the enzyme L-dopadecarboxylase, which converts L-DOPA into dopamine, and which can be transformed into norepinephrine by the enzyme dopamine-β-hydroxylase. Both catecholamines are important neurotransmitters involved in different higher activities of the central nervous system. In addition to dopamine precursors (L-DOPA), other symptomatic treatments for PD include dopamine agonists (amantadine, apomorphine, bromocriptine, cabergoline, lisuride, pergolide, pramipexole, ropinirole, rotigotine),

monoamine oxidase (MAO) inhibitors (selegiline, rasagiline), and catechol-O-methyltransferase (COMT) inhibitors (entacapone, tolcapone). The initial complication of long-term L-DOPA therapy is the “wearing-off” phenomenon, together with motor fluctuations and dyskinesia, which develop during the use of both L-DOPA and dopamine agonists. Polypharmacy with antidepressants, antipsychotics, urological drugs, analgesics, antihistamines and cholinesterase inhibitors also contributes to severe complications associated with the anticholinergic burden in Parkinson’s disease. Furthermore, gastrointestinal complications, cardiovascular problems, neuroendocrine changes and psychiatric disorders are frequent in Parkinsonian patients chronically treated with conventional antiparkinsonian drugs.

The onset of these complications is also influenced by the genomic background of the patients, and the efficacy and safety of the drugs currently consumed by those who suffer a Parkinsonian disorder is highly dependent on their pharmacogenomics profile. Genes involved in the pharmacogenetics network include: pathogenic, mechanistic, metabolic, transporter and pleiotropic genes, and all these genes are also under the influence of potential epigenetic aberrations. In recent years novel evidence has demonstrated the impact of pharmacogenetics on the efficacy and safety of most antiparkinsonian drugs. In the particular case of L-DOPA, the ANKK1, BDNF, LRRK2, and PARK2 genes are pathogenic genes potentially involved in its effects. The CCK, CCKAR, CCKBR, DRD1, DRD2, DRD3, DRD4, DRD5, GRIN2A, GRIN2B, HCRT, HOMER1, LMO3, and OPRM1 genes are mechanistic genes whose

products influence L-DOPA efficacy and safety. L-DOPA is a substrate of enzymes encoded by the COMT, CYP1A2, CYP2B6, CYP2C19, CYP2D6, CYP3A4, CYP3A5, DBH, DDC, G6PD, MAOB, TH, UGT1A1, and UGT1A9 genes responsible for its metabolism. SLC6A3 is the major transporter of L-DOPA; and ACE, ACHE and APOE are pleiotropic players in L-DOPA effects. ADORA2A SNPs and HOMER1 variants may be associated with L-DOPA-induced dyskinesia and psychotic symptoms. A haplotype integrating -141CIns/Del, rs2283265, rs1076560, C957T, TaqIA and rs2734849 polymorphisms at the DRD2/ANKK1 gene region might also be associated with L-DOPA-induced motor dysfunction; and SLC6A3 is a genetic modifier of the treatment response to L-DOPA in Parkinson’s disease.

Since the “wearing-off” phenomenon and additional complications related to the chronic use of antiparkinsonian drugs represent a major concern for patients and the medical community, some voices claim for changes in the conceptualisation of Parkinson’s disease and its treatment. It is obvious that the growing prevalence and incidence of Parkinson’s disease for the past 50 years must be associated with environmental factors which demand better epidemiological scrutiny and consequent preventive programs to halt disease progression, especially at a pre-symptomatic stage. If this is assumed by health authorities and the scientific community, then new challenges should be raised in relation to the pathogenesis and treatment of Parkinson’s disease, if we do not want to experience a situation similar to that of schizophrenia (another disease related to a cerebral dopaminergic dysregulation), in which the excess of

antipsychotics/neuroleptics leads to a disabling extrapyramidal syndrome after years of neuroleptic treatment.

Under these circumstances, it is imperative to characterise biomarkers for the pre-symptomatic identification of the population at risk of suffering Parkinson’s disease, and to design novel preventive strategies, as well as alternative therapeutics devoid of the long-term complications posed by conventional antiparkinsonian drugs. Some attempts have been made with novel compounds in recent times; and new applications have been submitted to the European Patent Office in this regard, with selective dopaminergic neuroprotectants to prevent neurodegeneration. Modern Neuroscience must embrace the idea that most brain disorders require more neuroprotection and fewer symptomatic repressors. Unfortunately, the history of Neuropsychopharmacology is a history of chemical symptomatic repression with delayed consequences for patients and society in terms of chronic disability, family burden, and health costs.



**Ramón Cacabelos MD PhD DMSci**  
**Professor and Chairman of**  
**Genomic Medicine**  
**President, EuroEspes Biomedical**  
**Research Center, Corunna, Spain**  
**President, World Association of**  
**Genomic Medicine**

EuroEspes Biomedical Research Center  
[www.euroespes.com](http://www.euroespes.com)

# Interception therapies for neurodegeneration, the promise and the challenge

Duncan McHale, Vice President, Head of Global Early Development at UCB highlights new therapies for neurodegenerative diseases such as Alzheimer's disease...

Neurodegenerative diseases are a growing global challenge as medical advances ensures more individuals live longer. By 2020 there will be more than 40 million individuals in the world with Alzheimer's disease and by 2040, without the development of truly disease modifying drugs this will grow to more than 80 million. Similar trends are also seen for Parkinson's disease. The annual treatment and social care of individuals with neurodegenerative diseases is estimated to be more than \$1 trillion by 2050, making it one of the most important socioeconomic challenges of this century. Research spending in this area is currently running into billions of dollars per annum. Discovering and developing disease modifying drugs, i.e. those that prevent progression of the disease has been very challenging with many programs failing.

This growing healthcare challenge has been a focus of biomedical research in most developed nations leading to large investments in research from both public and private funders. Significant biological findings have been discovered and new diagnostic tools have been developed increasing our ability to identify the disease early and even predict subjects at significant risk before significant symptoms begin. We are approaching an era where we can identify subjects who have a neurodegenerative disease, but do not yet have any of the symp-

toms. We will have therapies which in theory will prevent or at least substantially delay the onset of symptoms but we have a development and commercial framework which does not support this approach.

## Interception Therapies

Since the mid-19th century and the work of William Farr, our understanding and classification of disease has been based on the identification of disease based on symptomatology and overt clinical signs. Therapies have been focussed on reducing symptoms and treatments started after the disease process has damaged the body to the point of impaired function.

The latter 20 years of the 20th century saw a shift toward disease prevention with some limited success. The aim here was to modify people's lifestyles so they reduce the risk of a disease occurring. These interventions were often general e.g. increase in exercise, stop smoking, reduce alcohol intake etc. There have been some pharmacological interventions in this area but these have been limited and often with uncertain outcomes, e.g. use of low dose aspirin for primary prevention of cardiovascular disease or use of statins in subjects with normal LDL levels in primary prevention of cardiovascular disease.

Advances in disease understanding and the use of biomarkers is now offering an opportunity which could

be the best of both worlds. Biomarkers are currently being discovered and qualified which allow the detection of a disease process before any symptoms or overt clinical signs are present. These subjects have a high (and sometimes very high) risk of developing a symptomatic disease, although this may be a few years in the future. Good examples of this include the detection of increased amyloid deposition in the brain before cognitive impairment occurs in individuals with pre-symptomatic Alzheimer's disease, individuals with anti-drug antibodies to insulin and beta islet cells before they develop type 1 diabetes. Our ability to detect these very early pre-symptomatic disease processes will only increase in the future, e.g. the use of mobile phone technology to detect early Parkinson's disease through texting speed or voice analysis. The development of therapies to intervene at this very early stage in a disease process is being termed as interception therapies. There is a great hope that these therapies will significantly improve population well-being by delaying or preventing the symptomatic phase of the disease developing. It is well established in many conditions that early intervention results in improved outcomes and this is a further extension of that. In neurodegeneration, where significant cell death causes the symptomatic phase and AD in particular, it is clear from recent failed studies that early and ideally pre-symptomatic



treatment is going to be required to gain the benefit of these new therapies aimed at preventing disease progression.

### **The Challenge**

This appears a straightforward opportunity which patients, healthcare systems, regulators, payers and industry would be able to seize and deliver on. However, the current drug regulatory and reimbursement system does not support or incentivise developing interception therapies.

From a regulatory perspective new drugs are evaluated against a standardised set of clinical outcome measures. These measures are well established and despite imperfections are trusted. The clinical outcome measures are generally based on symptomatic scoring systems which may be enhanced by the use of clinical signs, e.g. joint swelling. The whole aim of interception therapies is however, to prevent these symptoms from developing. Therefore, a complete new set of regulatory qualified tools are required based on the prediction of the onset of symptoms and the reduction in a disease process rather than on symptomatic improvement. A clear example here would be the demonstration of a reduction in amyloid plaque load or more likely a reduction in the accumulation of plaque load. At present this is just a supporting biomarker, but it needs to be the primary end-point of the randomised control trials and even this may take 1-2 years per subject to detect a treatment effect.

From a payer / reimbursement perspective the challenge is a temporal one. The need to pay now for savings

on healthcare and social care costs several years in the future creates a real challenge. This is challenging enough in a single payer publically funded system, such as the UK National Health Service (NHS) but amplified in a private insurance based system where individuals regularly change their provider.

**“By 2020 there will be more than 40 million individuals in the world with Alzheimer’s disease and by 2040, without the development of truly disease modifying drugs this will grow to more than 80 million.”**

### **True Partnership and Shared Risk and Reward**

In our current drug development and commercialisation framework the biopharmaceutical companies take the vast majority of the risk and this is coupled with the reward driven through high drug pricing for new branded therapies. The development of interception therapies will require the use of larger cohorts and longer studies if definitive proof of impact on currently recognised symptomatic scoring systems is required before drug approval. This increase in length and size of trials combined with the reduction in patent life of novel therapies will drive the cost of medical innovation even higher. These costs are likely to be unsustainable and so the benefits to patients of these new biological understandings will go unrealised.

We require a new paradigm where the healthcare systems and subsequently patients share some of the risk and enjoy the rewards of better health through the use of interception ther-

apies. The cost of clinical trials needs to be reduced and be seen as an investment in future medical innovation by healthcare providers and funders rather than a potential short term revenue generator. Regulators and patients will need to understand that initially these type of therapies may be licensed, based on proven reduction disease processes and mechanisms and that proof of symptomatic benefit will only be obtained in a real world setting several years after launch. The reward for patients is access to medical innovations much earlier and at an affordable price to the healthcare system. Biopharmaceutical companies must accept that this is a sharing of risk through a reduction in their cost to get these innovations to patients and this reduction in cost and hence risk must be accompanied by changes in approaches to pricing so that we develop an affordable strategy to develop interception therapies.



**Duncan McHale**  
**Vice President, Head of Global**  
**Early Development**  
UCB  
Duncan.McHale@ucb.com

# Linking Alzheimer's disease, diabetes and nutrition

**A**lzheimer's disease (AD) is the most common form of dementia in those over the age of 65, and currently ranked as the sixth leading cause of death in the United States. AD is one of the most persistent and devastating dementing disorders of old age, because it eventually leads to a complete loss of memory and of the ability to function independently. The hallmarks of AD are the retention of plaques and tangles in the brain; plaques are protein beta-amyloid (A $\beta$ ) that build up in the spaces between nerve cells, whereas tangles are twisted fibers of protein tau that build up inside the cells. These 2 abnormal structures are prime suspects in damaging and killing nerve cells. Currently there are only a few interventions that have been approved for the treatment of AD, but none has shown a clear effect on disease progression.

**“With the awareness of the nutritional impacts on brain metabolism and the practices of healthy lifestyle, the risk of neurological diseases such as Alzheimer's – or type 3 diabetes – can be reduced and the onset of dementia can be prevented.”**

The risk for AD did not begin with the build up of the plaques and tangles. Research has shown that brain metabolism may already decline decades before the retention of A $\beta$  and tau. As the human brain has the

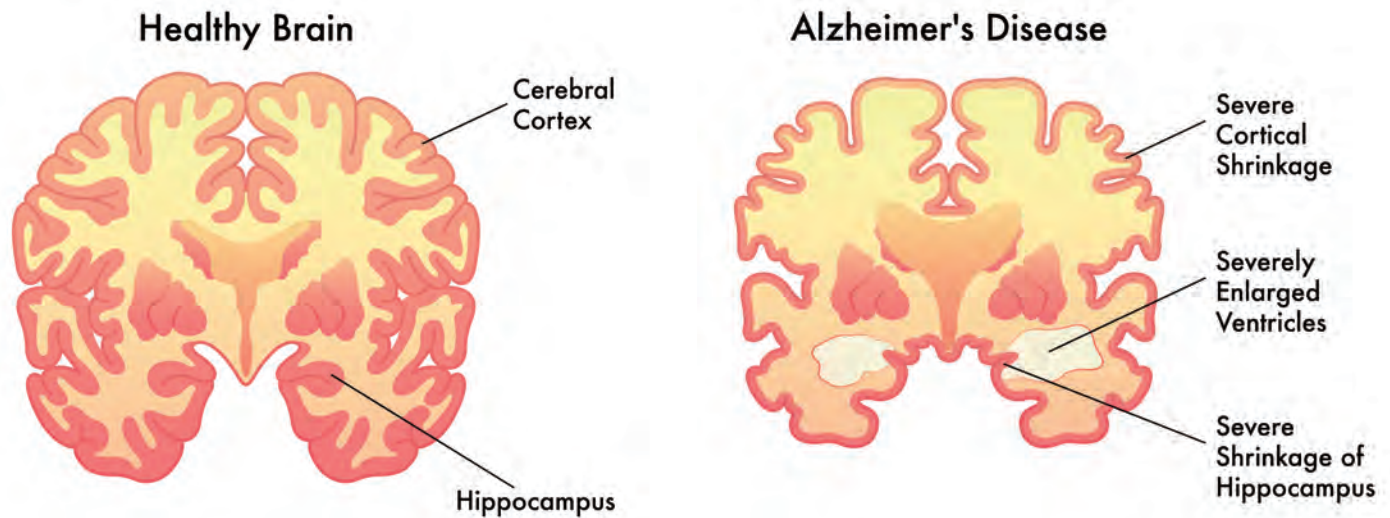
highest energy demand among all other organs, the disruption of brain metabolism and energy supply could cause devastating effects on brain functions, including neuronal cell death, brain volume shrinkage, and ultimately memory impairment.

The risk factors for brain metabolism dysfunctions include genetics, age and lifestyle. For example, apolipoprotein  $\epsilon$ 4 (APOE4) allele is the strongest genetic risk factor for AD. Recent studies have shown that cognitively normal carriers of the APOE4 allele have abnormally low glucose metabolism in the same brain regions as patients with AD. The metabolic abnormality was observed in young (20-39 years of age) and late-middle-aged (40-60 years of age) APOE4 carriers, who have intact memory and are free from A $\beta$  or tau pathology. Brain glucose metabolism also declines with age, independent of genotypes. Therefore, advanced age has been suggested as one of the greatest risk factors for AD. Further, the metabolic abnormality is exacerbated with increased body weight. Clinical data have shown that individuals with obesity (Body Mass Index- BMI greater than 25) are associated with 2-3 fold increase in AD risk, compared to those with a normal BMI.

Obesity is a strong risk factor for other metabolic complications such as Type 2 Diabetes (T2D). Emerging evidence has shown strong association between

T2D and AD. In particular, individuals with T2D display significant memory impairment and attention deficits on cognitive testing compared to control subjects. The major symptom of individuals with T2D is insulin resistance, which includes: impaired glucose metabolism, abnormal blood sugar levels and dysfunctional insulin signalling. When insulin resistance occurs in the brain, it directly leads to disrupted glucose utilisation, impaired energy supply to neurons and ultimately cognitive defects. Furthermore, high blood sugar causes inflammation, which could trigger A $\beta$  and tau production, damage brain cells and accelerate AD-like pathology to develop. Interestingly, AD patients, whether they have T2D or not, also show insulin resistance in the brain, which makes AD being recognised as 'type 3 diabetes'.

To preserve brain function and reduce incidence of neurological degeneration, it is essential to find ways of maintaining or restoring brain metabolism. Nutritional interventions have shown to be effective to preserve metabolic homeostasis. In our laboratory, our goal is to better understand the effects of caloric intake on brain metabolism in aging, APOE4 and diabetes. While caloric restriction (20-40% reduced caloric intake) has been shown to increase the life span and health of many species, the effects of it on in vivo brain functions is still largely unexplored. Using



*Shrinking of brain tissue caused by Alzheimer's disease*

neurological imaging techniques, we found that rodents with calorie-restricted diet had reduced glucose uptake, but an increase in the level of medium chain triglyceride ketone bodies. Their brain used ketone bodies as an alternative fuel substrate to sustain energy supply and reduce inflammation. Importantly, this shift in metabolism was found to be associated with the preservation of memory and brain structure in aging rodents. In animals modelling human Alzheimer's disease, caloric restriction has been shown to increase insulin sensitivity and reduce A $\beta$  accumulation. We also demonstrated that restoring brain glucose metabolism is critical to prevent learning deficits developed in young mice that carry human APOE4 genes. In another study, instead of caloric restriction, we fed mice a ketogenic diet with diabetes and AD phenotype. We found that the mice had reduced A $\beta$  retention, lowered blood sugar, improved brain metabolism and circulation, and retained learning and memory capacity.

These research findings indicate that proper nutrition plays a crucial role on maintenance of energy balance and preservation of brain integrity.

**“Alzheimer's disease (AD) is the most common form of dementia in those over the age of 65, and currently ranked as the sixth leading cause of death in the United States.”**

As the prevalence of obesity and T2D are increasing on a global scale, it is a pressing need for the societies and governments to develop programs to educate their citizens on how to choose healthy diets, and to ensure access to healthy, high-quality food. If the importance of a balanced diet can be instilled in an individual at a young age, it is far more likely to stay with them throughout their lives. And, significantly, this information would be cascaded down to their children, thereby becoming common practice for all society. With the awareness of the nutritional impacts on brain metabolism and the practices of

healthy lifestyle, the risk of neurological diseases such as Alzheimer's – or type 3 diabetes – can be reduced and the onset of dementia can be prevented.



**Ai-Ling Lin, Ph.D.**

**Assistant Professor**

Sanders-Brown Center on Aging, Department of Pharmacology and Nutritional Sciences, and Department of Biomedical Engineering, University of Kentucky

Tel: +1 859 323 6671

[ailing.lin@uky.edu](mailto:ailing.lin@uky.edu)

<https://med.uky.edu/users/ali245>



# The National Mental Capacity Forum

Prof Baroness Finlay of Llandaff highlights the work of the National Mental Capacity Forum and the key priorities it aims to tackle...

The National Mental Capacity Forum has started its work. In September, as the appointed chair answerable to Ministers, I began to explore the reasons that the 2005 Mental Capacity Act (MCA) had failed to meet expectations and failed to deliver the change in attitudes and behaviours that it was expected to usher in. There is a great deal of work going on up and down the country to implement the MCA; evidence of this was brought together and shared at a National Mental Capacity Action Day in February.

So after many consultation events, meetings and taking soundings, a few areas have emerged as needing to be addressed urgently. Of these the National Mental Capacity Forum Leadership Group agreed to tackle of these as the main priority of work for the coming year.

Firstly, the principles of the MCA are confusing and somehow difficult to grasp. Secondly, carers have reported feeling excluded and often unrecognised. They carry the main responsibility for someone and yet are often ignored when it comes to decision making on behalf of the person who lack capacity for that decision – who I shall refer to as ‘P’ from now on. These carers have needs themselves; they need information about P and they know a great deal about P, which is invaluable for best interests’ decision-making. They may well observe failings in care either of P, or of others in a facility such as a care home or ward where P is, but fear saying anything in case it rebounds on P.

The Mental Capacity Action Day brought some possible solutions to simplifying the message over the MCA itself, with presentations of excellent teaching/training initiatives. One, from Shropshire CCG, used a simple diagram of a hand to remind people of the 5 principles of the Act. Three fingers remind everyone of the



principles that apply to everyone every day – they are about ‘you and me’, so please:

- Assume I have capacity unless proved otherwise;
- Support me by doing all you can to enhance my ability (explain things in language and terms I am more likely to understand, make sure I have glasses, hearing aids);
- Realise that we all make unwise decisions at times.

And the remaining fingers (forefinger and thumb which together form the most powerful pincer movement of the hand) concern P when capacity is lost. So:

- Best interests’ decisions need to gather information from everyone who knows P about the preferences and probable refusals to determine what P might have wanted;

## Mental Capacity Act 2005 – 5 principles

1. **A presumption of capacity**
  - Start by thinking I **can** make a decision
2. **Individuals supported to make their own decisions**
  - Do all you can to **help** me make a decision
3. **Unwise decisions**
  - You must **not** say I lack capacity just because my decision seems unwise
4. **Best interests**
  - Use a **best interest checklist** for me if I can't make a decision
5. **Less restrictive option**
  - Check the decision made **does not** stop my freedom more than needed



**NHS**  
Shropshire  
Clinical Commissioning Group

- Use the least restrictive option – i.e. don't keep P under anyone's thumb.

When it comes to carers, a cross cutting initiative is being launched as the National Carers Strategy gets underway, which will raise awareness of the needs of relatives and that large army of informal and largely unrecognised carers who are important to P.

All this needs to change attitudes and behaviours in society far beyond health and social care, even though these services are where the majority of interactions with P occur. For example, the finance sector is addressing the training of front line staff to support P and their carers. Banks and building societies are often best placed to detect grooming and fraud, as they can see that tell-tale change in the way an account is used when unusual sums of money, large or small, are suddenly being paid out.

Preparation for possibly losing mental capacity through creating Lasting Powers of Attorney (LPAs), both for finance and for health and welfare decisions, has been promoted through the Office of the Public Guardian (OPG). Excellent training videos on the OPG website about finance LPAs are being further devel-

oped to also cover health and welfare LPAs. Several groups have been working at producing Advance Care Planning support materials.

The activity around the MCA through the National Mental Capacity Forum is being hosted in part on the Social Care Institute for Excellence (SCIE) website. Its pages are being updated to create a reference forum for ideas and experiences to be shared. The coming year will prove exciting – turning round the tanker of risk averse approaches to achieve behaviours that support all and recognise the intrinsic value of each and every person- whether P or those important to P – will take time and persistent effort. But it is worth it – after all, most of us will be P one day and we don't know how soon that day will come. ■

.....  
**Baroness Ilora Finlay**  
**Chair**

National Mental Capacity Forum Chair  
FINLAYI@parliament.uk  
[www.parliament.uk/biographies/lords/baroness-finlay-of-llandaff/3609](http://www.parliament.uk/biographies/lords/baroness-finlay-of-llandaff/3609)



## Is your workforce mentally healthy?

Liz Skelton, Vice-President of the Institution of Occupational Safety and Health (IOSH), provides advice for employers on ensuring that workers are mentally healthy...

**H**aving a mentally healthy workforce is a key component of any successful organisation. Positive feelings about work have been linked with higher productivity, profitability and customer and worker loyalty. The value of having a culture of care is something which is being recognised by increasing numbers of organisations across different industries.

Mental health problems can affect anyone at any time, just as a cold or flu can. Therefore all organisations should have it high on their health agenda. In fact, mental health should be given parity with physical health.

So, how do you ensure you have a mentally healthy workforce?

If you are looking to set up a programme to promote mental health it is vital that you must get buy-in at all levels. This means from the CEO through to all employees.

It is important that those at management levels lead the way. Managers can help employees strike a good work/life balance in many ways, something which is very important for our mental health.

Managers can do this by encouraging staff to take holiday entitlement, take breaks and work sensible hours. Meanwhile flexible working arrangements can be helpful. If you, as a manager, lead the way on this by doing it yourself, they will be inclined to follow. On the flip side, if workers see a manager not taking holidays and working long hours, they may do the same.

Mental health is often a tricky subject to talk about. There is a real stigma around it, meaning it can make people uncomfortable. But this doesn't need to be the case, nor should it be. By opening up and engaging with your teams about mental health you can start the dialogue.



Think of the benefits of promoting a culture of support; where positive behaviour is rewarded and people feel valued. This encourages openness, which in turn makes employees feel they can talk about the issues they have and get the right level of support.

Quite often poor mental health is not the result of just one factor. It can be many factors, for example someone could be worried about a piece of work they have on and at the same time have a personal issue. As a manager, you should attempt to regularly touch base with employees to gain an understanding of how they are – both in and outside work – and give them an opportunity to ask for help and advice.

Ask questions like “how are things for you at the moment?” and “how’s work going?”

While encouraging openness among staff members is a good start to building a mentally healthy workforce, it is not enough by itself. It is also important that managers have the tools to be able to help.

**“Quite often poor mental health is not the result of just one factor. It can be many factors, for example someone could be worried about a piece of work they have on and at the same time have a personal issue.”**

This can include proactive policies, training in what to look out for and how to manage cases, occupational health support and a good understanding of emotional intelligence. You can ensure that managers – and staff members – have access to stress management and resilience training. This not only equips teams but helps to develop their skills and confidence, as well as demonstrate you value them.

Within organisations there can be a disconnection between what a senior manager believes is happening and what actually happens. To avoid this, line managers should communicate clearly with teams and ensure that senior managers know if there are increasing demands.



So there are many ways in which organisations can start looking at ensuring workers are mentally healthy. It should form part of their safety and health management systems. Organisations which view these systems as a priority experience improved reputation, resilience and results.

IOSH is the Chartered body for health and safety professionals. With more than 44,000 members in 120 countries, we’re the world’s biggest professional health and safety organisation. We set standards, and support, develop and connect our members with resources, guidance, events and training. We’re the voice of the profession, and campaign on issues that affect millions of working people.

IOSH was founded in 1945 and is a registered charity with international NGO status. ■

.....  
**Liz Skelton**

**Vice-President**

Institution of Occupational Safety and Health (IOSH)

[www.iosh.co.uk](http://www.iosh.co.uk)

# Healthy in every sphere of life

Projects by the Initiative 'The Palatinate makes itself/you strong – ways to resilience'...

The Palatinate makes itself/you strong – ways to resilience' initiative was founded by Pfalzkrlinikum for psychiatry and neurology in the Palatinate, in Southwest Germany. Together with national and international project partners such as, universities, communication experts and think tanks it aims to develop a resilient palatinate region until 2025. People shall be enabled to help one another to remain healthy and to cope well with personal challenges and crises. At the moment, the initiative is involved in different projects that illustrate their 3 work fields 'Myself and Others', 'The Job and the Company', and 'Me/Us in the Community'.

## Healthcare centre in Donnersberg – a project by "Me/Us in the Community"

A completely new concept in healthcare service is the healthcare centre Donnersberg, which will be developed in the Palatinate town Rockenhausen and its neighbouring cities in the administrative district Donnersberg. On the one hand, Pfalzkrlinikum for psychiatry and neurology, as well as Westpfalz-Klinikum for somatic medicine are pooling their competences in terms of mental and physical health. On the other hand, both stationary and ambulatory, as well as caring and preventive services will be narrowly interlinked.

Both partners aim to maintain people's health and quality of life in that region



as long as possible – especially regarding the ageing population and the shortage of doctors and other skilled professionals in the care sector. The healthcare centre shall merge the competences of hospitals, resident doctors, and aftercare institutions such as stationary living or welfare centres. Not only patients can benefit from the close exchange and the spatial proximity of the institutions.

The concept also offers an incentive for young doctors: In this way, they can establish themselves in the rural area without being forced to become self-employed. With this idea, Pfalzkrlinikum and Westpfalz-Klinikum are facing important challenges in the country: rural exodus, lack of doctors and ageing. In addition, they plan to involve different stakeholders of the population at an early state of

## PROFILE



the planning. The focus lies here on the positive impact of participation and the development of health literacy.

**“Both partners aim to maintain people’s health and quality of life in that region as long as possible – especially regarding the ageing population and the shortage of doctors and other skilled professionals in the care sector.”**

### **Fostering of emotion regulation of school children – a project by ‘Me and the others’**

How does it feel to be angry or happy? How do I recognise if someone laughs about me or with me? How do I show other people that I like them? Why do I have emotions and why is it important to allow them? Developing basic emotional competences is as important for children as acquainting rules of social conduct. It is an essential precondition for resilience. The initiative is currently working on the expansion of an emotional training which has

been implemented in more than 50 classes in Palatinate schools. It was developed and tested by Prof. Tina In-Albon and psychology students of the University of Koblenz-Landau. The training transfers knowledge about emotions to the children and develops their competences in being empathetic, controlling their impulses, coping with conflicts and communicating violent freely. The elder children and teenagers from class’s 8 to 9 are also trained in coping with depression and building cognitive strategies and resources.

### **Tool box for sustainable companies – a project by ‘The Job and the Company’**

Whether it is the implementation of new technologies, a strategic realignment, ageing staff or an internal shift of culture – change often bares both potential and risks for companies. But there is often a lack of practicable implementation concepts in order to deal with such situations successfully

without burdening the people in a company. Therefore it is necessary to develop a new kind of implementation process that strengthens companies and their employees against crises. The solution approach is to balance individual and organisational resilience.

In their work field – ‘The Job and the Company’ – the initiative ‘The Palatinate makes itself/you strong’ is currently working with small and medium sized enterprises in order to develop measurements that make them fit for challenges and resistant against crises. For example, before change projects are decided, the management and the employee organisation check which alternative implementations bare the least burden for the staff. In these processes, the focus is laid on preserving mental health instead of discussing diseases.



### **Romina Männl Project Assistant**

“The Palatinate makes itself/you strong”  
Pfalzlinikum für Psychiatrie und Neurologie  
Tel: +49 6349/900 1643  
romina.maennl@pfalzlinikum.de  
www.pfalzlinikum.de



# Analytics on the frontline of saving lives

David Downing, Director of Health at SAS UK looks at how the NHS can embrace digitalisation and overcome some of its biggest challenges, highlighting the Carter Review...

Since its creation in 1948, the National Health Service (NHS) has grown to become the world's largest publicly funded health service. Made up of hundreds of different trusts, it now faces the biggest challenge in its history as it looks to fully embrace the digital age to make the changes necessary to achieve £22bn of efficiency savings by 2020. How can it possibly achieve this?

In a recent report on NHS cost savings, [The Carter Review](#), which was published earlier this year, included recommendations designed to end 'unwarranted variations' in the quality of care and resource management that costs the NHS billions.

The review of hospital productivity suggested that efficiency gains could be achieved through the creation of 'meaningful use' standards for clinical IT systems and incentives to drive better adoption of technology. Carter's review also highlighted the importance of data and information in managing quality and efficiency performance at all points in the care pathway.

While some trusts have embraced technology in this way already, it is inconsistent and rarely integrated. However, with the digitisation of the health and care system being a high priority for government, this signals promise. Health secretary Jeremy Hunt has pledged that the government's investment in health IT over the course of this parliament will be around £4bn. A significant proportion of this should be invested in systems that underpin the collection of performance data on quality and efficiency, and ensure these systems are interoperable.

## Pride of the country

Former Prime Minister Tony Blair once labelled the NHS ["the pride of the country."](#) If it is to retain this



status then it must find a way to drive up patient value by changing the way that services are organised, delivered, costed and measured. Instead of orientating services around the specialisms of doctors, care needs to be centered on the needs of the patient.

As the Carter Review suggested, this means making better use of the resources available and enabling better integration. Greater collaboration between primary care, ambulance services, urgent care centres, community pharmacies and mental health teams will ensure that services are used and care is delivered closer to the patient. For example, regular home visits can ensure the patient's condition and medicines are monitored and varied accordingly – preventing unnecessary admissions to the already overstretched accident & emergency units.

It also relies on NHS vanguards making better use of the clinical insights available to forecast demand for services, plan new care pathways, eradicate duplication, model treatment plans and continuously analyse patient outcomes and values. Only then can the right services be delivered at the right time and in the right place to reduce emergency admissions, cut waiting times and improve efficiency.

### Big data and IoT could be the cure

To achieve its vision of a more efficient and productive healthcare system, the NHS needs to make data the lifeblood of the organisation. Our [research with the Centre for Economics and Business Research](#) shows that big data and the Internet of Things (IoT) will add £15.8bn to the healthcare industry over 2015-2020 due to improvements in business efficiency, patient insight and quality management. However, only 52% cent of health-care organisations will have adopted big data solutions by 2020 and just 26% will have adopted IoT by 2020.

A change is needed. Improving the performance of the NHS requires researchers, clinicians, commissioners and managers to 'know more'. This means understanding, what is possible, predicting needs, modeling outcomes and measuring the value of patient outcomes. To do this, real-world data needs to be put at the heart of performance analysis. Robust evidence can then be used to assess challenges, prioritise investments and make changes that deliver greater value to patients.

### In data we trust

Improving patient outcomes needs to be at the core of everything the NHS does. By applying powerful analytics to the data available then clinicians can be presented with valuable insight and predictions about the patient. In turn, this evidence can enable better interventions and potentially more rapid diagnosis.

SAS's work with [Royal Brompton & Harefield NHS Foundation Trust](#) is an example of delivering greater patient value using data. With just under 500 beds, the trust specialises in surgery and medical care for heart and lung conditions. It carries out major heart and lung transplants, and its facilities include intensive and high-dependency care units.

Throughout the years, like many other trusts, it has accumulated a huge amount of clinical data, with

digital data increasing dramatically in recent times. Most of this data is disconnected and held in multiple databases. The trust chose SAS® to help transform its fractured network of siloed information into a single data warehouse where insight and analysis can lead to better patient care. For instance, before the implementation of our solution, if a cardiologist wanted to assess something like the relationship between prescribing certain antibiotics and the outcome, they would have required 3 or 4 junior doctors to review some 400 case notes on paper. Now the hospital is able to perform such analyses in under five minutes.

### A forward view

With the NHS being a relentless producer of data – be it patient, performance, clinical or administrative data – the solution lies in analytics. In making good use of data to better understand patient conditions and circumstances, the NHS can improve overall efficiency. Everything from alleviating queuing time in the emergency room due to unnecessary visits to identifying underlying factors contributing to higher admission rates. Many private sector organisations are improving the way they collect, analyse and use big data. It has become a trend that the public sector cannot ignore given the benefits in terms of decision making, efficiency and cost cutting. ■

To find out more, read this report on [How To Use Analytics to Create Health Care Value](#).

.....  
**David Downing**  
**Director of Health**

SAS UK

[www.sas.com](http://www.sas.com)

[www.twitter.com/SASsoftwareUK](https://twitter.com/SASsoftwareUK)

# Fraud and corruption with medical devices and how to get away with it

Paul Vincke, Managing Director of the European Healthcare Fraud and Corruption Network...

**T**here are alarming signs of fraud and corruption with medical devices and implants. At least in Belgium, in the sector of medical devices the ratio of fraud and corruption is the highest compared to the extent in the other healthcare sectors.

A lot of infringements stay under the radar and they only surface when whistle-blowers reveal evidence in cases reported.

There are a lot of little suppliers and the playing field lacks transparency compared to the pharma sector. One of these cases relates to a fraud and corruption case in Belgium with involvement of an orthopaedic surgeon.

Company A, a manufacturer of orthopaedic materials (knee braces a. o.) has been taken over by company B in 2007. Shortly after the take-over it became clear to the new owner that manufacturer A had defrauded Belgian public health insurance by forgery of prescriptions for orthopaedic materials; as a result two knee braces for two different knees could be charged to health insurance where the original two prescriptions presented an alternative brace for the same knee. Only one of both could be charged to health insurance. 148 prescriptions were forged between 2005 and 2008. The way the scam has been perpetrated is as follows:



An orthopaedic surgeon (always the same) working at a university hospital in Belgium prescribes (always) a knee brace (fixed) and a neoprene knee bandage (flexible).

The orthopaedic surgeon sends the two prescriptions in hard copy and fax to (always the same) manufacturer A.

As both products belong to the same orthopaedic category the public health insurer reimburses to the patient only one of both orthopaedic devices; as a consequence the patient only wants to buy one of the devices.

Manufacturer A however, instructs the supplier of the bandages to deliver both the knee devices to the patient. After deliverance, Manufacturer A receives document 13YT from the bandage manufacturer as proof of deliverance for the public health insurer.

Manufacturer A “corrects” in one of the prescriptions and in document 13YT the knee initially prescribed for (changes left knee into right knee). As a result one prescription is intended for a knee brace for the left knee and the other prescription is intended for a neoprene knee bandage for the right knee.

Both prescriptions and the document 13YT were then forwarded to the health insurer who reimbursed both devices to manufacturer A, leaving the patient with a co-payment of only 10€ to be paid (here is a conflict of interest on behalf of the insurer).

As a consequence an extra device has been sold to the patient at a value of 223€.

The orthopaedic surgeon, when interviewed by the health insurer,



## PROFILE

declares that he himself did not forge the prescriptions. Interesting to know is that the 56% of the turnover of Manufacturer A was generated by prescriptions of the orthopaedic surgeon: about 100 prescriptions per month.

Manufacturer B informs the public health insurer on 9 February 2009. The health insurer refers the case to the public prosecutor on 28 April 2011.

On 27 May 2015 there is a judgment in court. In the mean while an administrative action by the health insurer could not be completed as the action became prescribed, in application of the Belgian healthcare law. The court sentenced Manufacturer A to 12 months imprisonment suspended for 3 years and to a fine and attributed damages to the civil parties involved.

In the meanwhile, on 29 September 2011, manufacturer B also files a complaint against the orthopaedic surgeon for an attempt of extortion as the surgeon had suggested that he would only continue to work with him if he returned him 50% of the turnover he generated by his prescriptions, as this was the practice with manufacturer A.

Manufacturer B has declined the offer and the surgeon stopped the "partnership" and from then on colluded with Manufacturer C (a cover up for Manufacturer A).

The orthopaedic surgeon was the top prescriber in Belgium in 2007 and 2008 of knee braces, neoprene knee bandages and walkers. On his behalf there were clear indications of overconsumption or unnecessary prescriptions, such as the standard "double" prescription of both a knee

### **About EHFCN**

[www.ehfcn-powerhouse.org/welcome](http://www.ehfcn-powerhouse.org/welcome)

EHFCN has formally been established in 2005 as a not for profit international association by Belgian law.

The Network is membership based. The actual 16 members from 14 European countries represent public and private healthcare insurers, health financiers and payers who all have the countering of fraud, waste and corruption in healthcare as their core business or as part of their mission.

The aim of EHFCN is to improve European healthcare systems by reducing losses to fraud, waste and corruption and its objective is to help members to be more efficient and effective in their work of prevention, detection, investigation, sanctioning and redress of healthcare fraud, waste and corruption, with the ultimate goal of preventing from money being lost and returning money to healthcare services for the benefit of every patient.

EHFCN provides its members with high quality information, tools, training, global links and access to professional consultancy. It also promotes the share of good practice, joint work, bilateral agreements and the development of common working standards.

brace and a neoprene bandage for the same person.

Meanwhile, in 2011 the orthopaedic surgeon was honourably discharged by the university hospital for a swindle with implants. He had developed a new kind of implant for bone extension (hydraulic extension nail). This implant was illegally manufactured in his laboratory in the university hospital and used without certification nor authorisation of the Belgian Medical Devices Agency. At the same time he asked manufacturer A to invoice the hospital as if he manufactured the devices himself.

After his discharge the orthopaedic surgeon, up until today, continued working with the new company of manufacturer A, now C, still using his unauthorised hydraulic bone extension devise.

Up until today the complaint against the orthopaedic surgeon has not been followed up by the Belgian health insurer who is only competent for the indication of fraudulent overconsumption. A referral to the public prosecutor for the indication of corruption has not been made. Nor has the case been taken on by the Belgian Medical Devices Agency.



**Paul Vincke**

**Managing Director**

European Healthcare Fraud  
and Corruption Network

<https://ehfcn-powerhouse.org/welcome>



# Productivity and efficiency in English acute hospitals

James Thompson, Senior Research Analyst at the King's Fund asks whether the Carter Review guides us to productivity and efficiency in acute hospitals...

In June 2014, at the request of the Secretary of State for Health, Jeremy Hunt, Lord Carter began to look at what could be done to improve efficiency in non-specialist NHS hospitals in England. In February 2016, following 18 months of work, the final report was published. The review takes stock of the productivity and efficiency of English non-specialist acute hospitals as they try to achieve the efficiencies of 2-3% annually until 2020 set out by the national bodies. The review sets out the scale of variation across hospitals in a number of areas and says that the opportunity for the NHS of reducing this variation amounts to around £5bn by 2020. This is the equivalent of 9% of the £55.6bn current budget for acute hospitals.

The findings and the recommendations were certainly the result of an impressive piece of work. Over the 18 months Lord Carter and his team engaged with 136 acute hospitals; the Royal Colleges of Nursing, Surgeons, Pathologists and Radiologists; NHS England; NHS Improvement; the Care Quality Commission and many more. In terms of engagement with local leaders and national stakeholders, this is to be celebrated.

The report puts forward 15 recommendations, though within each of these lots of further work is required to achieve them. For example, there are at least 5 different operational plans each trust will need to develop and have signed off by NHS Improvement. The demands on

trusts and NHS Improvement, themselves in the middle of their own internal change programme, to achieve this should not be underestimated. Quick wins, these are not.

The involvement of NHS Improvement on a continuous monitoring basis adds more emphasis on central control of the NHS, a trend we have seen in other recent developments, as summarised in our recent [briefing paper](#). How this central control will balance short-term quality and financial improvements while allowing local areas to strategically plan long-term transformation is yet to be seen.

Nationally the Carter review identifies £5bn of savings, no small number, but it is still less than a quarter of the wider £22bn worth of efficiencies the NHS has identified it needs to make by 2020. Until recently where the rest of the savings were going to come from was up for debate – though NHS England have now spelt this out in their appearance before the [Commons Health Committee](#).

As with these wider savings, the Carter review doesn't pretend that the savings it identifies can be achieved in isolation. Rather it requires the successful implementation of new care models and achievement of financial turnaround plans to achieve its aims. Whether these can all be achieved as they were first envisaged by 2020 will require both strong NHS and political commitment.

The review acknowledges this by emphasising the need to “significantly improve” leadership capability and capacity from trust boards through to clinical staff, echoing our 2015 report [Better Value in the NHS](#). It recommends a national people strategy to build-up leadership capacity, engagement and inclusion, a

welcome ideal to have in an age where NHS executive tenure are too short and turnover too high.

Though set in a challenging environment with concurrent and often competing priorities, the Carter review certainly makes a compelling case for reducing variations in acute hospitals in the NHS in England. Though the NHS has a mixed record on achieving year-on-year efficiency gains, there is enough variation there to aspire to drive these down as far as possible.

**“Nationally the Carter review identifies £5bn of savings, no small number, but it is still less than a quarter of the wider £22bn worth of efficiencies the NHS has identified it needs to make by 2020.”**

Does Carter show us the way forward? He shows us one version of the future but achieving all this at a time when demand and cost pressures leave very little room for strategic foresightedness is perhaps the greatest, and unwritten, aspiration. ■

.....  
**James Thompson**  
**Senior Research Analyst**  
The King's Fund  
[www.kingsfund.org.uk](http://www.kingsfund.org.uk)





# Preventing and reducing HCAs

Professor Alan Johnson, Head of the Department of Healthcare-Associated Infection and Antimicrobial Resistance at Public Health England, explains to Editor Laura Evans about healthcare association infections and how they link to antibiotic resistance...

**H**ealthcare-Associated Infections (HCAs) are infections that are contracted within healthcare settings, such as hospitals and care homes. They are often acquired as a result of healthcare interventions, such as surgery. [NICE estimates](#) that in England, around 300,000 patients a year acquire a HCA as a result of care within the NHS. The most common types of HCA are said to be respiratory infections (including pneumonia), urinary tract infections, and surgical site infections.

One of the major problems with HCAs is they can be resistant to antibiotics. This is why preventing HCAs is an important aspect of work to tackle antimicrobial resistance; reducing these infections would also reduce the number that are resistant to antibiotics.

As part of work to reduce HCAs, [Public Health England \(PHE\)](#) runs a number of surveillance programmes that

monitor the number of infections that occur in healthcare settings, along with working with hospitals to improve their infection prevention and control measures. In the first of two interviews, Professor Alan Johnson, Head of the Department of Healthcare-Associated Infection and Antimicrobial Resistance at PHE, tells Adjacent Government Editor Laura Evans how much of a problem HCAs are in the UK and how PHE are helping to prevent and reduce them.

**“It is essential that we use our surveillance and feedback findings to our colleagues in the NHS so they can take action.”**

**How are HCAs contracted? And what are the risks?**

Essentially HCAs are infections that patients contract when they come into a healthcare setting. Most healthy people don't get many infections, the reason

being that the human body has a natural barrier to infection – the skin – and most microorganisms, with a small number of exceptions, can't actually get through intact skin. However, when you breach the skin, for example by having surgery, bacteria can get through and enter the body to cause infection. Hence, invasive medical procedures, such as surgery or insertion of catheters into blood vessels beneath the skin, increase the risk of infection.

A second barrier to infection is the body's immune system. If bacteria get into a wound or surgery site the body's immune system will kick in and try to fight off the infection. Sometimes however, patients may be taking medicines or on treatment which can dampen down the body's immune system, making it less effective in fighting infection. One such example is anti-cancer chemotherapy; the drugs that are used to attack cancer cells are fairly non-specific in that they attack any rapidly dividing cells in our body. Hence they not only attack the cancer cells, but also the cells of the immune system. This can cause a patient's white blood cell count to drop dramatically, making them much more prone to getting an infection.

### **How much of a problem are HCAs in healthcare environments in England?**

HCAs occur in hospitals around the world; they are not unique to the UK. In England we have a good track record of reducing HCAs – one particular example of bacteria contracted in hospitals is MRSA. During the 1990s in England the number of MRSA cases dramatically increased; one reason we identified for this increase was inadequate infection prevention and control in hospitals.

In 2001 the government made reducing cases of MRSA and other HCAs a national priority. Indeed, in 2006 John Reid, the then Secretary of State for Health, set hospitals a target of halving their MRSA blood stream infection rates over 3 years. Although many people thought it was unachievable at the time, the strategy was successful with a dramatic reduction in MRSA cases acquired in hospitals. During the mid-2000s through to the present time we have seen a remarkable response from NHS hospitals in work to combat HCAs; over the last 10 years there has been around a 90%

reduction in MRSA infections. This reduction reflects both HCAs becoming a national priority, the government making the surveillance of MRSA mandatory and many individual hospitals making reductions in MRSA and other HCAs a top priority (this includes ensuring enough resource and staff to take forward work).

### **How does PHE monitor and work to prevent HCAs?**

When a patient gets an infection in hospital, samples from the site of infection in the patient (for example blood, urine, sputum, wound swabs etc.) will be sent to the hospital microbiology laboratory, which will try and diagnose the exact cause of the infection and assess whether it is resistant to antibiotics.

The results of these diagnostic tests are then collected and analysed by PHE as part of our national surveillance programme for HCAs. This involves holding all the data centrally on a national database and monitoring the numbers of different types of infections we are seeing. We also look at the degree of antibiotic resistance seen in the different types of bacteria that are causing the infections. This work allows us to identify any trends in infections, such as any sharp increases, and take action to prevent further cases.

It is essential that we use our surveillance and feedback findings to our colleagues in the NHS so they can take action.

PHE has a web-based online tool called '[Fingertips](#)' that allows access to a data for a range of public health indicators. Launched in April 2016, Fingertips brings together data on different types of HCAs and levels of antibiotic resistance, as well as data on levels on antibiotic prescribing. The data is available at the level of individual hospitals, Clinical Commissioning Groups (CCGs) or GP practices and is publically accessible.

Monitoring the levels of prescribing of antibiotics in different healthcare settings is a relatively new initiative by PHE. Making this information available to hospitals, CCGs, GP practices and the public, can help prescribers take action, such as look for safe ways to reduce inappropriate antibiotic prescribing, if their rate of prescribing is particularly high compared to others.



Data on Fingertips can be viewed in various accessible formats including tables, graphs and maps.

### **Do you think enough is being done in hospitals to ensure infection control is being managed properly?**

There is a huge amount of work that must continue to take place to maintain and improve infection prevention and control. One reason for this is the increase we are currently seeing in antibiotic resistance.

Preventing infections occurring in the first place means that less antibiotics will need to be prescribed to treat them, which can in turn reduce the risk of antibiotic resistance emerging and spreading.

All hospitals must have high standards of infection prevention and control; the legislation for the NHS indicates that hospitals should be doing their utmost to minimise harm to patients through hospital-acquired infections.

PHE works closely with hospitals across the country,

assisting them in preventing infections and providing expert guidance and support.

In the next edition of Adjacent Government, Professor Alan Johnson will discuss antibiotic resistance and infection prevention and control. ■



.....

### **Professor Alan Johnson Head of the Department of Healthcare-Associated Infection and Antimicrobial Resistance**

Public Health England

<https://www.gov.uk/government/organisations/public-health-england>

[www.twitter.com/PHE\\_uk](https://twitter.com/PHE_uk)



# Controlling hygiene and risk

Martin Easter, General Manager at Hygiena International Ltd highlights the importance of objective measurement of cleanliness

**"Measurement is the first step that leads to control and eventually to improvement.**

**If you can't measure something, you can't understand it.**

**If you can't understand it, you can't control it.**

**If you can't control it, you can't improve it."**

**(H James Harrington)**

**H**ealthcare Associated Infections (HCAI) are preventable. WHO statistics show a prevalence of 7.1% in Europe, affecting 4.1 million patients and costing €7bn and 37,000 deaths per annum. In the UK the prevalence is 6.4%, affecting 300,000 patients and costing £1bn.

The patient environment is recognised as a reservoir of contamination where bacteria can survive up to 60 days on surfaces. Unclean surfaces and hands of healthcare workers are claimed to be responsible for 20 to 40% of HCAI's, and the emergence of superbugs without suitable antibiotic treatments is a major challenge for the future. Evidence shows that degerming the environment reduces infection risks and there is a cost benefit of effective cleaning.

Cleaning is one of the primary preventative measures against HCAI's. The

NHS spends £725m per annum on cleaning and the NHS Productivity Review (2016) showed that £93m could be saved from a better control of cleaning. However, cleaning is inadequately measured by visual assessment methods that are highly subjective and only detect gross lapses of practice. Visual assessment gives a "misleading over-estimate of cleaning that undermines infection control strategies" (Jones 2009).

The National Institute of Health Research recognises that, "NHS places great reliance on visual assessment of surface cleanliness. However, reliance on observational evidence in judging cleaning efficacy is subjective and may be of questionable validity.....The use of ATP bioluminescence is a better method because it gives an instant indication of total surface contamination and importantly an objective assessment of cleanliness. ATP detects invisible contamination and tells us that the surface has been cleaned."

ATP bioluminescence is a simple rapid method for measuring organic soil. It requires a small hand held instrument and an all-in-one sample collection and testing device, which generates a numerical result in 15 seconds. The use of ATP bioluminescence for cleaning verification is well established and recognised by the Rapid Review Panel of the Department of Health and Public Health England in support of



the fight against HCAI's. The test is also recognised by the Centre for Disease Prevention and Control (CDC) in USA and is written into a standard for cleaning in Denmark and Sweden.

Earlier adopters such as North Tees and Hartlepool Trust have shown a consistent and marked improvement in cleanliness and reductions in infection rates since its introduction in 2008. The results have shown a >20% improvement in pass rates and a large reduction in fail scores to fewer than 5%, with a corresponding decrease of 35% in C. difficile cases and a 39% reduction in infections per 10,000 occupied bed days. Monitoring officers, independent from nursing and environmental services staff, are assigned to act as project champions for individual facilities, reporting to departmental managers wherever poor cleaning was discovered and where corrective action is required. Monthly reports are circulated for

## PROFILE

cross-functional team meetings of nursing, facilities and infection control staff. This allows for open discussions on all cleaning and maintenance related issues and stimulates actions for improvement.

The Hygiena SystemSURE Plus received the highest recommendation for the Department of Health and Public Health England's Rapid Review Panel in 2009 and it has many different applications within hospitals including the routine testing of patient rooms, identification of hotspots and hazard management, training of cleaning staff, and hand wash training and verification.

The benefits of the ATP cleaning verification system include, a dramatic improvement in hospital cleanliness, optimised cleaning performance and personnel training, increased productivity commitment and morale of cleaning staff and reduced infection rates.

Southport and Ormskirk NHS Trust have been using the ATP technology for more than 5 years for several applications and departments from medical equipment library, ITU, IP&C, domestic services, planned care, catering and operating theatres. It is also used for hand hygiene training and compliance monitoring. Andrew Chambers explained: "We also use Hygiena ATP monitoring when we may have had an incidence of VRE. For example, after a clean, the area might look clean but a number of spot ATP tests might show that the area is, in fact, not clean.

"ATP gives you a clean hospital," said Val Hulme (team leader, domestic services). "When you're doing a deep



clean, the staff know they are going to be tested but they do everything to a very high standard now. ATP has helped us to achieve that.

"When you have a number – like the ATP machine gives you – it's more objective than subjective. You can't argue with it. ATP makes the staff competitive. They all want to score five or below. And ideally zero."

Andrew explained further: "The results of the ATP monitoring are incorporated into the weekly infection prevention and control performance report, which is circulated trust-wide. It includes a breakdown of the results of commode cleanliness, amongst a range of other items, area by area.

"This adds a competitive edge and drives the staff to achieve a low score. It's there to encourage people, to make them aware. If they're doing a good job, it's a low number and the staff are delighted.

"If we have an area of concern with a particular infection or organism – we use ATP as part of the investigation." Andrew added. "The benefit is that with ATP we can react immediately to the results on site and put any necessary interventions into immediate effect. That way we're safeguarding patients, which is what it's all about. Low numbers mean it's a safe environment for patients to be in."

Similar improvements are seen in USA where the CDC also recommends the use of ATP as part of the monitoring tool kit for environmental cleaning. Many US hospitals are using SystemSURE Plus in support of the Affordable Care Act and infection control, and are seeing the same benefits as UK hospitals.

Regular objective monitoring of cleaning increases compliance of cleaning policies from 40% to 82%. This decreases contamination levels, reduces infection rates, maximises the use and value of existing resources thus saving time, money and lives.



**Martin Easter**

**General Manager**

Hygiena International Ltd

Tel: +44 1923 818821

[enquiries@hygiena.net](mailto:enquiries@hygiena.net)

[www.hygiena.com](http://www.hygiena.com)

[www.twitter.com/HygienaInt](https://www.twitter.com/HygienaInt)

# Infectious disease is a global problem

Prof Colin J Suckling, Research Professor of Chemistry at the Department of Pure & Applied Chemistry, University of Strathclyde looks at how the recent EU Referendum could impact his institution and research

Like many British academics, the result of the recent referendum on the UK's place in Europe was a great disappointment. We've thought of ourselves, with some justification, as being the leading scientific nation in Europe and now, because of what seems to me to be prejudice and petulance on behalf of the political classes, we find ourselves potentially being cut off from our European partners. Progress in all of my recent projects has had contributions from students or research associates from EU member states, all of them really productive people. Funding too has come from the EU, particularly for the early stages of both our anti-infective and anticancer programmes. Those who have brought us to this position now have the responsibility to ensure that we can continue to have a global impact as UK scientists. Perhaps they are more confident than I am. Some 15 years or so ago, I wrote a musical called Mrs McWheedle's Rant, which now seems very apt, from which I quote a chorus:

"So who do they think they're kidding when they play a central role?

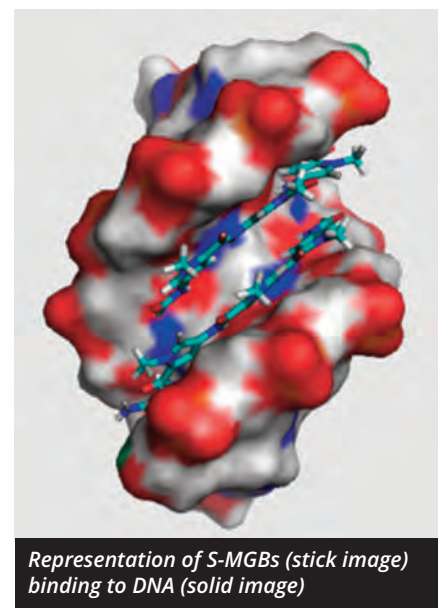
And who do they think they're kidding when they say they have control?

Perhaps there is very little just now that a government can rehearse

To make things better but sure as hell they can easily make things worse!"

Whatever actions are taken over the next few years it is likely that the Law of Unintended Consequences will apply, which leaves the scientific community with the challenge to make its case for support vigorously and to get on with the job of making things better. We're much better at that than politicians are and I'll use this opportunity to reiterate and update some of the important points I've made in previous articles for Adjacent Government.

Here I want to highlight infectious disease and what has been referred to sensationally but perhaps justifiably as the 'Antibiotic Apocalypse'. Media features, scientific papers, and official government sponsored reports all paint the same picture in different ways and with appropriately differing emphasis. For most of us most of the time an Antibiotic Apocalypse is as remote as a universal apocalypse but for many people, especially those otherwise ill and with weakened immune systems, it is real and immediately life-threatening. Every time I talk to my clinical colleague, Dr Stephanie Dancer, who is a consultant clinical microbiologist at an NHS District General Hospital in central Scotland, her frustration at being unable to help patients with life-threatening infections because of the lack of effective antibiotics is both challenging and moving. When you get closer to people afflicted by incurable infections the Antibiotic Apocalypse transforms from a media feature, scientific



discourse, or an official pronouncement to an imperative for action. We are all vulnerable. A world without antibiotics is a public health issue and one that is wider than an isolated UK.

## Don't just stand there - do something!

Having issued the order, what are we doing about it? What does heterocyclic chemistry contribute in this context? Coping with microbial resistance has many aspects. It's inevitable that sooner or later bacteria, fungi, viruses and other infective agents including parasites will become resistant to available drugs. Those infective individuals that are not killed by the drug will multiply and form a resistant population. It's an aspect of natural selection and there are many possible mechanisms that can lead to resist-





<http://www.mgb-biopharma.com/>. Excitingly, MGB-BP-3 recently completed Phase 1 clinical trials in an oral formulation for the treatment of *Clostridium difficile* infections. MGB Biopharma is now working hard to set up the Phase 2 trial for efficacy in late 2016. This development was highlighted in a BBC Scotland feature ( <http://www.bbc.co.uk/news/uk-scotland-34106754> ).

ance. The more extensively an antibiotic is used, the more rapidly resistance can be expected to develop. One approach, therefore, is to manage carefully the use of antibiotics, so-called antibiotic stewardship. It's something that can be tackled by health care providers, especially in the public sector, and regulators and is easier to do in a human health context than in an animal health environment.

Management of the use of antibiotics is, of course, beyond the range of heterocyclic chemistry itself, although colleagues at the University of Strathclyde led by one of our pharmacists, Professor Marion Bennie, are playing a major role in this aspect in Scotland. The efforts of my team focus on the discovery of new anti-infective compounds for human and animal health.

### New antibiotics from Strathclyde

The best treatment may be an established antibiotic. On the other hand, it is likely that antimicrobial resistance may have been identified, in which case new antibiotics are needed. This is where my own team's work comes

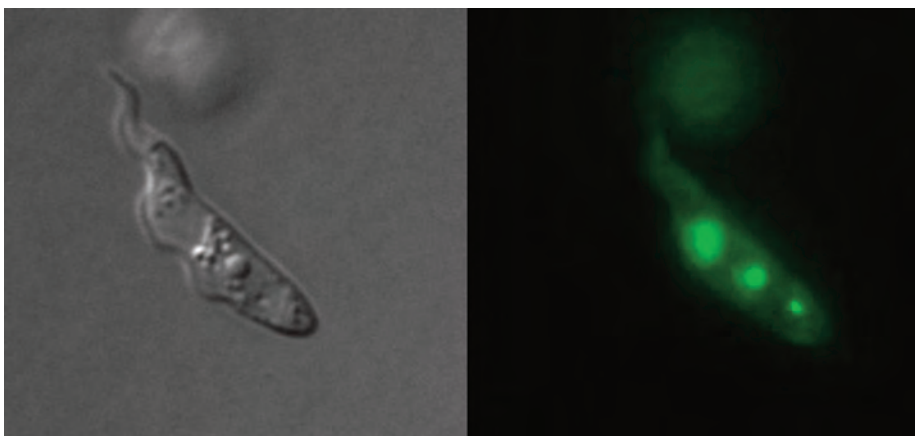
in. We're vigorously engaged in the study of a class of compounds that bind to DNA known as minor groove binders (MGBs) and we refer to the compounds designed and synthesised at Strathclyde as S-MGBs. This study has yielded a rich harvest of anti-infective compounds that can be targeted at bacterial, viral, or parasitic diseases, all of which need new treatments because all show resistance to established drugs. We obtain our selectivity of action and avoid toxicity by taking advantage of the vast range of available structures in heterocyclic compounds. A sort of molecular mix and match allows us to find compounds with the required profile.

Working with colleagues around the world (including Australia, South Africa, India, and Switzerland) in Universities and industry the S-MGB collection now has lead compounds for the treatment of Gram-positive bacterial infections in general, tuberculosis, animal African trypanosomiasis, and malaria. The front runner by some distance is a compound known as MGB-BP-3, which is licensed to a small Scottish company, MGB Biopharma.

We will continue to work with MGB Biopharma in the discovery of other antibacterial drugs for which we have active but unoptimised S-MGBs, notably to treat Gram-negative bacterial infections and tuberculosis. For tuberculosis, academic colleagues at the University of Cape Town, South Africa, have shown that a new class of S-MGB in which we have included an unusual heterocyclic component contains significant leads.

Antimicrobial therapy also includes drugs to treat parasitic diseases and in our research, we have found compounds of interest to treat malaria and infections caused by trypanosomes. The significant things about the anti-malarial S-MGBs are that they have different structural features from the antibacterial compounds, suggesting that we can get selectivity, and that they are active against strains that are resistant to currently available drugs. This encourages us to take this work forward, which we are doing in collaboration with academic partners at the University of Queensland, Australia.

## PROFILE



*A single trypanosome viewed through the microscope (left) and the same trypanosome with an S-MGB taken up into the cell showing as green fluorescence.*

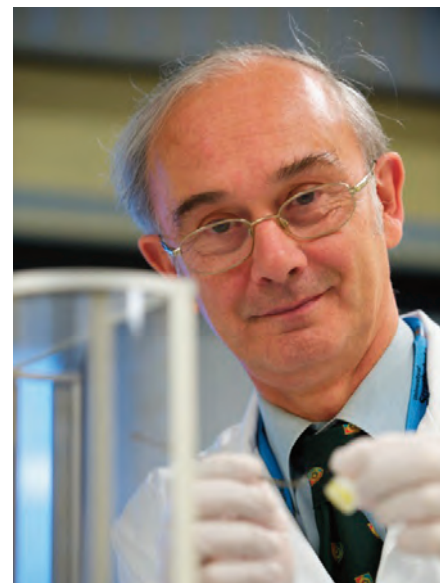
It's not just human health for which there are problems with antimicrobial resistance. Arguably, because of indiscriminate use of antibiotics, the challenges are greater in animal health, upon which the livelihood of millions of people worldwide depends. We've been working with colleagues at the University of Glasgow, the Swiss Tropical and Public Health Institute in Basel, and Galvmed, a not-for-profit company dedicated to animal health, to discover compounds to treat sleeping sickness in animals, caused by parasites known as trypanosomes. Trypanosomiasis in cattle is a devastating disease not only for the animals, but also for the human populations that depend upon them. We have achieved proof of concept in animal models that S-MGBs are able to treat successfully one species of infection of cattle. Moreover, as with malaria, we

can treat strains resistant to existing drugs and have found that S-MGBs work by a different biological mechanism from existing drugs, all of which encourages further development. Excitingly, our new three year collaborative programme to tackle this, funded by the UK's Bioscience and Biotechnology Research Council, led by Prof Mike Barrett at the University of Glasgow, and including the world famous Roslin Institute of the University of Edinburgh, has already delivered highly active new compounds with selectivity indices of greater than 1000, comparing the toxic doses for the trypanosome parasite and a typical mammalian cell. 1000 is a huge number in this context and the results point clearly the way ahead.

Clearly, unlike some politicians, we're not interested in Little Britain. But as the University of Strathclyde website puts it, we're engaged in 'world changing research'. We must keep this in mind as we deal with the fall-out from a referendum that did not need to have happened if the UK's best interest had taken precedence over political parties' internal interest. I'm tempted to end this note in traditional tabloid style by signing off as 'Disgusted, Glasgow'.



*A cow suffering from trypanosomiasis*



**Prof Colin J Suckling OBE DSc FRSE**  
Research Professor of Chemistry



*Department of Pure & Applied Chemistry,  
University of Strathclyde*



**Prof Colin J Suckling OBE DSc FRSE**  
**Research Professor of Chemistry**  
Department of Pure & Applied Chemistry  
University of Strathclyde  
Tel: 0141 548 2271  
[www.strath.ac.uk/chemistry](http://www.strath.ac.uk/chemistry)





# Infection prevention and control: setting the right standards for patients

Gaynor Evans, Head of Infection Prevention and Control (North) at NHS Improvement details how the organisation helps the NHS to maintain high standards and encourage best practice for infection control in healthcare settings...

**A**s providers see more patients with more complex needs, the financial and operational strain on the NHS intensifies.

In response to such challenges, NHS Improvement was formed in April 2016 from Monitor, the NHS Trust Development Authority and the National Patient Safety Team. Its ambition is to help NHS organisations in England find ways to make sustainable, positive changes that ensure services maintain high standards.

Encouraging best practice in infection prevention and control (IPC) is one way we help providers improve, which has a powerful impact on patients' lives.

NHS Improvement brings together experts who have contributed to national initiatives for preventing infec-

tion. It helps providers keep track of their infection rates, and it offers support when things go wrong and infection rates peak.

## Collaborating

We help trusts meet the national target of eliminating avoidable infections such as MRSA bacteraemia, as well as continually improving the *Clostridium difficile* infection rate. We monitor these infection rates continuously to identify providers that may need our support – for example, in developing leadership for IPC – or our advice on how to manage complex infectious incidents or outbreaks.

We work with individual providers and run collaborative initiatives to share best practice in the NHS. Currently we are running a 90-day improvement programme



across 22 trusts, meeting once a month to discuss and improve infection reduction processes and share best practice – for example, on decontaminating equipment. We test a solution for 90 days, and then roll it out to other sites if results are positive.

This encourages trusts to work together, and keeps a dialogue open between trusts about how to continuously improve.

### Raising awareness

Everything we do stems from research, evidence-based practice and making sure the NHS shares best practice to benefit patient care. We provide quality improvement programmes, workshops, training and coaching. And, we support regional and national conferences to highlight the value of IPC and good antibiotic management.

We encourage trusts to publish IPC information on their websites because it is important patients see providers' infection levels for themselves and to help us spot when they are struggling.

We are careful to use other quality indicators such as patient-led assessments of the care environment. We couple such indicators with patient feedback and IPC reviews of the clinical environment to alert us to potential issues and provide a more accurate picture of how carefully trusts are taking the risk of infection.

NHS Improvement raises awareness of national infection prevention campaigns throughout the year: for example, we encourage trusts to offer vaccinations to staff during the annual flu campaign, and highlight the importance of hand washing for hand hygiene awareness day.

### National action

Supporting the national 5 year antimicrobial plan to reduce the use of antibiotics and encourage early treatment of sepsis is one of the most important areas of our work.

Infections with antibiotic-resistant bacteria increase levels of disease and death. They can also increase the length of time people stay in hospital. Multi-drug resistance continues to spread globally to a point where it

threatens routine surgery and infections cannot be treated, causing at least 700,000 deaths a year.

It is crucial to devise new techniques for identifying infection risks early and to make sure patients receive appropriate treatment for the right amount of time.

**“We encourage trusts to publish IPC information on their websites because it is important patients see providers' infection levels for themselves and to help us spot when they are struggling.”**

The Patient Safety Team recently helped GPs reduce overprescribing by 7.3%, well beyond the 1% target. To build on this progress, we are extending the national incentive scheme to providers to help them reduce unnecessary prescriptions of antibiotics.

National schemes and strategies like this enable us to help NHS clinicians reduce the risks of endemic resistance with prudent prescribing.

### Next steps

NHS Improvement will continue to develop tools and foster learning environments to encourage trusts to share good practice. Using nationally available data, we will target our improvement strategies and offer bespoke support to providers that need it.

Our challenge will be to keep ahead of the game, make sure healthcare systems and their patients use antibiotics wisely and spot emerging threats early. ■

.....  
**Gaynor Evans**

**Head of Infection Prevention and Control (North)**

NHS Improvement

<https://improvement.nhs.uk/>

[www.twitter.com/NHSImprovement](https://twitter.com/NHSImprovement)

# Working to eradicate malaria worldwide

Adjacent Government highlights work by the National Institutes of Health (NIH) and the World Health Organization (WHO) to prevent and reduce malaria worldwide...

**A**pril 25th this year represented World Malaria Day – a day which helps to raise awareness and support in order to prevent and control the disease. According to the World Health Organization (WHO), roughly 3.2 billion people, which is almost half the world's population, are at risk of malaria. The disease is caused by parasites that are transmitted to people through the bites of infected female mosquitoes.

The most deadly malaria parasite is *Plasmodium falciparum*, which is most prevalent in Africa, according to WHO. In 2015, they reported that there were 214 million new cases of malaria worldwide, and 438,000 deaths caused by the disease. However, between 2000 and 2015, 57 countries have achieved reductions in new cases of malaria of at least 75%.

In conjunction with World Malaria Day, WHO released a [new report](#) showing that the goal of the World Health Assembly the previous year – to eliminate malaria from at least 35 countries by 2030 – could be achievable. In fact, in 2015, all countries in the WHO European Region reported zero indigenous cases of malaria for the first time, which is down from 90,000 cases in 1995.

"Our report shines a spotlight on countries that are well on their way to eliminating malaria," said Dr Pedro Alonso, Director of the WHO Global Malaria Programme. "WHO commends these countries while also highlighting the urgent need for greater investment in settings with high rates of malaria transmission, particularly in Africa. Saving lives must be our first priority."

As well as in the European regions, reductions have been reported globally, including in some African regions, where the burden of the disease is the heaviest. WHO reports that since the year 2000, malaria mortality rates have declined by 60% globally, and in

the WHO African regions these rates fell by 66% among all age groups and by 71% in children under 5 years.

The National Institutes of Health (NIH) in America also recognise the importance of reducing the burden of the disease. [In a statement released](#) on World Malaria Day in April, B Fenton Hall and Anthony S Fauci from [The National Institute of Allergy and Infectious Diseases \(NIAID\)](#), renewed their commitment to conducting and supporting the cutting-edge scientific research needed to end malaria.

As well as recognising the considerable gains that have been made on reducing the global burden of malaria, the NIAID said: "The World Malaria Day theme this year is 'End Malaria for Good', part of the NIH is committed to supporting and performing the scientific research critical to achieving this goal.

"NIAID scientists and grantees are working to better understand the malaria parasite and its biology; examining how anti-malaria drug resistance develops and spreads; and conducting studies to develop novel diagnostics; treatments; vaccines and vector management interventions and strategies."

In the statement Fenton Hall, chief of the Parasitology and International Programs Branch of the NIAID, and Fauci, Director of the NIAID, highlighted some of the research work being done in order to reduce and control the symptoms of the deadly disease.

One of the key focuses of scientists and researchers includes investigating the resistance of drugs to the malaria infections.

["A recent NIAID study](#) found Africa to be at greater risk for drug-resistant malaria infections than once thought,



which could complicate efforts to prevent and eliminate the disease in that region,” the statement said.

“NIAID scientists had previously demonstrated widespread artemisinin resistance among malaria-causing *Plasmodium falciparum* (*P. falciparum*) parasites in parts of Southeast Asia. NIAID research in this area helped shape new WHO malaria treatment guidelines for Cambodia.”

Researchers at the Institute are also supporting the development of new vaccines, which they feel could play a central role in controlling malaria. NIAID scientists are supporting the development of numerous vaccine candidates, of which 11 are in clinical testing.

“In addition to the pursuit of malaria treatments and vaccines, NIAID researchers are exploring innovative approaches to mosquito control and interruption of malaria transmission,” the statement said.

In a 2015 study, NIAID supported researchers used a gene editing tool called CRISPR/Cas9 to genetically engineer mosquitoes, so that they do not transmit malaria-causing parasites. When the genetically engineered mosquitoes were mated with normal mosquitoes in a laboratory setting, they passed on the malaria blocking trait to nearly 100% of their offspring.

“This new method represents an important advance for malaria control and prevention,” the scientists said.

They added: “Eliminating malaria will require a vigorous and sustained effort. On World Malaria Day,

we join our partners in reaffirming our commitment to a robust biomedical research programme needed to control, prevent, and ultimately, eradicate this deadly disease.”

Last year the World Health Assembly resolved to eliminate malaria from at least 35 countries by 2030. New vaccines and treatments such as the above could be the key to achieving this goal. Last year, for the first time, the European Medicines Agency issued a positive scientific opinion on a malaria vaccine. And, in January this year, WHO recommended large-scale pilots of the vaccine in several African countries, which could pave the way for wider deployment in the years ahead.

Dr Alonso from WHO agrees, “New technologies must go hand in hand with strong political and financial commitment. Reaching the goals of the ‘Global Technical Strategy’ – as approved by the World Health Assembly – will require a steep increase in global and domestic funding – from \$2.5bn today, to an estimated \$8.7bn annually by 2030.

“Through robust financing and political will, affected countries can speed progress towards malaria elimination and contribute the broader development agenda as laid out in the 2030 Agenda for Sustainable Development.” ■

.....  
Adjacent Government  
editorial@adjacentgovernment.co.uk  
www.adjacentgovernment.co.uk  
www.twitter.com/Adjacent\_Gov



# Residual malaria – relevance to transmission in the Amazon Basin

Jan Conn, Sara Bickersmith and Catharine Prussing from the Wadsworth Center, New York State Department of Health and Marta Moreno from the Department of Medicine, University of California-San Diego highlight issues confronting malaria elimination unique to the Amazon Basin

**B**roadly defined as all forms of transmission that can persist after achieving full universal coverage with effective LLINs (long-lasting insecticidal nets) and/or IRS (indoor residual spraying), containing active ingredients to which local vector populations are fully susceptible,<sup>1</sup> residual malaria requires several caveats in relation to nearly all South American malaria endemic regions. First, both interventions (LLINs, IRS) mainly affect endophagic (indoor feeding) and endophilic (indoor resting) mosquitoes, and the proportion of a mosquito population/species that feeds at night versus during crepuscular hours.<sup>2</sup> In the Amazon, as well as other endemic regions globally, more malaria vectors feed and rest outdoors (exophagy and exophily, respectively) than indoors, and thus escape being targeted by either intervention. Second, behavioural heterogeneity is common in many anopheline species.<sup>3</sup> Third, full universal coverage is uncommon in South America, although an overall decrease in malaria incidence between 2000-2014 is well documented in every country except Venezuela and, since 2012, in Peru.<sup>4</sup> This is not to disparage the use of LLINs or IRS in Latin America, where both have helped to achieve reductions in human-vector interactions, but rather to focus attention on additional local interventions that can be considered in the current climate of malaria elimination efforts.



Fig. 1 Map of study area, Peru

## The primary malaria vector

In the Loreto Department of Amazonian Peru, in the peri-Iquitos region, *Anopheles darlingi* is the main malaria vector, and here its behaviour is variable: it is mainly anthropophilic, but it also displays opportunism, depending on host availability; it is both exophagic and endophagic; and nearly exclu-

sively exophilic.<sup>5</sup> In this region, malaria cases normally peak during the rainy season, January to June (with some variation depending on river basin), corresponding with increased river levels and anopheline density. We have demonstrated also that transmission by *An. darlingi* is variable at small spatial scales.



Fig. 2 Salvador, Napo River, larval collection site positive for *An. darlingi* Peru 2016

## PROFILE

### Not all village houses are equal

We investigated spatial and space-time patterns of malaria diagnoses for an entire year in one riverine village, Lupuna, consisting of 432 residents in 94 houses along the Nanay River south of the city of Iquitos. In 2014, 177 cases of *Plasmodium vivax* and 11 of *P. falciparum* were registered at the Lupuna health center. We found that overall, malaria risk was higher in houses closer to the river.<sup>6</sup> The variability detected in malaria risk within a small village during one malaria season is congruent with findings from another recent study in this region,<sup>7</sup> and with those across the endemic malaria regions globally. Elucidating this variability, and correlating it with other data, such as mosquito infection rates and breeding site locations, suggests a focus of local malaria control efforts on hotspots within villages could substantially reduce malaria transmission.

### Four study sites along the Mazan and Napo Rivers in Peru

We are focusing on 4 villages, 2 on each of the Mazan and Napo Rivers (Fig. 1). These villages (2015 census, from 65-401 inhabitants) have the

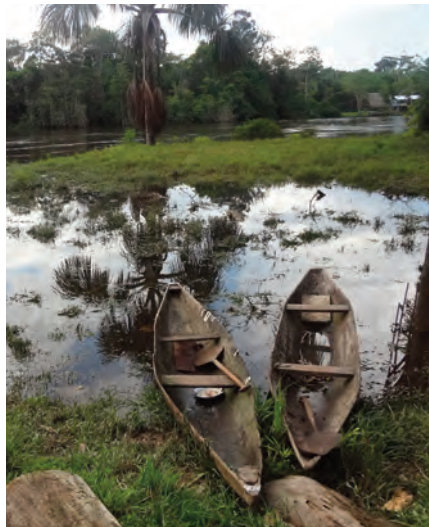


Fig. 3 Libertad, Napo River, Peru 2016

highest annual incidence of reported malaria cases for 2014-2015 in the Mazan District, and they are part of a transmission landscape (Figs. 2-3) that is interspersed with remote riverine malaria foci.<sup>8</sup> Our research plan, incorporating epidemiology, vector biology and parasitology, may provide data in support of additional interventions such as larval reduction (see below).

### Why consider larval reduction?

Many researchers, including ourselves, have found that transmission heterogeneity is widespread at many levels and its causes are complex. They

include proximity to breeding site, quality of breeding site, local mosquito species diversity, house construction and host availability. By characterising breeding sites and identifying anopheline species in nearby aquatic habitats (Fig. 4), we are investigating the relationships among several of these factors to evaluate the use of local targeted larval reduction.

Financial support was provided by U.S. National Institutes of Health (NIH) grant U19 AI089681 to J.M.Vinetz at University of California San Diego, USA.

#### References

- 1 Killeen GF. (2014) Malar J 13:330.
- 2 Durnez L. (2013) InTech, Ch. 21, pp. 671-704.
- 3 Smith DL & Coosmans M. (2014) Trans R Soc Trop Med Hyg 108:185-197.
- 4 WHO World Malaria Report 2015.
- 5 Moreno M et al. (2015) Malar J 14:290.
- 6 Prussing C et al. (2015) Abstract LB-5082. Amer Soc Trop Med Hyg Conference.
- 7 Bautista et al. (2006) Am J Trop Med Hyg 75:1216-1222.
- 8 Parker BS et al. (2013) Malar J 12:178.



Department  
of Health

Wadsworth  
Center



Fig. 4 Collecting anopheline larvae from boat, La Libertad, Napo River, Peru 2016

**Dr Jan Conn**  
Vector Biology and Population  
Genetics Laboratory

Tel: +1 518 485 6492

jan.conn@health.ny.gov

www.wadsworth.org/senior-staff/jan-conn

**Dr Marta Moreno**

Division of Infectious Diseases

Department of Medicine

University of California San Diego

mmorenoleirana@ucsd.edu



# Chromatin and epigenetic changes the immune response

**H**istone modifications and chromatin remodelling are involved in regulating the immune response to different pathogens. A proper immune response is essential in combating viruses, bacteria and parasites that are harmful for us. We have several lines of defence; from the physical barrier of the skin to specific cells in the body. The innate system is an early response and is composed of several cell types; monocytes, macrophages and natural killer cells (NK cells). These cells react unspecifically to infectious viruses, bacteria or parasites and present these agents to the adaptive immune cells. T-cells and B-cells comprise the adaptive immune system and these cells recognise specific antigens of the infectious agents. These cells constitute the memory, developing specific memory cells that can quickly be stimulated upon a further infection. Several studies have now shown that a memory exists in the absence of T-cells and B-cells, trained immunity, but the mechanisms behind are not fully understood<sup>1</sup>.

Several recent studies have shown that both the innate and the adaptive immune system change the epigenetic landscape in response to infections. The development of immune cells in the bone marrow involves a large epigenetic reprogramming. Depending on signal, the different cells in the immune cells develops and acquire the specific gene profile for the cell



lineage<sup>2, 3, 4, 5, 6</sup>. High through-put transcriptome analyses, performed together with ChIP seq of histone modifications<sup>7, 8</sup> and analyses of the global DNA methylation profile<sup>9, 10, 11</sup>, has shown that the change in gene expression follows changes in the epigenetic landscape in the different cell lineages. In particular, cell type specific transcription factors and signalling pathway factors are regulated by histone modifications and DNA methylation.

The further response of different immune cells to infections also involves transcriptional and epigenetic responses<sup>12, 13</sup>. In response to viral infections, not only genes regulating the immune response, such as cytokines and signalling factors, are modulated, but also genes involved in DNA methylation and histone modification changed, maybe to adjust cells to the new epigenetic state. Similar changes also occur upon the induction of inflammation processes in response



to infection, but also to non-infections stimuli, such as nutrients, stress and exercise. Inflammation is the host early response induced by innate immune cells, creating fever, swelling and pain. When the response goes wrong, inflammation can be harmful. Genes involved in the inflammatory response are particularly regulated and are marked by epigenetic mechanisms<sup>14</sup>.

The immune system protects us upon infections, but can also be the cause of diseases. Allergy is caused by the immune system overreacting and autoimmune diseases, such as rheumatism and MS, are caused by the immune cells starting to attack our own tissues. Autoimmunity together with chronic inflammatory response have now been linked to many diseases and disorders, and may be the underlying cause for yet many more.

The immune response differs slightly depending on the pathogen involved. Many pathogens have evolved ways to elude or inhibit the full response of the host. The immune system has particular difficulty when combating pathogens with a life cycle in several stages. One such pathogen is the Plasmodium parasite, which is the cause for malaria. Studies towards specific antigens produced by the parasite have been investigating specific responses. The biology of the mosquito<sup>15, 16</sup> has also been studied and the immune response elicited to understand to many ways the Plasmodium parasite affects its hosts. Malaria affects mainly children, those that survive are less susceptible as adults, but no real immunity is obtained. There are, however, differences in response between individuals as well as populations, most likely caused by genetic factors.

One ethnic group in Africa, the Fulani, which has been extensively studied because of the resistance to malaria. The immune response upon infection in the Fulani has been studied and compared with the response in various other neighbouring ethnic groups. These studies have mainly been SNP analyses, investigating variations in genes coding for factors in the immune response. One such example is the SNP study performed between them and the Dogon people in Mali that found genetic differences<sup>17</sup>. However, these studies have so far not been able to fully explain the differences in response between ethnic groups in the sub-Saharan region. The relative resistance found in the Fulani group could therefore be explained by other factors. Interestingly, it was shown that miRNA also involved in the response to malaria and most likely other parasites<sup>18</sup>. Hence, we are interested in studying the underlying cause for the difference in immune response on another level; in epigenetic factors, such as differences in DNA methylation and histone modification profiles as well as in non-coding RNA levels. A further phenomenon of certain complex pathogens that needs to be explained is the lack of real immunity. Immune tolerance could be part of it, but not fully explain the lack of immunity. The memory of the innate immune system, trained immunity<sup>1</sup>, could be involved in the finding that adult people living in exposed areas are less susceptible to malaria, a protection that is lost when leaving these areas.

To understand the human immune response to complex pathogens, and how host and the pathogen interacts, can then shed light to other

responses causing a variety of diseases, such as stress-induced immune responses, autoimmunity and chronic inflammation.

- 1 Quintin et al. (2014) *Current opinion in Immunology* 29, 1-7
- 2 Tondedeur et al. (2010) *PLoS One* 5(2), e8990
- 3 Lui et al. (2011) *Physiol Genomics* 43(20), 1117-1134
- 4 Shi et al. (2014) *Hum Mol Genet* 23(17), 4528-42
- 5 Prassade et al. (2014) *Blood* 123(17), e46-57
- 6 Chen (2014) *Science* 345, 1251033
- 7 Sashida and Iwama (2012) *Int J Hematol* 96(4), 405-1
- 8 Kondilis-Magnum and Wade (2013) *Mol. Aspects Med.* 34, 813-825
- 9 Ji et al. (2010) *Nature* 467, 338-342
- 10 Hodges et al. (2011) *Mol Cell* 44, 17-28
- 11 Zhang et al (2014) *Epigenetics and Chromatin* 7, 21
- 12 Pasis et al. (2014) *Current Opinion in Immunology* 29, 119-126.
- 13 Mejias and Ramiro (2014) *J. Infect.* 68 Suppl 1, S94-99
- 14 Alvarez-Errico et al. (2015) *Nat Rev Immunology* 15(1), 7-17
- 15 Wright and Rayner (2014) *PLoS Pathogens* 10(3), e1003943
- 16 Olivier et al. (2014) *Frontiers in Immunol.* 5, 25. doi: 10.3389/fimmu.2014.00025.
- 17 Maiga et al. (2013) *PLoS One* 8(10), e75675.
- 18 LaMonte (2012) *Cell Host Microbe*. 12(2), 187-99.



**Prof Ann-Kristin Ostlund-Farrants**  
**Stockholm University**  
The Wenner Gren Institute  
Cell Biology  
Tel: +46 816 4097  
Fax: +46 815 9837  
anki.ostlund@wgi.su.se



# Can data address the burden of childhood cancer?

Véronique Terrasse, Press Officer at the International Agency for Research on Cancer (IARC), outlines to Adjacent Government how high-quality data is critical for tackling childhood cancer globally...

**A**lthough cancer in children is rare, it is a significant cause of mortality. Each year, an estimated 80,000 children worldwide die from cancer before the age of 15. More than 90% of these deaths occur in less-developed regions.

In high-income countries, the survival rate within 5 years of childhood cancer diagnosis surpasses 80%, but in low- and middle-income countries, more than half of the children who get diagnosed die soon after diagnosis, with many children not diagnosed or treated.

Cancer is often thought of as a disease linked to ageing, because far more adults than children are affected. But given the fact that in some low-income countries, almost half the population is under the age of 15, childhood cancer is a major global public health concern regardless of the comparatively lower incidence rate in this age group.

## Cancer burden in children

It is increasingly recognised that childhood cancer has been neglected, and that access to early diagnosis, adequate care, and affordable treatment is critical for addressing the global cancer burden in children.

Such access can only be made possible through major improvements in public health services, which require health education, capacity building, implementation of adapted and affordable treatments, and the political will to establish efficient global policies to address childhood cancer as a whole.

Data from cancer registries are critical for bringing to light the full burden of the disease. IARC scientists are working to update current available incidence data, and preliminary results indicate that the burden of childhood cancer has long been underestimated, possibly because so many patients die before diagnosis.

According to the most recent statistics, which will be published in the third volume of the series International Incidence of Childhood Cancer (IICC-3), approximately 215,000 children under 14 years of age and 85,000 adolescents aged 15-19 years are diagnosed with cancer each year<sup>1</sup>.

### Specific cancers affecting children

Children tend to be affected by different types of cancers compared to adults. Cancers of the blood cells, such as leukaemia and lymphoma, account for almost half of all cancer cases in children, and tumours of the central nervous system are also common. Embryonal tumours such as retinoblastoma, neuroblastoma, and nephroblastoma occur nearly exclusively in children. Children are also prone to tumours of the brain, bones, and connective tissues, whereas carcinomas common in adults, such as breast, lung, and stomach cancers, are extremely rare in children.

There are striking variations in the distribution of childhood cancers across regions. For example, leukaemia and tumours of the nervous system, which are very common childhood cancers overall, are rarely diagnosed in sub-Saharan Africa, where there is a high incidence rate of lymphomas.

Certain cancers that are very rare in general occur with a relatively high frequency in some parts of the world. For example, Burkitt lymphoma occurs frequently in equatorial African countries, in association with high rates of exposure to infectious agents such as Epstein-Barr virus and malaria. Kaposi sarcoma is the most common childhood cancer in some countries, such as Uganda, that have a high prevalence of HIV infection. Another notable disparity is the very low incidence of central nervous system tumours in low-resource countries, which might be explained at least in part by a lack of appropriate (and expensive) diagnostic facilities for detecting these tumours.

The reasons behind all of these differences are not clear. A substantial number of cancers affecting children are associated with specific genetic alterations and syndromes, which suggests that genetic constitution and individual susceptibilities may play a role.

Barriers to early detection, such as lack of infrastructure, inadequate diagnostic facilities, and lack of awareness

among primary care providers, as well as risk factors linked to socioeconomic development, may also contribute to geographical variations in incidence.

### Access to high-quality data

The data presented in IICC-3 are the most accurate currently available, but the collection of high-quality data in low-resource countries remains a considerable challenge. Unfortunately, relatively few reliable data are available from low- and middle-income countries, and their quantity and quality vary substantially across regions.

In many countries, incidence data are insufficient or even non-existent. In most low- and middle-income countries, not enough of the population is covered by reliable population-based cancer registries, which means that the available statistics are based on few real data. Additionally, the number of paediatric registries is wholly inadequate.

In developed countries, access to data may be impeded by other challenges, such as complex regulations, in particular pertaining to data confidentiality.

Despite the great strides made in the treatment of childhood cancer in recent years, many uncertainties remain regarding its causes, biology, and patterns. For example, identifying potential environmental causes is particularly challenging in children because it is difficult to determine exposures during early development.

To better understand and address the global burden of childhood cancers, research is critical. Stakeholders and governments must play key roles in supporting cancer registration among children, because high-quality local data are vital for the development and implementation of efficient national cancer plans. ■

<sup>1</sup> These new estimates are based on high-quality data from 100 cancer registries in 68 countries, collected between 2001 and 2010.

.....  
**Véronique Terrasse**  
**Press Officer**

International Agency for Research on Cancer (IARC)  
[www.iarc.fr](http://www.iarc.fr)

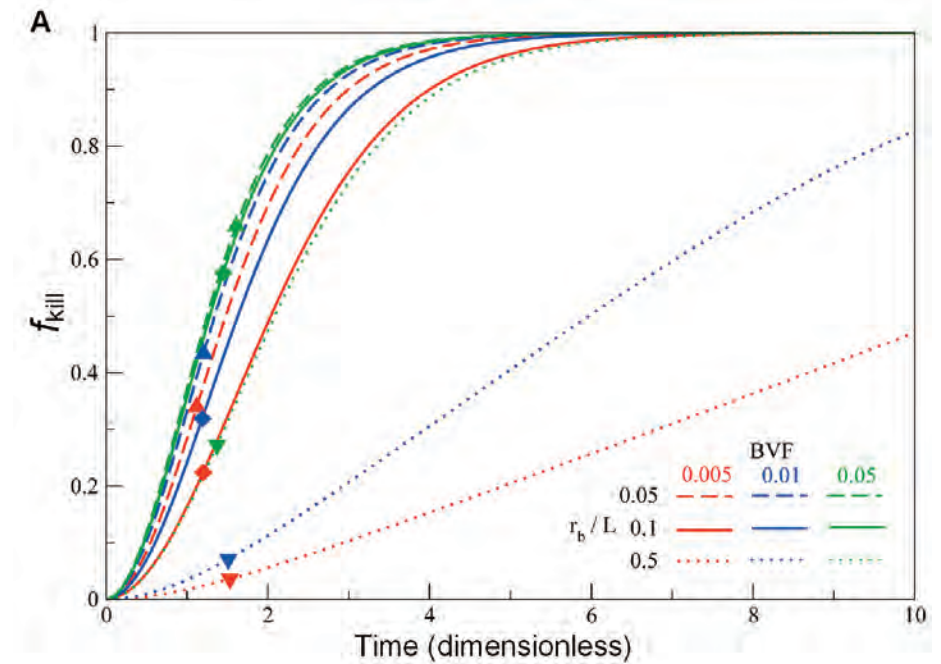


# A Spatio-temporal mathematical model

Zihui Wang<sup>1,2</sup> and Vittorio Cristini<sup>1,2</sup> outline how they have developed a model to help predict cancer treatment outcomes...

The physical properties of a tumour's microenvironment influence a drug's ability to penetrate and kill tumour cells. Some of these properties can be potential obstructions to drug diffusion, increasing the tumour's resistance to chemotherapy. As reported in previous experimental and clinical work, these barriers include overexpression of protein efflux pumps, cell growth cycles, acidosis, hypoxia, tissue density, high interstitial fluid pressure, and electrostatic charge. We argue that diffusion barriers may be another main cause for a tumour's ability to be drug resistant, and while all of the above factors can contribute to resistance, the drug's primary challenge is reaching the tumour microenvironment. Whether a drug can be ultimately delivered to the tumour, past the diffusion barriers, depends primarily on the vasculature in the surrounding area and its influence in creating a static environment that prevents perfusion of blood.

Through our integrated mathematical modelling and experimental work (Wang *et al.*, PLoS Computer Biol 2016, PMC4902302), we prove that the key parameters in successfully predicting the amount of cancer cells that will be killed in chemotherapy treatment are the blood volume fraction (BVF) and the radius of the main blood vessels



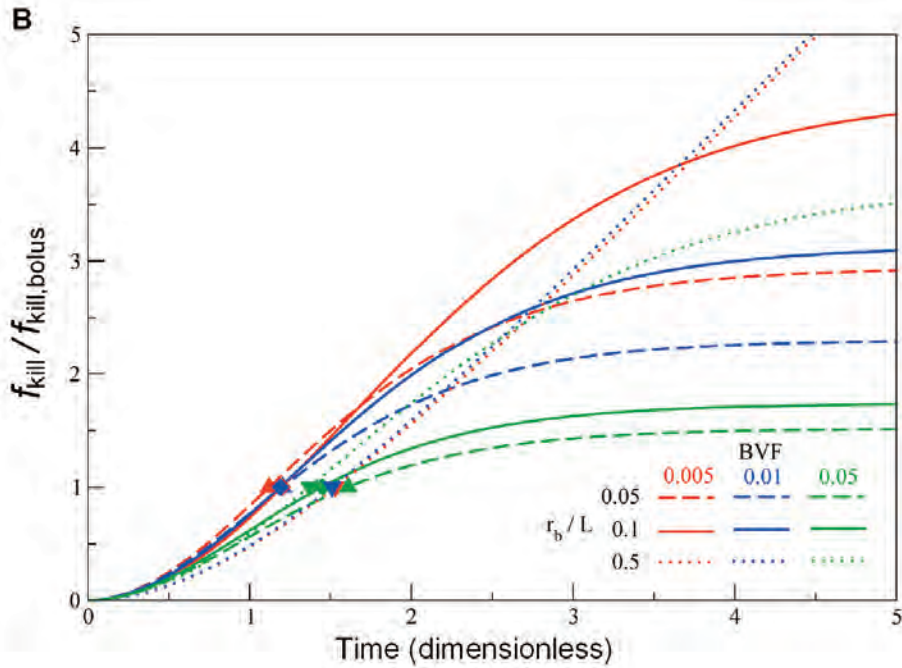
( $r_b$ ) involved in delivering blood and nutrients to the area. This lays the groundwork for further human clinical studies, specifically in colorectal cancer metastatic to the liver, as well as further research into the contribution of other factors in the microenvironment on drug resistance.

The model is an extension of a previously developed time-dependent drug-cell interaction model (Pascal *et al.*, ACS Nano 2013, PMC3891887) by introducing spatial dependence to describe perfusion and diffusion heterogeneities. The governing equations for drug concentration  $\sigma(\mathbf{x}, t)$  and the volume fraction of tumour cells  $\varphi(\mathbf{x}, t)$  are:

$$\frac{\partial \sigma}{\partial t} = D \nabla^2 \sigma - \lambda_u \varphi \sigma, \quad (1)$$

$$\frac{\partial \varphi}{\partial t} = -\lambda_k \lambda_u \varphi(\mathbf{x}, t) \int_0^t \sigma(\mathbf{x}, \tau) \varphi(\mathbf{x}, \tau) d\tau, \quad (2)$$

where  $D$  is the diffusivity of the drug,  $\lambda_u$  the per-volume cellular uptake rate of drug, and  $\lambda_k$  the death rate of tumour cells per unit cumulative drug concentration. This generalised model allows us to examine not only successive (conventional) bolus chemotherapy, characterised by a time-varying intravenous drug concentration  $\sigma_0$  according to a specific dosing and timing regimen, but also drug release through loaded nanoparticles where drugs are released at a nearly constant rate over a certain time interval, approximated here by a constant  $\sigma_0$ .



By integrating the viable tumour volume fraction at each time point over the cylindrical tissue domain surrounding a blood vessel and affected by the drug diffusion, we calculate  $f_{kill}$  as the ratio of the killed tumour volume to the total initial tumour volume:

$$f_{kill}(t) = 1 - \frac{2}{q_0 L^2} \int_{r_b/L}^{L\sqrt{BVf}} \varphi(r, t) r dr \quad (3)$$

as a function of parameters:  $r_b$ , blood volume fraction (BVF), and  $L = \sqrt{D/(q_0 \lambda_0)}$  (the effective diffusion penetration length of the drug).

**Fig. 1A.** shows the temporal evolution curves of  $f_{kill}$  calculated from Eq. 3 by varying the parameters  $r_b/L$  and BVF, representing conditions where drug-loaded nanoparticles are employed, as well as the estimates using the previously developed “bolus” model (Pascal *et al.*, Proc Natl Acad Sci U S A 2013, PMC3761643; Frieboes *et al.*, PLoS One 2015, PMC4464754). The results indicate that the “bolus” killing

ratios are readily achieved by drug-loaded nanoparticles after 1 or 2 cell cycles. To estimate the benefits of drug release by the nanoparticles over a longer period of time, we normalised the  $f_{kill}$  curves using their corresponding bolus  $f_{kill}$  values (**Fig. 1B**). The results suggest that we may achieve 2- to 4-fold of the bolus killing ratios if the drug release from nanoparticles administration lasts for 3 or 4 apoptotic cycles. However, for large BVF values (representing highly vascularised tumours), cell killing effects from both methods of delivery are roughly equivalent. This suggests an alternative strategy to improve chemotherapeutic efficacy by promoting or normalising angiogenesis at the target site before administrating chemotherapy drugs, or by promoting perfusion by other means such as mild hyperthermia, both of which would lead to an increase in BVF.

**Fig. 1.** Drug-loaded nanoparticles lead to cell-kill enhancement over bolus delivery. **(A)** Time-evolution curves of chemotherapeutic efficacy  $f_{kill}$  (Eq. 3) of nanoparticles releasing drug com-

pared to the estimated efficacy (symbols) of conventional chemotherapy, for parameter values:  $r_b/L = 0.05$  (dashed curves, upper triangles), 0.1 (solid curves, diamonds), and 0.5 (dotted curves, lower triangles), paired with BVF = 0.005 (red curves and symbols), 0.01 (blue curves and symbols), and 0.05 (green curves and symbols). **(B)** Same as **(A)**, but normalized to the corresponding bolus values of tumor kill,  $f_{kill,bolus}$ . Figure reproduced from (Wang *et al.*, PLoS Comput Biol 2016, PMC4902302).

1 Department of NanoMedicine and Biomedical Engineering, University of Texas Health Science Center at Houston (UTHealth) McGovern Medical School, Houston, TX 77054, USA

2 Brown Foundation Institute of Molecular Medicine, University of Texas Health Science Center at Houston (UTHealth) McGovern Medical School, Houston, TX 77030, USA

<https://med.uth.edu/nbme/faculty/vittorio-cristini/>

<http://highlycited.com>

<http://scholar.google.com/citations?user=uwl5tw0AAAAJ&hl=en&oi=ao>

Additional resources:

<http://physics.cancer.gov/>

<http://www.internationalinnovation.com/taking-cancer-out-of-the-equation/>

<http://www.pnas.org/content/110/35/14266.long>

<http://www.jci.org/articles/view/73455>



**Vittorio Cristini, Ph.D.**

UTHealth McGovern Medical School  
Department of Nanomedicine and Biomedical Engineering Center for Advanced Biomedical Imaging (CABI) building  
Tel: +1 713 486 2315  
Fax: +1 713 796 9697  
Vittorio.Cristini@uth.tmc.edu

# A new class of nanotherapy blockades the genetic drive for multiple myeloma progression

Gregory M. Lanza and Michael H Tomasson, Department of Medicine, Washington University School of Medicine, St. Louis, MO, Siteman Center for Multiple Myeloma Nanomedicine (CMMN)...

**M**ultiple myeloma is malignancy of plasma cells that reside in the bone marrow and normally function as part of our immune defence system. Plasma cells mature from activated B-cell lymphocytes that are stimulated by foreign substances to produce protective antibodies. However, plasma cells can become cancerous and proliferate out of control forming multiple tumours, called plasmacytomas that excessively overproduce a single abnormal antibody or M-protein. This is multiple myeloma (MM). MM initially responds to chemotherapy, but despite recent advances, virtually all remissions are transient, and the majority of patients relapse and die of their disease.

**“The animals that received the VLA-4-cMyc-prodrug micelle system survived nearly twice as long as those mice receiving one of many control or non-targeted treatments. The results were definitive.”**

Many human cancers and notably MM are associated with activation of an oncogene known as c-Myc (MYC). The cMYC protein combines with another MAX to form a complex that binds a DNA regulatory region and promotes the activation of many genes involved in MM cell proliferation. The proliferating cancer cells become addicted and require constant MYC-MAX DNA stimulation to survive. Disrupting this pathway by interfering with MYC-MAX complex formation or

## How MM targeted cMyc-inhibitors work (step-by-step):

1. The Myc-inhibitor prodrug is incorporated into a tiny lipid-based micelle;
2. The Micelle targets and binds to MM cell surface allowing the lipid surfaces fuse;
3. The Myc-inhibitor prodrug transfers into MM outer cell membrane;
4. The prodrug further distributes throughout the intracellular membranes;
5. Enzymes, i.e., lipases, in the cell release the active drug from the lipid backbone.
6. The freed Myc-inhibitor binds MYC protein and blocks coupling to MAX;
7. Failure of MYC-MAX complex binding to DNA stops cell proliferation;
8. The MM cell dies and cancer progression is slowed or halted.

*Figure 1. How VLA-4-cMyc-prodrug micelles treat multiple myeloma*

MYC-MAX binding to DNA can lead to MM cell death. Recent understanding concerning the biochemical details of MYC-MAX formation led to the discovery of small-molecule inhibiting drugs, such as the compounds reported by Dr. Ed Prochownik from Children's Hospital in Pittsburgh. These anti-MYC drugs and others like them worked well in bench assays, but unfortunately failed in animal models because the drugs were largely destroyed during circulation in the blood and too little compound reached and penetrated into the MM cells to be effective.

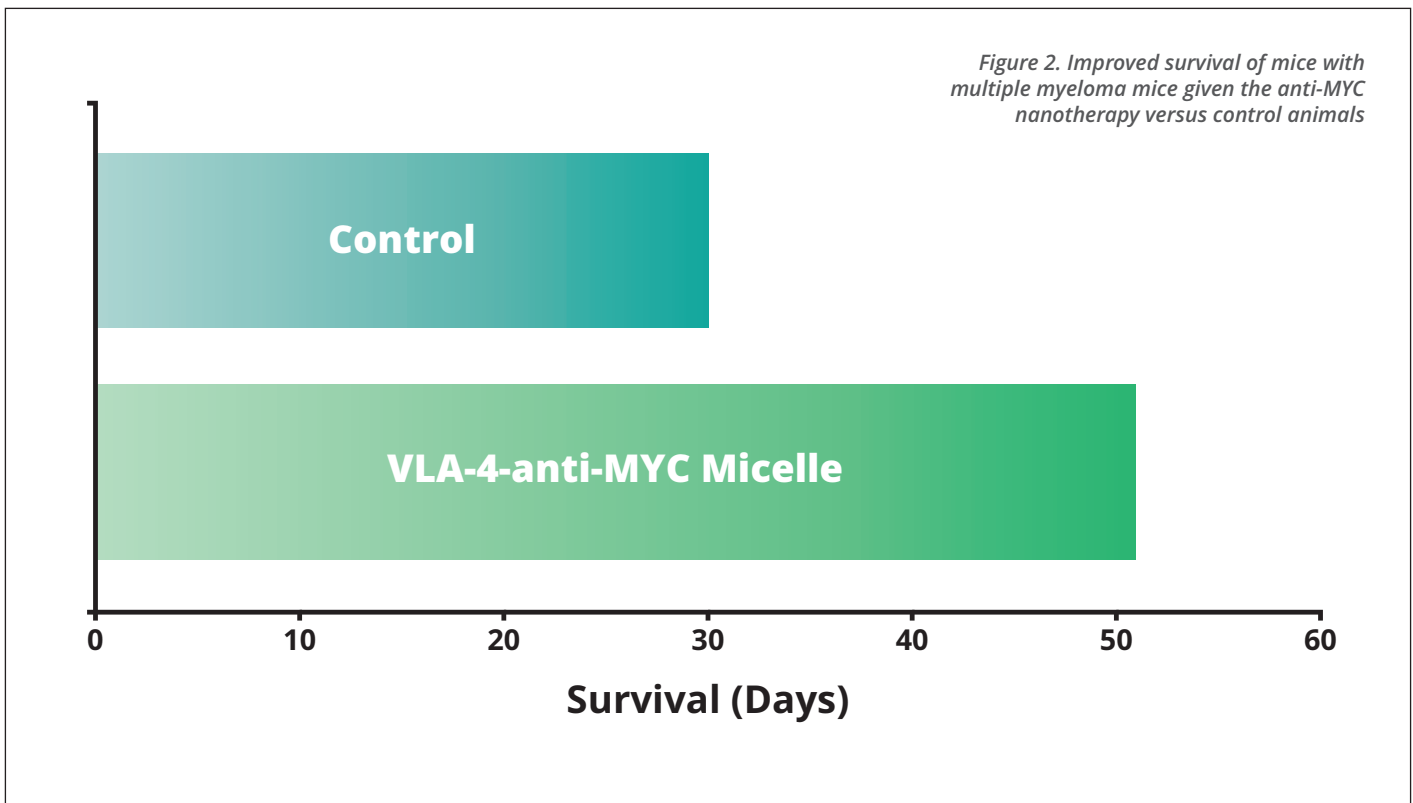
Drs. Gregory Lanza and Michael Tomasson, members of the Siteman Cancer Center at the Washington University School of Medicine in Saint Louis, understood this dilemma and envisioned a novel nanotechnology solution. Their vision was to transform the small molecule cMyc-inhibitors into lipid prodrugs and incorporate them securely into minute micelles

that would be home to a common MM cell surface marker, VLA-4. (Figure 1).

The cMyc-inhibitor prodrug was created by using a natural cell membrane constituent, lecithin, and coupling the drug to a modified end of the middle fatty acid (Sn2), the oily part of lipid. Incubation of the cMyc-prodrug MM cell revealed more rapid adsorption of the drug into the MM cell than the free drug. But, unlike the free drug, the cMyc-prodrug is not active as a lipid conjugate. However, once the prodrug enters the cell membranes, the active drug can be liberated into the cytosol by a myriad of enzymes where it can bind the transcription factor, cMyc. This inhibitor, once bound to cMyc, disrupts or distorts its complexation with MAX in the nucleus, and the binding of the oncogenic pair to DNA is disrupted. In this way, the signal for more MM proliferation is blocked and the MM cells, addicted to the cMyc-Max stimulation, die.



## PROFILE



Another key advancement was the tiny nanoparticles called micelles, which are not much bigger than an antibody. This small size allows the micelles to penetrate into bone marrow, spleen, and other extravascular MM metastatic depots. To give the micelles MM-specificity, the particles were activated to recognise and bind to the MM cell surface marker, VLA-4. The VLA-4-cMyc-prodrug micelles bypass normal tissues and cells and bind and fuse to almost irreversibly to the MM cells presenting VLA-4. Unlike many nanoparticles, fusion of the micelle lipid surface with the MM cell membrane surface, and the prodrug transfers like a “kiss of death” into the cell. Subsequently, the prodrug passages through the cell membranes into the MM cell, where the active cMyc-inhibitor is freed to have its anticancer effects. This novel drug delivery mechanism is termed

“contact facilitated drug delivery” (CFDD).

Dr. Tomasson’s laboratory demonstrated the vision of the VLA-4-cMyc-prodrug micelle is an aggressive disseminated mouse model of MM, known as 5TGM1/ KaLwRij. The overarching result of this experiment is shown in Figure 2. The animals that received the VLA-4-cMyc-prodrug micelle system survived nearly twice as long as those mice receiving one of many control or non-targeted treatments. The results were definitive.

Today, Drs. Lanza and Tomasson optimising the nanotherapy using newer cMyc-inhibitors designed and synthesized by Drs. Prochownik, and Steven Fletcher, University of Maryland School of Pharmacy as of the US NCI Cancer Centers of Nanotechnology Excellence (CCNE) program at Wash-

ington University School of Medicine, the Siteman Center for Multiple Myeloma Nanomedicine (CMMN).

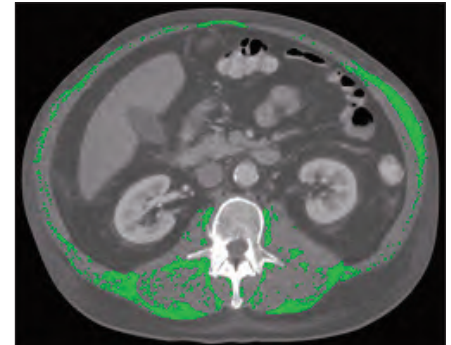


**Gregory M. Lanza**  
**Michael H Tomasson**  
Department of Medicine  
Washington University School of Medicine  
Siteman Center for Multiple Myeloma  
Nanomedicine (CMMN)  
Tel: +1 314 454 8813  
greg.lanza@mac.com  
<http://internalmed.wustl.edu/>

# Disease-associated myosteatorsis in people with cancer: Can it be treated?

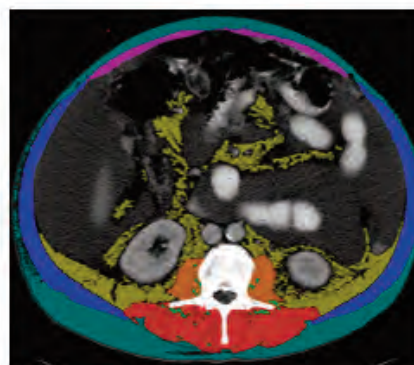
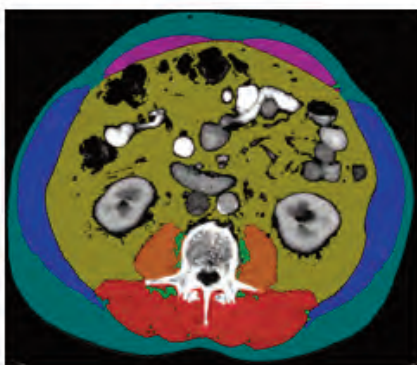
**P**athological fat infiltration into muscle is a feature of disease-induced muscle loss that significantly associates with shorter survival in people with cancer. Fat is associated with skeletal muscles in the form of intra-myocellular lipid droplets within the cytoplasm of myocytes as well as intermuscular adipocytes. These lipid stores are thought to provide fuels for skeletal muscle contraction, however, excess deposition of triglycerides within cells and organs that normally contain only small amounts of fat (such as liver, pancreas, skeletal and cardiac muscle) is defined as steatorsis. Myosteatorsis (steatorsis of the muscle) is a pathological phenomenon reflecting an impairment of synthesis and elimination of triglyceride.

Myosteatorsis is revealed in vivo by computed tomography (CT) imaging as muscle with low radiodensity combined with presence of intermuscular adipose tissue. The evidence for a relationship between low muscle radiodensity and shorter survival in people with cancer is building. Loss of skeletal muscle mass appears to generally occur with accumulation of adipose tissue into muscle. We reported that patients undergoing treatment for lung cancer lost muscle mass and concurrently gained intermuscular adipose tissue during treatment for cancer, whereas patients who supplemented their daily intake with fish oil containing eicosapentaenoic acid and docosahexaenoic acid [EPA+DHA (2.2 g/day)] maintained or gained muscle



*This slide shows a CT image from a cancer patient who underwent 16 weeks of first line platinum doublet chemotherapy for lung cancer. Only the intramuscular adipose tissue is shown in color*

mass and experienced a decline in intermuscular adipose tissue over the same time period. This intervention also resulted in a greater response by the tumor to the drugs being used to



**Skeletal Muscle**

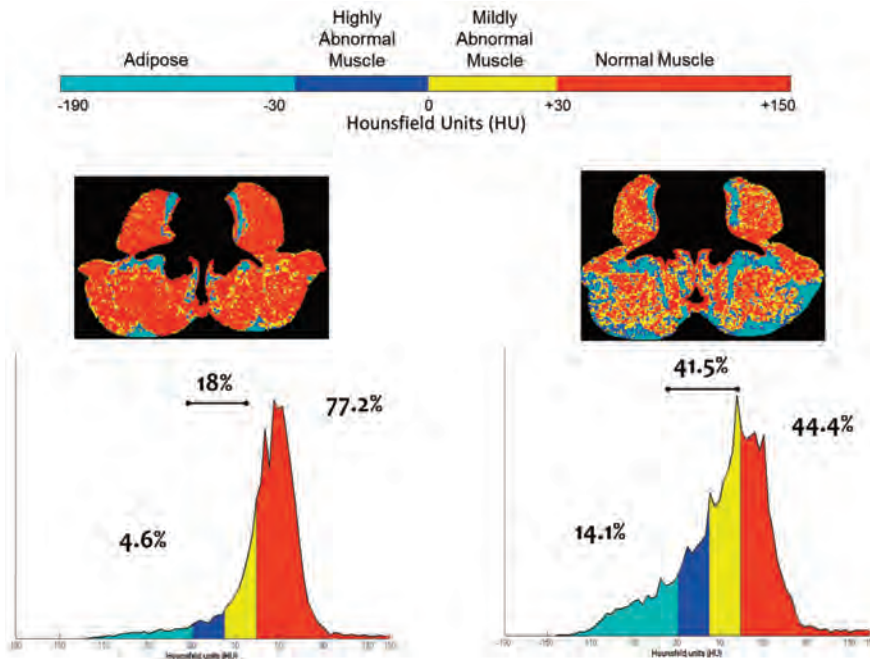


**Adipose Tissue**



*To quantify different tissues for body composition analysis using computed tomography imaging, a bony landmark is used to consistently measure the same region of the body across patients. The 3rd lumbar vertebrae is an established landmark in body composition analysis that correlates with amount of whole body muscle and fat. Each tissue attenuates radiation in a specific way which is recognised by a software program to enable skeletal muscles and different types of adipose tissues to be identified. Each tissue of interest is then color coded (see legend). When more than one CT image exists in the patient record, tissue changes over the trajectory of the disease can be determined. This image presents 2 scans taken approx 6 months apart at the same region within the same patient. The marked decline in muscle and adipose tissue is evident, concurrent with deposition of adipose tissue into muscle*

## Illustration of Variation in Muscle Radiodensity



An illustration of annotated CT images, and accompanying histograms of radiation attenuation showing the percentages of total tissue cross-sectional area within the ranges of adipose tissue in paraspinal/psoas muscles is useful to understand the problem of myosteatosis. This illustration shows the percentages of total tissue cross-sectional area within the typical attenuation ranges determined for the respective tissues for 2 subjects. Subject 1 is a 63 year old male with muscle characteristics at the median values for male cancer patients with a diagnosis of solid tumor at our centre. For Subject 2 there is extensive macroscopic adipose tissue and less than half of the cross sectional area of his muscles falls within the normal attenuation range. Overall, Patient 1 has a greater proportion of fat and low attenuation muscle, than muscle with normal characteristics. Patient II is remarkable in several respects, including extensive visible fatty infiltration and extremely high proportion of total muscle area falling within a range of attenuation values generally recognized to be abnormally low (adapted from Aubrey et al 2014)

treat the cancer. Therefore there may be multiple benefits of dietary fish oil to the cancer patient undergoing treatment.

To explore these observations that cancer patients supplementing with EPA+DHA experience an improvement in myosteatosis, we established a pre-clinical model to enable intervention with EPA+DHA at various time points in the cancer trajectory. We used an rat model bearing the Ward colorectal tumor and treated in a manner that mimics standard clinical care for this disease in humans with respect to the types of drugs used and the toxicities they evoke. Using this model we have demonstrated that the results align with our human data suggesting an improvement in muscle condition concurrent with a better response by the tumor to the anti-cancer drugs.

Using this as the rationale for the next step of this line of questioning, we have planned a clinical trial upon which to test the biological efficacy of fish oil to reverse cancer- associated myosteatosis in a cancer population known to exhibit myosteatosis, verified by in vivo imaging of muscle features by CT scan. At the time of diagnosis and treatment planning, patients will be randomized and consented to consume EPA+DHA (2.2 g per day) until day of surgery (at least a 4 week period) or receive standard of care (no intervention). Muscle from the subjects will be collected at the time of surgery and prepared for analysis. Analysis of the muscle tissue will enable determination of differences in Triglyceride-fatty acid content (a hallmark of myosteatosis). We expect that this research will verify the tantalizing evidence we have in hand

that suggests an improvement in pathological features of myosteatosis by dietary EPA and DHA. If so demonstrated, this work will provide critical translational knowledge required to effectively plan treatment interventions that have significant potential to impact the lives of people diagnosed with cancer, a major cause of death globally.



**Dr Vera Mazurak**

University of Alberta

[www.afns.ualberta.ca/StaffProfiles/AcademicProfiles/Mazurak.aspx](http://www.afns.ualberta.ca/StaffProfiles/AcademicProfiles/Mazurak.aspx)



# Improving the long-term health of childhood cancer survivors

SIOPE – The European Society for Paediatric Oncology highlights the importance of strengthening collaborations to ensure childhood cancer survivors lead a healthy life...

All childhood cancer survivors should be able to lead a normal life. In Europe however, in spite of the increase of the survival rates, many of them suffer from considerable treatment-related side-effects throughout their lives. Between 300,000 and 500,000 childhood cancer former patients currently live in Europe: two thirds of them suffer from late treatment complications which, in half of them, have a serious or even life-threatening nature. Late effects may impact not only health (e.g. heart failure, renal toxicity, secondary cancers, etc.), but also have a negative impact on growth, fertility, mental health and more generally on their professional and private life.

**“The importance of advancing research via large pan-European collaborations to reduce the frequency, severity and impact of late side-effects is thus crucial.”**

“Improving the quality of survivorship” became thus a priority for SIOPE (the European Society for Paediatric Oncology), who recently organised the [PanCareSurFup European Conference](#) ‘Acting Now’ (23-24 May 2016, Brussels, BE) to open this year’s European Week Against Cancer (25-31 May). More than a 100 participants attended this event – held in the framework of the EU-funded project PanCareSurFup (PanCare Childhood and Adolescent Cancer Survivor Care and Follow-Up Studies) – and agreed that more collaborations between health-care professionals and survivors, about the possible treatment side effects, a wider awareness of society and screenings for early detection of possible late effects, should become more widely available.

Several survivors shared their experiences during this conference, pointing out that the main problem they faced was not the cancer itself, but to have to deal years later with heavy repercussions on their lives. A

young woman shared the frustration she felt when facing the lack of knowledge of medical professionals about her side effects, which strongly impacted her pregnancy. Other survivors stressed the importance of communicating to each other and explained that the word “survivor” carries a stigma, as a condition that cannot change, while the word “resilient” might be more appropriate.

As each complication is rare, and the follow up of survivors is unequally applied across Europe, there is a lack of consistent data and understanding on the late side effects of cancer and its treatment. The importance of advancing research via large pan-European collaborations to reduce the frequency, severity and impact of late side-effects is thus crucial. “Cure is not enough” was a recurrent sentence during the event, as research should shift its focus on developing new treatment protocols that minimise the risk of late complications without jeopardising good results. This could be done by taking into account childhood cancers’ biology and patients’ genetic predisposition to adjust the treatment and ensure the lower possible late effects and toxicities.

Where in Europe a patient is treated for childhood cancer may also affect the extent of negative late complications for survivors. The issue of health and survival inequalities across Europe was raised by Mr. Alojz Peterle MEP (SL, EPP and President of the MAC - MEPs Against Cancer Group), who opened the Conference. A cancer survivor himself, MEP Peterle last November (during the SIOPE-MAC launch of the [European Cancer Plan for Children and Adolescents](#)) affirmed that better childhood cancer outcomes should remain a priority for the European Union. Apart from [PanCareSurFup](#), the EU has already made possible a series of highly relevant projects – [ENCCA](#), [ExPO-](#)

Image: © Joke Emmerechts – SIOPE, Belgium



r-Net and PanCareLIFE – but sustainability of advances and results obtained in these projects is crucial, and all stakeholders need to keep working together to make sure this happens.

“Quality of survivorship” is one of the 7 objectives of the SIOPE Strategic Plan, which strategically identifies ways to address the long-term consequences of cancer treatment. Together with partners in the PanCareSurFup project, SIOPE strives to find solutions to overcome such obstacles with concrete initiatives such as the “Survivorship Passport”. Defined via the partnership between professionals, survivors and IT experts, this innovative tool provides young patients who ended a cancer therapy with relevant information – including a treatment summary and individualised guidelines to follow on the long-term – making everyone aware of the potential risks or late effects. This initiative addresses the current lack of information on many patients’ medical history – particularly critical as children become adults, or as they move to another country – by both educating healthcare professionals

and engaging survivors to play an active role in maintaining their own health and well-being.

In summary, SIOPE and its project partners highly appreciated the engagement of all participants – including survivors and their families, healthcare professionals, researchers, EU policymakers and others – to strengthen their collaborations and accelerate their efforts to ensure a full and meaningful life to all European survivors of childhood and adolescent cancer. ■

  
SIOPE Europe  
the European Society for Paediatric Oncology

.....  
SIOPE – The European Society for Paediatric Oncology  
office@siope.eu  
www.siope.eu

# Research at Oslo University Hospital in the field of Gynecologic cancer

**O**slø University Hospital (OUS) is a big hospital formed by the merger of 4 hospitals. The State Hospital, the Norwegian Radium Hospital, Ullevaal Hospital and Aker Hospital. It serves as a local hospital for about 600,000 inhabitants and as a referral center for about 2.8 million people. As a big University center OUS is heavily dependent on research and development.

In the field of gynecologic oncology we are engaged in international clinical trials and in more basic research, but also in refinements of diagnostic and therapeutic procedures.

In the field of international clinical trials, our department has participated in some important studies on ovarian cancer. Standard treatment for ovarian cancer is surgery, if the patient is fit, followed by chemotherapy. The goal for surgery is to remove all visible tumor elements. The ICON7 trial showed a benefit of adding bevacizumab to chemotherapy for patients with a high risk of relapse. This group consisted of patients with residual tumor of 1 cm or more after surgery for ovarian cancer or stage 4. The patients received bevacizumab together with standard chemotherapy, followed by maintenance treatment with bevacizumab for a total treatment period of 12 months. For the high risk group, survival was prolonged by 4.8 months from 34.5 to 39.3 months. The length of the maintenance phase in the

ICON7 study was chosen somewhat arbitrarily. It is a question whether the maintenance phase should be extended until progression of the tumor. This is the basis for an ongoing study (OVAR17), for which we do not yet know the results. Another important study is the Calypso study on relapsed ovarian cancer resistant to standard carboplatin based chemotherapy. Patients were randomized to either chemotherapy or chemotherapy and bevacizumab. The treating physician could choose between 3 commonly used chemotherapies. This study showed a prolongation of the median time to relapse from 3.4 with chemo alone to 6.7 months with chemo and bevacizumab. Survival was somewhat, although not statistically significant, increased from 13.3 to 16.6 months. The addition of bevacizumab was very effective in treating ascites, which can be very troublesome for this group of patients.

Some 10-15% of patients with ovarian cancer have a defect in the BRCA genes. This defect is heritable. Our department offers free testing of the BRCA genes to all patients with ovarian cancer. In the case of a defect gene, the patient can then pass this information to her children. Knowledge about the status of the BRCA genes also has implications for the treatment of the patient. In a previous study (Lancet Oncol. 2014 Jul;15(8):852-61) it was shown that maintenance treatment with Olaparib (a PARP

inhibitor) prolonged the median time to progression by 6.9 months from 4.3 to 11.2 months in patients having a BRCA defect tumor. The patients received maintenance treatment with Olaparib after having chemotherapy for a relapse of ovarian cancer occurring 6 months or later after previous platinum based chemotherapy. We participated in studies on another PARP inhibitor to further evaluate the effect of these drugs after the initial treatment and after later relapse.

For families with a defect BRCA gene, this implies a considerable burden. The women in the family have to decide whether they want to test the status of their gene. In case of a defect gene they have to decide whether they prefer risk reducing surgery by removing the ovaries and fallopian tubes at the age of 35-40 years. The psychologic stress, effect on quality of life and also somatic side effects have been the topic for a recent PhD study from our department.

In the department for pathology at our hospital, Professor Ben Davidson and his colleagues have done a tremendous job by evaluating the importance of a number of genes for resistance to chemotherapy. Detailed knowledge about the biology of tumors is important for drug development. In some cases the treatment for each individual patient can also be guided by knowledge about the biology of the patient's tumor.



## PROFILE



For some tumors, important signal pathways in the tumor are already known. In well differentiated serous ovarian cancer, the MEK pathway is such an example. We participate in a study to evaluate the effect on survival by blocking the MEK pathway.

Immunotherapy has become much in focus in recent years after the success first obtained in malignant melanoma and later on in other tumor forms. Studies in gynecologic cancer on checkpoint inhibitors have just started. Our department participates in a couple of phase II studies and a phase III study is in development.

In cervical cancer, the 5-year survival in Norway is about 78%. There are a number of reasons for this high survival rate such as the effect of screening on stage distribution, living conditions and the quality of health

care. In our department, we have used a lot of resources in research and development on treatment aspects of cervical cancer. The delineation of the tumor and metastases is important for good treatment planning. We use DCE-MRI routinely for this purpose. It has for some time been well known that hypoxia in the tumor decreases the susceptibility to radiation. Detection of hypoxic tumors or hypoxic parts in the tumor might therefore be of clinical relevance by either increasing the dose of radiation to these parts of the tumor or by administering some drug that could increase the sensitivity to radiation of these hypoxic tumor cells. Researchers in our institution have found that, by texture analysis of pictures obtained by DCE-MRI, they could predict the outcome for the patient. Other researchers have worked on the importance of genes and their expres-

sion in cervical cancer. They have developed and validated a gene list identifying hypoxic tumors. This list has been compared to the findings by texture analysis of DCE-MRI and they fit together. This can be used to select patients for studies on the effect of drugs with special effect on hypoxic cells given alongside radiotherapy.



**Gunnar Kristensen**  
**Professor, Consultant, PhD**  
Oslo University Hospital,  
Radiumhospital  
Tel: +47 22934000  
gbk@ous-hf.no  
[www.oslo-universitetssykehus.no/](http://www.oslo-universitetssykehus.no/)

# The measurement conundrum in healthcare

**"Y**ou can't manage what you can't measure". "What you can't count, doesn't count". These bromides of the corporate world found a home in the healthcare industry as it sought measures for evaluating quality of health care service provision. Insurance plans and public insurers adopted quantitative measures as easily evaluated indicators of meeting accepted standards of medical practice.

The Department of Paediatrics at the University of Illinois (UIC Paediatrics) is developing algorithms to enhance the measurement of quality of care in order to accommodate the new expectations that greatly expand the purview of primary care. These new expectations include care coordination and attention to the Social Determinants of Health (SDoH). These variables are particularly important for publicly insured patients for whom social and supportive services may ameliorate circumstances of social and economic deprivation and lack of health literacy. The new expectations require the development of innovative measures to capture the effect of these services on patients and their health outcomes. Sustainability of care coordination and social support services depends upon the incorporation of updated standards of care and relevant measures to document effectiveness and return on investment.

The evolution of clinical practice from a focus on acute and infectious diseases to one in which the health care provider is supporting the ability of a patient to prevent and/or manage one or more chronic diseases requires a

different way of evaluating quality of care. In the "old days" of medicine, quality of care was typically focused on the Donabedian model of structure and process, as defined by clinical measures which were then associated with outcome measures. Current measures for tracking quality include variables such as meeting the schedules for wellness visits, vaccinations, and, in paediatrics, monitoring growth and development. For adults, the measures typically include meeting the schedule for routine labs such as testing for cholesterol, or keeping measures such as blood pressure or blood glucose within an accepted range. Preventive measures such as ordering mammograms or specific assessments required as a result of a chronic illness are also typical. For example, the standard of care for a diabetic patient includes measuring the provider's adherence to the recommended schedule for provision of HbA1C tests, foot examinations, and vision screening. These services can be measured and counted and then used to define quality of care, both for health insurance plans and for providers. This type of quality measurement has been the foundation of both health services research and the accreditation of service providers.

Measurable outcomes have become de rigueur in assessing the success or failure of a given endeavour. Performance management and measurement relies on quantitative measures of process and outcomes, as do quality improvement (QI) and quality assurance (QA) measures. However, devel-

oping appropriate measures to get at the human impact of a given endeavour can be very challenging. The current QA measures, for example, do not reflect the change in focus of care from simple clinical measures to assessment of the impact of providing services such as care coordination, or addressing the social determinants of health in patient's lives, or increasing patient engagement and self-management skills.

Many of the most innovative advances in bringing care coordination and attention to the SDoH into the purview of primary care have been funded by grants. In the United States, the federal government has funded a wide range of innovative models to improve the process and outcomes of patient care. The Patient Centred Outcomes Research Institute, the Centers for Medicare and Medicaid Healthcare Innovation awards, along with funding from foundations, such as Robert Wood Johnson have allowed providers to develop and test new models of care that are designed to break down the traditional silos between primary care and specialty care, including mental and dental health. These innovative models also develop partnerships with community resources to address critical deficiencies in the lives of patients that affect their ability to maintain a positive state of health and well-being.

The evaluation standards for most of these initiatives continue to rely on the standard measures of quality care: number of well-child visits, currency with the schedule of immunisa-

## PROFILE

tions, etc. The current (voluntary) reporting requirements for publicly insured children includes some additional measures asking about consumer satisfaction with the care experience, and follow-up care after hospitalisations for mental illness. These QA measures do not reflect the change in focus of care to more than simple clinical measures or “counts” of services. If innovative models of service delivery are to be sustainable, they must be able to document the return on investment for providing services focused on addressing the SDoH, and expanding the range of vision for primary care to include monitoring for mental and dental health and coordinating services with those providers.

What is needed is a new conceptual model that describes the impact of these expanded services on patient well-being and success in maintaining optimal health outcomes. New measures to assess the effectiveness of these additional activities tied to primary care must be developed and implemented to provide documentation for their contribution to health outcomes, and the attendant reduction in health care costs resulting from improving the ability of patients and families to maintain health.

Assessment of the impact of social services and support provided to patients and families must be measured by more than counts of services provided, or even patient or family satisfaction with those services. At the patient level, quality of care requires a means of assessing the results of implementing interventions

and detailing how they individually and collectively affect a range of outcomes: patient satisfaction and engagement, physical and emotional health, and ability to understand and manage health conditions.

**“The evolution of clinical practice from a focus on acute and infectious diseases to one in which the health care provider is supporting the ability of a patient to prevent and/or manage one or more chronic diseases requires a different way of evaluating quality of care.”**

The conundrum is that evaluation of interventions and activities, as well as the assessment of quality of care is necessarily reliant on quantitative measures for both expediency and a lack of more refined models of assessment. In addition, the reporting requirements for grant funded health care innovation projects typically require the regurgitation of numbers of services, patients, contacts, etc. These measures are necessary, but not sufficient to the purpose of developing a better understanding of the relationship between innovative activities and health outcomes.

UIC Paediatrics is taking major steps toward moving the science of evaluation to the next level. It is developing a conceptual model and both quantitative and qualitative measures to clearly explicate the incremental and contextual effects between increased care coordination and social support services and health outcomes. Documenting positive and powerful changes in patient health, and the

resultant return on investment in reduced health care costs, is critical to the sustainability of innovative models of care. Such evidence will support efforts to incorporate these innovations into accepted standards of medical practice and to make the case for financial support from health insurance plans, both public and private.

Capturing the return on investment requires a deep dive into understanding the total cost of the health care services provided, including care coordination and social support services, as well as the outcomes in terms of patient quality of life and state of well-being. A truly sophisticated model of outcomes assessment would include variables such as improved school attendance and performance for youth. This level of analysis would not only enhance our understanding of the human impact of services provided, but will allow us to understand how best to invest resources to improve the lives of children, particularly those who have been historically underserved. UIC Paediatrics is developing just such an assessment model.



### **Dr. Benjamin Van Voorhees**

Department of Paediatrics,  
University of Illinois at  
Chicago College of Medicine

Tel: +1 312 996 8352

[bvanvoor@uic.edu](mailto:bvanvoor@uic.edu)

[www.chicago.medicine.uic.edu](http://www.chicago.medicine.uic.edu)





## Improving diabetes control in England

Dr Justin Warner, Clinical Lead for the National Paediatric Diabetes Audit at the Royal College of Paediatrics and Child Health, details how continued improvements in diabetes care for children is needed in England and Wales...

**A**ccording to latest statistics, the outcomes for children and young people with type 1 diabetes in England and Wales are improving.

The National Paediatric Diabetes Audit (NPDA) 2014/15, which measures quality improvement in care, has suggested that these changes are secondary to a number of influences including advancements in research, improved technology, structured education and a better understanding of the condition and patient needs.

In addition, the establishment of managed clinical networks, quality assurance measurements, the publication of service delivery plans in England and Wales, along with England's 'best practice tariff' has enabled Trusts and Health Boards delivering care to improve the quality of service they provide. Families of children and young people with diabetes have also had a large influence on shaping the future of services by providing feedback on the experience of care they receive.

The NPDA published earlier this year by the Royal College of Paediatrics and Child Health (RCPCH), has identified more children than ever before achieving excellent diabetes control. Furthermore, the rate of improvement seen in England and Wales has exceeded that of some other European countries. Something healthcare professionals can be proud of.

According to the audit, which looked at data from all 27,682 children and young people with diabetes who attended paediatric diabetes units in England and Wales between 1 April 2014 and 31 March 2015, the average blood glucose level (HbA1C) – a marker which measures overall diabetes control – in children reduced for the fifth consecutive year with 23.5% of children in 2014/15 having excellent control compared to 15.8% in 2012/13. This means that overall children and young people with diabetes are reducing their lifetime risk of diabetes-associated complications such as kidney disease, blindness and amputations.

However, whilst the audit brought much to be celebrated, it also highlighted areas of concern, emphasising much more that needs to be done – particularly around recording health checks and variation in care seen across the two nations.

The audit also found that, despite the number of children receiving recommended healthcare checks improving year on year, just 25.4% of 12-year-olds have all 7 checks performed – HbA1c, height and weight, blood pressure, kidneys, cholesterol level – although NICE has recently removed this as a key health check – eye screening and foot examination. This is concerning as these checks are performed to identify risk factors associated with the potential development of long term complications from the disease. They enable professionals to identify complications at the earliest opportunity, when they are amenable to interventions and more likely to see a reduction in progression.

Worryingly, high numbers of children over the age of 12 are already beginning to demonstrate early markers associated with complications such as kidney disease and blindness. So why are these checks being missed and what can we do to improve this?

The NPDA relies on paediatric diabetes units to record and document this information on an annual basis. In some cases children are receiving these checks but due to pressures on staff and poor IT recording facilities, they are not able to log this information formally. Appropriate IT systems need to be in place to allow those providing care to capture their activity, record it and demonstrate ongoing improvement.

Continued improvement is required if England and Wales are to achieve standards set by some of our European counterparts. It is vitally important that centres providing care for children and young people are adequately staffed including consultants trained in paediatric diabetes, specialist diabetes nurses, diabetes dietitians and psychologists. Centres are now working as part of networks to ensure standards are met and guidelines implemented at a regional and national level thereby leading to a reduction in the variability in outcomes seen. Families also have an important role to play when it comes to improving care delivered to children so it is vital they are equipped with the right information as early as possible.

Structured regional and national education programmes for children and their families should be given at diagnosis and then through key life stages of the child. Currently there is no formal recognised universal structured education programme in the UK yet there are examples up and down the country of extremely good practice. We know from looking at the audit data that just over half (58%) of children and young people were recorded as receiving structured educational programmes so there is clearly a long way to go.

Managing diet, blood glucose levels and insulin requirements are a challenging balancing act for families. It can impact on relationships, emotions and health and well-being. For some, psychological help in addition to educational support is crucial to achieving an optimal outcome. According to the NPDA, the use of mental health services for nearly half of children with diabetes was not documented, suggesting they are not being offered this support. However, in many centres the provision of psychological support is changing for the better with clinical psychologists becoming embedded within the diabetes service itself – this can only be of benefit to children and young people and their families living with this chronic disease.

There is clearly a lot England and Wales can be proud of when it comes to paediatric diabetes care but it is crucial that the shortfalls identified are addressed. By doing so, it will enable us to move ahead of the pack, positioning ourselves as service leaders and a country that others strive to match when it comes to outcomes for paediatric diabetes care. ■

.....  
**Dr Justin Warner**

**Clinical Lead for the NPDA**

Royal College of Paediatrics and Child Health  
[www.rcpch.ac.uk/](http://www.rcpch.ac.uk/)  
[www.twitter.com/RCPCHtweets](https://twitter.com/RCPCHtweets)

# Welcome to the house for children and adolescents

In November 2013 it was ready to be launched – The house for children and adolescents. Over 100 professionals moved into the House, under the same roof, to give integrated help, guidance and treatment to families with children under 18 years of age. Previously there had been 17 different addresses for children's services, one profession here and another there.

The house for children and adolescents, integrates social and health care and offers its know-how and concrete help to the inhabitants of South Karelia, Finland (population 133 000). Various processes including every day work habits were – and are – developed to a new kind of integrated easy access service that works tightly on the frame of preventive work and problem solving.

The professionals working in the house for children and adolescents are from different areas of expertise. There are social workers, child and adolescence psychiatrists, psychiatric nurses, family workers, psychologists, pediatrician, general practitioners (part of student health care) and office workers. Depending on the matter of the child (and one's family) they form multidisciplinary teams that can support the family in a crisis, or on a matter that can be solved with more time and patience.

There are eight main principles that concern both family services and the house for children and adolescents:

- Easy access. The help-seeker doesn't have to know what kind of help he/she needs. Contacting methods are easy (e.g. mobile, walk-in, e-contact), there is no referral needed;
- Counselling and early support. First one to five times evaluation for all new patients;
- Straight guidance to right address. Patients with certain symptoms are guided straight to the special department (such as child welfare);
- The whole family is taken into consideration, not just the one who looks for help;
- A contact person will be named for every family;
- Tailored treatment plans for those who need care from many departments at the same time (such as child welfare and psychiatry);
- Cooperation inside the house and also outside with schools, daycare and child health centers. The family can give a permission to exchange the needed information in a multitalented team;
- Treatment and support at homes and schools.

After the first year of activity there are several results to be seen: The customers get instant help which is convenient and at the right time. They

are also more confident on getting help. The service system is more equal than before and the access is easier. The institutional child care has decreased, there has been less custody cases and short term placements from home. The knowledge and know-how of professionals has increased.

**“Over 100 professionals moved into the House, under the same roof, to give integrated help, guidance and treatment to families with children under 18 years of age.”**

However, the development work continues and prevention has an even greater meaning than before.

The House for Children and Adolescents is located at the former garrison area in the City of Lappeenranta.



**Merja Tepponen**  
**Chief Development Officer, Doc Sci.**  
South Karelia Social and Health Care District  
Tel: +358 400 655 197  
merja.tepponen@eksote.fi  
www.eksote.fi



# Improving environmental health across Europe

The World Health Organization calls for greater reviews of environmental health in schools to prevent illness due to issues such as poor air quality...

Air quality is something that impacts us all. Said to be one of the biggest environmental health risks, air pollution is responsible for 3m deaths annually, according to the World Health Organization (WHO). Both indoor and outdoor pollution can be harmful to our health. WHO estimates there are 4.3m deaths each year caused by indoor pollution, as a result of dirty cookstoves, unprocessed coal, and kerosene and diesel fuels. Whereas, outdoor pollution can be caused by vehicles, power plants, waste burning, landfill emissions and livestock production.

The problem with air pollution is, it's something you cannot see, however, it can cause some of our most common and dangerous illnesses, such as lung cancer (36% of deaths), stroke (34%), and heart disease (27%). In order to prevent such diseases it's important to improve environments where we work and live to reduce the impact. [WHO estimates in Europe](#), 12.6m people died as a result of living or working in unhealthy environments in 2012.

Indoor environments are also prone to air quality problems. Poor ventilation, dampness and mould can all cause health problems. In 2015, WHO delivered a new report that looked specifically at schools in the WHO European Regions. Poor indoor environments in schools in these regions are exposing children to many health problems and can also reduce children's academic performance.

The report, '[School environment: policies and current status](#),' looked at the results of a WHO survey on policies to improve environmental and health conditions in European schools and kindergartens.

Dr Marco Martuzzi, Programme Manager, Environmental Health intelligence and Forecasting at WHO/Europe,

[commented on the report](#): "Our children spend most of their daily lives in school and kindergarten, and we expect them to enjoy the best environmental conditions, promoting health and education.

"Our analysis shows substantial environmental problems in schools, however, which are largely overlooked. We hope that decision-makers take stock of the evidence and make sure that existing norms and regulations are implemented," he said.

The report highlights and reviews findings from a WHO survey on policies to prevent exposure to chemical air pollutants, mould and physical factors; improve access to sanitation and hygiene practices in schools and kindergartens; and, promote walking and cycling to school.

In most countries there are policies in place to help improve indoor air quality in schools, however, WHO believes there is still more to be done.

Dr Martuzzi added: "Schools must be clean, safe and comfortable – they need adequate lighting, air temperature and relative humidity; adequately ventilated classrooms; and functioning toilets that pupils would not hesitate to use.

"This not only reducing pupils' exposure to toxic substances and prevents diseases, it also enables cognitive development, offering equal educational opportunities for all." ■

.....  
Adjacent Government  
[editorial@adjacentgovernment.co.uk](mailto:editorial@adjacentgovernment.co.uk)  
[www.adjacentgovernment.co.uk](http://www.adjacentgovernment.co.uk)  
[www.twitter.com/Adjacent\\_Gov](https://www.twitter.com/Adjacent_Gov)

# Young people's decision making in environmental health

**T**he LIFE + GIOCONDA project – i GIOvani CONTano nelle Decisioni su salute e Ambiente – ‘Young people count in environment and health decisions’, provides young citizens and local administrations with a tool for dialogue on health and environmental issues. The dialogue is established via the active involvement of these actors through participation and education in environmental and health decision-making.

This participatory process was set up in secondary schools, within five areas in Italy with different socio-economic and environmental pressures: Ravenna and Ferrara, which are small towns with significant industrial and agricultural activities; the Lower Arno Valley (San Miniato), an area with small tanneries and agriculture; Naples, a metropolis affected by waste management problems, air pollution and high noise levels; Taranto, town that is home to the largest steel industry in Europe.

Protagonists were 800 young people aged between 11 and 17, who were involved in air quality and noise monitoring, inside and outside of the schools. These schoolgoers observed how the instruments worked, discussed the hazards and risks with experts, and assessed their own perception of risks through a questionnaire. Finally, they compared their risk perception with the monitoring results and then reflected on how to live in a healthier, cleaner environment.

The local administrators in the areas were informed and engaged with the young citizens and listened to their recommendations. The dialogue was a success: the chance to discuss the official and reliable data, collected by the local agencies for the environment (ARPA), and to listen to the fresh voices of the youngsters was highly effective in promoting scientific citizenship.

GIOCONDA focused on air pollution and noise since the negative influence on health of these factors has been established and they are both recognised as modifiable environmental factors by the WHO. According to the EU Noise Directive, schools are “sensitive receptors” and should be located in quiet areas.

Household and ambient air pollution causes an increase in respiratory infections, and it is recognised by the WHO as one of the main contributors of the global burden of diseases. Lower respiratory infections, including pneumonia, bronchitis and bronchiolitis, are the most significant cause of mortality in children.

Noise is one of the risk factors influencing mental, behavioural and neurological disorders. Cognitive impairment in school-age children represents a serious health issue, with language skills, reading comprehension, memory and attention being particularly affected; teachers can suffer from stress or voice problems due to the noise coming from outside or inside the classrooms.

The results of the atmospheric particulate monitoring carried out by GIOCONDA, inside and outside of the school buildings (aggregated into annual and seasonal means), were under the limits set by Italian legislation. Nevertheless, the results were generally above the thresholds for health-harmful pollution levels proposed by the “WHO Air quality guidelines”.

As for noise measurements, a global indicator was identified for an overall evaluation of the noise situation in each of the monitored classrooms (Global Noise Score). The results were very poor in the eight schools monitored: around 75% of the classrooms were in the lower levels of the ranking, i.e. “very poor” or “poor”, mainly due to structural problems of the school buildings.

The perception of risk related to the air quality was consistent with the levels of pollution monitored, particularly in schools close to congested streets or located in city centres, pupils’ perception of risk was higher than in the other locations investigated. In industrial areas the risk was perceived as high, almost only attributed to the nearby industries and to a lesser extent to vehicle emissions, which are actually a major cause of pollution.

A significant gap between risk perception and noise monitoring was observed. The answer to questions relating to “declared knowledge on risks related to noise” and “concerns

## PROFILE



about your health” showed scarce awareness.

The novelty of GIOCONDA was to demonstrate the efficiency and efficacy of including these findings in a participatory process, where pupils formulated their recommendations to the local policy makers based on evidence. The recommendations were presented in public events in order to help decision makers to develop evidence-informed policies to promote measures to prevent or reduce environmental health risks. The local administrators were able to respond and give their feedback live.

The key words were:

**Data** – The need to make the data on air and noise pollution not just transparent but also well communicated to citizens emerged as a priority in all the GIOCONDA schools. “Don’t hide data on the environment and health” was a key phrase resulting from the consultations.

**Mobility** – Practical actions were proposed to administrators, such as improving local public transport and bike lanes linking city centres to the outskirts. This was also a field where young citizens felt committed to real change, as they were willing to modify their habits and encourage their families to do the same. In Ravenna and in Ferrara, the school goers’ recommendations were formally included in the Urban Mobility Plans. In Naples, school goers asked for “a city, not just clean from waste, but also from polluting and noisy traffic”.

**Participation** – In terms of how to prevent air and noise pollution, beside raising topics such as sustainable transport, energy production, the introduction of new technologies to mitigate the effects of polluting industries, or the need to consume less, there was a clear and repeated need to “unite people to save the environment”. Based on reliable and well communicated data, people need to be encouraged to regularly meet with

their administrators, which is a successful way to foster a real scientific citizenship. In San Miniato, as well as in Taranto, the request for a Young People’s Town Council was proposed and taken into consideration by the decision makers.

The participatory process revealed the potential of the public engagement in environmental health-related policies and of the direct involvement of children in understanding their own exposure and actively taking the initiative to modify it.

Authors are: Federica Manzoli, Liliana Cori and Fabrizio Bianchi.



**Liliana Cori**

Institute of Clinical Physiology of the Italian  
National Research Council  
Funded by LIFE+ Environment Policy &  
Governance  
LIFE13 ENV/IT/000225  
liliana.cori@ifc.cnr.it  
www.gioconda.ifc.cnr.it



# Bridging the European healthcare gaps

Bridge Health Coordination highlight the three main functions of public health

Public health policy and organisations aim to prevent disease, and to promote health and the quality and quantity of the life of populations. Public health has 3 main functions: (1) the continuous follow-up of the health populations and of specific sub-populations to be able to identify those at risk, define health problems, set health objectives, and develop policy prioritisation and phasing of action plans; (2) the proposal of policies to tackle local, national, EU and global health problems; and (3) the creation of policies ensuring equitable and non-discriminatory access to an effective and efficient health system, that covers health promotion, prevention, care and cure. The BRIDGE Health project covers all 3 functions.

In the May 2016 issue of Adjacent Government, we gave an introduction to the BRIDGE Health project and described the need for and benefits of an EU health information system (EU HIS), within the current political context. In this contribution, the concepts of the EU HIS will be further explained as well as the activities of BRIDGE Health.

The idea behind an EU HIS is to understand the dynamics of population health, to understand what drives the optimisation of health systems performance and to understand how policies interact with and affect both. As such the essentials of an EU HIS are to improve people's health and to

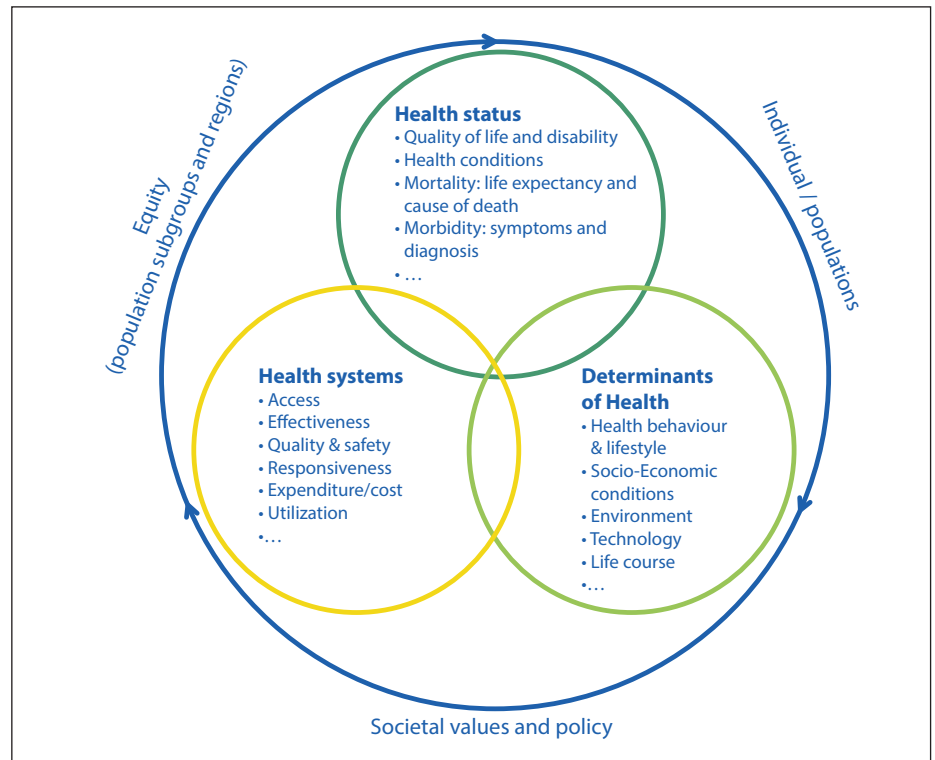


Figure 1. Scope of EU health information system

optimise the health systems of the different EU member states by data integration, analytics and inference, research, knowledge generation and dissemination that supports multi-level policies and actions.

The scope of an EU HIS should be comprehensive, addressing health systems and population health including health status and determinants of health. Health information at individual level and population level should be considered with focus on equity and looking at societal values. The information should be used for evidence-based policy-making, (Figure 1). Data are used in research to understand

the health level of the EU citizens, to understand the health gaps between EU populations and to identify the factors (health system and health determinants) affecting the health level and the health gap between populations.

BRIDGE Health has a wide scope covering the main areas of public health: health status, health determinants and health systems. The expertise of the different BRIDGE Health partners was essential not only in the development phase of the project but also in the realisation of the project, which is organised, (1) to cover both content and technical or methodological issues in health information and (2) to max-

## PROFILE

imise the use of the broad expertise of the BRIDGE Health partners.

BRIDGE Health updates and improves the existing European Core Health Indicators (ECHI) knowledge and expertise. Focus is given to strengthening the scientific base that supports the effective development and use of health indicators for health policy evaluation and prioritisation by the EU and its Member States. ECHI are a set of 88 indicators providing information on health promotion, health services, determinants of health, health status and demography and socio-economic situation.

Harmonised population-based health examination surveys are an important tool for objective and reliable data that are comparable over time and between Member States. There is a need for further standardisation of the surveys and for a broader deployment covering more Member States.

The project fosters the use of environmental health surveillance in European health information by building on and expanding the work on a European-wide protocol, for human biomonitoring (HBM) surveillance in the European population and on establishing a network of European birth cohorts for environmental health research, based on the experience of COPHES/DEMOCOPHES and ENRIECO.

In the domain of reproductive, maternal, new born, children and adolescent health, we optimise the sustainability, timeliness, comprehensiveness, quality and use of perinatal health information from routine systems and research initiatives such as CHICOS, RICHE and ENRIECO.

Registers of specific chronic diseases are essential within a health information system. Therefore, BRIDGE Health focusses on population-based registries and gathers, harmonises and disseminates procedures, methods and best practices in such registries, as a common platform for the provision of community health indicators of occurrence, quality of care and outcomes of chronic diseases in Europe.

BRIDGE Health continues the work on a platform for injury surveillance (see previous IDB and JAMIE projects). It ensures the availability and EU-wide coverage of up-to-date and high quality injury data for benchmarking policies relevant for the safety of citizens in Europe and to monitor their progress in reducing injuries. By maximising synergy with existing health information repositories, it contributes to the development of a sustainable European infrastructure for health information.

The 3 remaining working domains of BRIDGE Health foster the Health System Performance Analysis (HSPA) by strengthening the use of administrative data, by piloting the use of combining data from different data sources and by seeking for best practices in HSPA:

- To strengthen the use of administrative data we provide insights on how to build a data infrastructure. We explore the integration of individual-level routinely collected administrative data with a view of producing relevant information for healthcare performance assessment, at different levels of interest (i.e. patient, provider, healthcare area, region, country). This work builds on the work already undertaken for the ECHO project;

- BRIDGE Health pilots methods to link individual level data from different sources by developing a coherent methodology to integrate health information systems from existing data sources – administrative data, survey data or registry data, both population- and disease-based;

- The evaluation of healthcare systems provides harmonised indicators, methods and tools to monitor and evaluate healthcare systems for Member States, for EU and international stakeholders to enhance evidence-based policymaking.

The different work domains in BRIDGE Health are essential building blocks for an EU health information system. BRIDGE Health uses previous successful experiences to develop not only a clear vision on the future of each specific topic it focusses on, but especially to develop a vision on a unified EU health information system.



Bridge Health Coordination  
Scientific Institute of Public Health  
Tel: +32 2 642 5748  
[bridge.coordination@wiv-isp.be](mailto:bridge.coordination@wiv-isp.be)  
[www.bridge-health.eu/](http://www.bridge-health.eu/)  
[www.twitter.com/bridge\\_health](https://twitter.com/bridge_health)

# Neurodegenerative diseases

Neurodegenerative diseases are a growing global challenge as medical advances ensures more individuals live longer. By 2020 there will be more than 40 million individuals in the world with Alzheimer's disease and by 2040, without the development of truly disease modifying drugs this will be more than 80 million. Similar trends are also seen for Parkinson's disease.

The annual treatment and social care of individuals with Neurodegenerative diseases is estimated to be more than \$1 trillion by 2050, making it one of the most important socioeconomic challenges of this century.

Discovering and developing disease modifying drugs i.e. those that prevent progression of the disease, has been very challenging with many programs failing. One of the reasons why the biopharmaceutical industry is having challenges in converting the emerging science in these diseases is the way we classify them. This is referred to as the disease taxonomy.



Read the  
digital ebook





# Stimulating productivity growth

Carlos Moedas, Commissioner for Research, Science and Innovation outlined in a speech last month in Lisbon, how public policy should play a role in productivity growth...

**W**e are still recovering from the shock results of the British referendum and its aftermath. Over these days, we were reminded of Lenin's famous quote that "there are decades where nothing happens and there are weeks where decades happen".

In these difficult days for the European Project, I find it useful to go back to basics, back to the fundamentals.

Above all, the European Union is a project of peace, democracy and prosperity. And on these 3 fronts it has delivered.

The topic of this Forum goes to the heart of one of these fronts, namely "prosperity".

After several years of recession, stagnation and weak recovery, it is fair to ask:

Will Europe continue to be a convergence machine? Will the single market continue to deliver? Will we be able to generate growth while sustaining our social model?

The issue of "productivity" is at the core of all these questions.

I'd like to talk about 2 things in particular.

First, about the fact that investment in R&D is not being translated into productivity growth, at least not at the rate we would want. So the question here is: what can we do about it?

And second, how EU Research and Innovation Policy can maximise productivity-increasing innovations.

Let's start with R&D and productivity growth.



And allow me to use my country, Portugal, as an example. Portugal has come a long way in research and innovation. I graduated in civil engineering right here in Lisbon in 1993. At that point investment in R&D in this country was around half a percent of GDP.

Today Portugal spends around 1.3% of GDP on R&D. Portugal produces excellent science. Per capita, this country produces more scientific publications than South Korea, Italy and Japan.

But is spending on R&D as high as we would like it to be? No. Is Portugal reaching the full heights of its potential in research and innovation? Not yet.

Portugal's talent in science and research must be cultivated. But we also need to ensure that this talent is then translated into productivity.

We all know that across the EU, there has been hardly any increase in productivity since the crisis started in 2007.

OECD's recent analysis on this issue makes a lot of sense. In the digital age, productivity does not seem to

diffuse efficiently from those at the top, from the firms at the frontier, to the other firms.

The winners take it all. There seems to be 2 disconnects:

One between the high quality research and development carried out in Europe – and their economic impact.

And another between frontier firms and average firms.

This troubles me, as someone whose job it is to advocate higher Member State spending in R&D. It suggests that the very nature of innovation is changing.

The new economic opportunities of this century are increasingly emerging from the intersections of the digital and physical worlds.

And for this to happen we need to have a more open system of innovation, a more connected economy we need to be less protective of incumbents, we need to be more tolerant of disruptive, market creating innovation.

Is Europe, ready to make these changes? How willing are we to encourage new entrants, weaken the power of incumbents, increase the connectivity of our economies, test out new ideas, and to allow the users to take control? Are we capable in Europe to enable this kind of disruption?

I am certainly working for it, advocating it constantly.

The reason I chose as my priorities “Open Innovation, Open Science and Open to the World”, is because I truly believe in this:

That Europe will only reach a higher plane of growth and job creation to the extent that it is willing and able to lower the barriers that still hinder our internal market and our competitive landscape.

I truly believe that the answer to how we translate more effectively R&D investment to actual productivity growth was the old fashioned one of accelerating the single market: that means being more effective in enforcing its rules, stepping up competition policy, implementing the Capital Markets Union and the Energy Union.

We need to eliminate the many invisible barriers that still curtail our full potential and increase the connectivity between our different markets.

So, to transform investment in R&D into productivity our whole society and economy needs to be more open and our markets more competitive and connected. That should be our overall aim, enforced through all EU policies.

But there are also specific policies and instruments at the EU level that can lead to a more rapid translation between R&D and productivity growth. Policies and instruments that can increase the likelihood of generating disruptive, market-creating innovations in Europe.

To me there are 3 areas that can make a difference to the current public and private funding environment:

- We need to be able to scale-up new businesses, so we need investment at a pan-european level, with more firepower and more tolerance for risk;
- We need to remove regulatory uncertainty, so we need better regulation for innovation;
- And we need to get public support for innovation right, so we need new ways to fund individual innovators.

Let's talk about the first area, investment.

In 2014, venture capital investment across the EU was around 5 billion euro, which is more than 5 times less than in the US.

At EU level, we're working hard to address this issue in the most practical way possible.

Together with the European Investment Fund, we're currently working towards a European Venture Capital Fund-of-Funds.

This Fund of Funds could invest in a combination of early stage, later stage and expansion stage venture capital funds, above €500mn, with the majority of funding coming from the private sector;

And with independent fund management:



That would bring an entirely new momentum to the European venture capital market. The idea is to attract large institutional investors that today shy away from projects that involve some scientific or technological risk but that are crucial for future productivity growth.

Regulation, the second area I want to mention, can also help increase investor confidence.

In June, the Commission launched an Innovation Deals pilot scheme, within the scope of the Circular Economy.

EU Innovation Deals are designed to address perceived legislative barriers more quickly.

By providing clarity, or identifying solutions within existing legislation.

Finally, the third area, which is public funding for innovation.

Generating productivity from innovation is about more than investment and regulation.

Public funding also plays a role as there are various market failures at work. Here we have been asking ourselves: Are we supporting a wide enough diversity of innovators? Do our funding instruments capture market-creating disruptive innovations?

The conclusion we have come to is that Europe can do more, much more, on this front. This is why I launched a call for ideas to develop a European Innovation Council.

We want to create something that will meet the needs of start-ups and those with ideas for disruptive innovations – ones that create entirely new markets.

As a result of our call for ideas and intense debate with innovators across Europe, I will soon announce important reforms in our funding instruments. We will consolidate the existing instruments in a simpler, more responsive grant schemes; and we will make funding more bottom-up so as to be open to the innovation happening at the intersection of disciplines and sectors. With these reforms we hope to increase the likelihood of nurturing the breakthrough innovations of the future, the ones that will lead to productivity growth and job creation.

Today we are already doing this. But I believe there is much more we can do.

I started with a reference to the historic moment we are living in.

At a time when some are shutting borders – tangible and intangible – others should be even more vocal and active in breaking those same barriers.

We can only kick-start productivity growth if we are willing to go for a big, renewed push in our single market. We will achieve very little without trust, solidarity, and diversity.

Europe does not, and will never, think and act as a homogenous whole. Nor should that be our goal.

Our goal should be to make the very most of our unique and enviable situation. We are very different, and yet we work remarkably well together.

We have succeeded in creating peace and prosperity, like no other political or economic project in the history of mankind. So let's trust in ourselves.

Let's work towards our shared goal of building a prosperous, innovative, sustainable economy that leaves no one behind. ■

This is an edited version of a speech, the full version can be found here – [http://ec.europa.eu/commission/2014-2019/moedas/announcements/stimulating-productivity-growth-role-public-policy\\_en](http://ec.europa.eu/commission/2014-2019/moedas/announcements/stimulating-productivity-growth-role-public-policy_en)

.....  
**Carlos Moedas**  
**Commissioner for Research,**  
**Science and Innovation**

European Commission  
[http://ec.europa.eu/commission/2014-2019/moedas/announcements/stimulating-productivity-growth-role-public-policy\\_en](http://ec.europa.eu/commission/2014-2019/moedas/announcements/stimulating-productivity-growth-role-public-policy_en)  
[www.twitter.com/Moedas](http://www.twitter.com/Moedas)

# Settlement archaeology in Egypt and Nubia

Julia Budka, Professor of Egyptian Archaeology and Art at LMU Munich sheds light on the missing link to a more direct understanding of Pharaonic culture...

Egyptological research has been traditionally focused on the evaluation of texts and funerary remains, resulting in a biased view of Ancient Egypt. The present knowledge of everyday life, social structures, as well as ethics and beliefs of people in Pharaonic Egypt is derived mostly from mortuary records and strongly associated with the upper class. Within this elite-biased view of Ancient Egypt, rural settlements and village life are often neglected. In addition, there is still a tendency to assess our knowledge about daily activities at domestic sites as illustrated best by textual data, or by means of a combination of textual and material evidence.

Case studies in Egyptian archaeology that explore possibilities and limits of tracing identities, individuals and their biographies, are until now primarily restricted to the funerary sphere. To achieve a more complete understanding of the full complexity of Pharaonic culture, we need to address substantial aspects, like everyday activities and domestic architecture, preferably relating to various social classes. These issues can be investigated at their best in settlements and urban sites which are very challenging in exploration, require specialised and well trained staff and are often badly preserved or inaccessible because they are under water or overbuilt by modern houses. Here, Egyptian towns located in modern Sudan offer the unique chance to conduct a detailed



*Ruins of the New Kingdom town of Sai*

analysis of domestic life at the junction of Egyptian and Nubian culture. In direct opposition to sites located within the borders of modern Egypt, these sites in Northern Sudan are better preserved and more accessible because they have not been superimposed by modern houses or cities.

Although much progress has been made in the last decades, the discipline of settlement archaeology in Pharaonic Egypt and Ancient Nubia is still somewhere between its infancy and teenage age. Especially because of the technical and methodological advances of Egyptian archaeology in the last decades (e.g. various survey techniques and 3D documentation), it is appropriate to concentrate on settlements, towns and urban patterns.

Settlement archaeology offers the tool to create a more realistic understanding of ancient cultures along the Nile, different from elite-biased and idealised projections deriving from the mortuary record only. It should be considered as the most important field of Egyptian archaeology with rich potential, especially for the time period of the Second Millennium BCE.

Egypt and Nubia (modern Northern Sudan) are situated across ancient and modern borders and have diverse environmental and cultural preconditions, with a long history of changing interactions and influences. The international age of the New Kingdom (c. 1539-1077 BCE) resulted in the foundation of several Egyptian towns and settlements in the area

## PROFILE



*Settlement archaeology produces tons of ceramics*

known today as Upper Nubia, in Sudan. Some of these are well preserved (e.g. Amara West, Sesebi and Sai) and offer the unique chance to explore domestic life in an ancient Egyptian settlement outside of Egypt proper. The most promising example of such “colonial sites” is the exceptionally well preserved town on Sai Island because of its long occupation period and its attested history as an important site of the African Kingdom of Kerma. Prior to the New Kingdom, Sai was the northernmost stronghold of the Kerma Kingdom with a significant strategic role, well attested by archaeological remains.

The AcrossBorders project conducts archaeological fieldwork on Sai Island since 2013. Archaeological excavations in the New Kingdom town and cemetery are being complemented with kite aerial photography, terrestrial 3D laser scans, geoarchaeological surveys, micromorphological sampling and various archaeometric analyses. Human remains, animal bones, botanical material, soil, plaster, sandstone and all kinds of objects are being assessed under the general

question: can Sai be evaluated as an Egyptian microcosm, despite its location outside Egypt and its specific topographical, environmental and cultural situation? How did the local Kerma Nubians react to foreign influences? And, how did the Egyptians present themselves outside Egypt?

The AcrossBorders project aims to provide new insights on the lifestyle and the living conditions in New Kingdom Nubia, thanks to its multi-layered research on Sai Island. It might serve as a wide-ranging trigger to advertising modern settlement archaeology in Egypt and Nubia, bringing together new methods and scientific analyses with current archaeological research questions focusing on households, daily life and the environmental conditions of past societies. Because of the exceptional situation of Nubia as a border region which experienced periods of conquest and colonial settlement by the neighbouring Pharaonic state, as well as heydays under the rule of the African Kingdom of Kerma, this field offers an enormous potential to increase our understanding of ancient human behaviour

including complex questions like migration, adaptation and acculturation. As a project with a bottom-up approach, the detailed assessment of architecture and material culture embedded in the environmental settings and their effect on daily life will result in the reconstruction of regional settings, but also the historical context of Egyptian towns set up in Nubia, thus combining research questions on the micro-level with the macro-level.



**Julia Budka**  
**Professor of Egyptian Archaeology and Art**  
LMU Munich  
Tel: +49 89 / 289 27543  
Julia.Budka@lmu.de  
<http://acrossborders.oeaw.ac.at/>  
[www.twitter.com/jubudka](http://www.twitter.com/jubudka)



# Doing research on endocrine disrupting chemicals? Still worthwhile?

**E**ndocrine Disrupting Chemicals (EDC) are chemical substances that can damage our health and/or the health of environmental organisms by altering the hormone function. Thus, EDC-like mutagenic or carcinogenic substances- are a group made by highly diverse substances, from the standpoints of chemical structures and usages (pesticides, plasticisers, persistent pollutants...) sharing the same action. Indeed, the endocrine system is the most complex signalling network in the organism; EDC, therefore, may act through a number of mechanisms and targets.



Why such a fuss about EDC among EU and non-EU agencies, scientists, industries and NGOs? From my toxicologist's viewpoint the fuss is justified. EDC are hazardous for next generation's health, since hormones are crucial for development, from embryo through to puberty. Each hormone regulates several, often many, organs and tissues: for instance, besides reproduction estrogen function impinges on bone, fat, brain, etc. Hence, an "estrogen-mimicking" EDC may display patterns of multiple effects, depending on the sex and age of the exposed organism. Last but not least, EDC are widespread in environment, products, foods and some may also bioaccumulate in our bodies: tiny amounts of one EDC might sum up with other substances with similar action and elicit some adverse effect, just like the pyramid of minions achieves to change a light bulb.

Europe and some Member States have devoted substantial resources to research on EDC for about 20 years. So one EU citizen could legitimately say "So much knowledge gained, stop putting money on research, let's regulate the hazards": my answer is **"Yes and No"**.

**"Yes"** because gaps of knowledge must not prevent taking action whenever it is supported by knowledge. For instance, current EU regulations on pesticides and biocides require that EDC are identified and restricted: this can be done, based on available knowledge, and delays would be unjustified.

**"No"** because the available evidence presents a few "holes" of major relevance for risk assessment.

The first one is an old, yet still ongoing, story which is essential for risk assessment. How can we define a "safe dose" for EDC? EDC that interact with nuclear receptors may elicit a cellular response at very low doses, that may be qualitatively different from ones that are elicited at higher doses (e.g., stimulating at lower and antagonising at higher concentrations): research is still needed to understand whether these low-dose responses are linked to adverse effects, especially in developing organisms which are considered to be more susceptible.

Then, are we able to assess hazards to all main EDC targets?

Most EDC research still concentrates on effects on the reproductive cycle, whose importance cannot be disputed.

## PROFILE



**Alberto Mantovani**  
Research Director

Yet, as already mentioned above, major hormones do regulate a number of organs and tissues. As an example, estrogen balance regulate bone metabolism, with recognised effects in post-menopausal women. However, skeletal health is not a usual target in toxicological testing, either *in vitro* and *in vivo*. Most important, the current testing tools, either regulatory *in vivo* tests or novel *in vitro* assays, do not appropriately identify effects related to the major, endocrine disease of today's world, type II diabetes; the same applies to the endocrine component of obesity, which is connected to diabetes in the so-called "metabolic syndrome". Experimental, and to a lesser extent epidemiological, research shows that some environmental chemicals increase the risk of diabetes and/or obesity; in general such substances belong to the small group of thoroughly investigated ones, like arsenic or bisphenol A. However, the absence of robust endpoints and assays jeopardises the consistent identification of substances, (beyond the "usual suspects") that elicit effects relevant to such top-class public health issues, as the metabolic syndrome. Adverse outcome pathways (AOP) are a novel toxicological approach, building causative chains

from molecular changes through to pathological conditions at organism level; Indeed AOP could support understanding of the full spectrum of EDC effects.

Besides testing EDC in the lab, a lot of identified or possible EDC are present in our living environment. Is there a health risk ongoing? Should urgent measures be taken to reduce such risk? Then we come to epidemiological studies, which currently show a good ground for improvement. The main issue is how to assess the "early exposure-late effect" scenario which is the foremost problem with EDC: in practice, the exposure in the womb or as a kid does matter definitely more than the current EDC levels in body fluids of fully-grown adults. But how do we cope with this? An answer could be creating and exploiting biobanks, and finding biomarkers of effect that can link developmental exposures to adult health risks. Not to say that adult exposure does not matter: here too, substantial advances are needed, including models and tools for exposure characterisation and relevant biomarkers. Biological plausibility of endpoints and findings is a main requirement for epidemiological studies: here "cross-fertilisation" between epidemiology and toxicology will greatly help. Finally, and again, also epidemiological research should take into account substances other than the "usual suspects".

All that said, many EDC are useful substances for consumers, not just for industry: pesticides to protect crops, plasticisers, preservatives, sunscreens for our everyday life, flame retardants, etc. Yet, restrictions are required to protect our health. Sunstitution of high-concern substances is invoked by the EU Regulation REACH (Registra-

tion, Evaluation, Authorisation and Restriction of Chemicals). There is the chance that chemicals candidates for replacing hazardous substances just appear to be less hazardous because their toxicity was insufficiently investigated. The challenge, therefore, is to identify EDC of priority concern, in particular because of widespread use and exposure, and search for substitutes through a robust testing strategy that considers EDC-related as well as other high-concern activities (genotoxicity, bioaccumulation, etc.). As a consequence, the substitutes would be confidently identified as less hazardous. Since the need to screen among numerous potential substitutes requests the development of cost-effective screening strategies, making the best possible use of non-animal (*in silico*, *in vitro*) tools (see the project LIFE EDESIA).

So, we do not need "more research" on EDC; rather, we need "fit-for-purpose" research to support risk managers and policy makers in Europe and worldwide.

Alberto Mantovani, Senior Toxicologist, Istituto Superiore di Sanità (Italian National Health Institute), Roma-Italy; [alberto.mantovani@iss.it](mailto:alberto.mantovani@iss.it); national ED website: <http://www.iss.it/inte>



**Alberto Mantovani**  
Research Director  
Istituto Superiore di Sanità – Roma, Italy  
Tel: +39 06 4990 2815  
[alberto.mantovani@iss.it](mailto:alberto.mantovani@iss.it)  
<http://www.iss.it/inte>

# Investing in research and innovation in Ireland

Minister for Jobs, Enterprise and Innovation, Mary Mitchell O'Connor, T.D outlines, how Ireland aims to become a global leader in innovation, research and development, highlighting the government's Innovation 2020 strategy...

Innovation has been central to securing Ireland's economic recovery and the Irish government plans to continue building a sustainable economy that can support the jobs of the future. Innovation has supported growth in the numbers at work and Ireland has seen unemployment fall from a peak of 15.1% in 2012 to 7.8% in June 2016. Government is determined to ensure that this trend continues and my key priority is keeping innovation as a core focus of government policy. This is demonstrated in Innovation 2020, Ireland's whole of government strategy for research and development, science and technology, which was launched last December.

**“Ireland's greatest asset has always been our talented people and Ireland is the European country with the highest proportion of young people.”**

In Innovation 2020, we set out our vision for Ireland to become a global innovation leader driving a strong sustainable economy and a better society. Research, development, science and technology will all contribute to this goal. Key to delivering our vision is a commitment to increase public and private investment in research to reach our target of 2.5% of GNP by 2020.

Our investment to date in research and innovation has been instrumental in strengthening indigenous enterprise, in securing, diversifying and growing foreign direct investment, in licensing new technologies, in establishing new companies, and in providing the highly educated workforce needed to grow the economy and contribute to society. I am committed to building on this significant progress and to deliver on the ambition of Innovation 2020.



**Mary Mitchell  
O'Connor, T.D**

The importance of innovation for enterprise cannot be underestimated. Our enterprise base must be resilient and internationally competitive, and innovation is central to ensuring that these aims are achieved. One of my key priorities is to encourage greater engagement in R&D in both indigenous and foreign-owned enterprises and in both SMEs and large-scale enterprises. Optimising the transfer of knowledge between our public research system and enterprise is also a priority.

At EU level, Ireland has been performing well. We have consistently improved our innovation performance over the last 4 years moving from 10th place in 2013, 9th in 2014, 8th place in 2015, and now 6th place in 2016, in the European Innovation Scoreboard. Ireland remains the overall leader in the innovators dimension which demonstrates how innovative Irish SMEs are as European leaders in product, process and marketing innovation. Latest data around the EU programme to support research and innovation, Horizon 2020, demonstrates that researchers and companies in Ireland have won a total of €275m in funding from the programme for research projects, including €54m for





SMEs. It is also clear that the research being carried out in Ireland is in the top-tier of EU research and this is a key factor in the companies' success in Horizon 2020.

**“The importance of innovation for enterprise cannot be underestimated. Our enterprise base must be resilient and internationally competitive, and innovation is central to ensuring that that these aims are achieved.”**

We remain committed to maintaining and improving standards in the excellence of our research. Since 2009, Ireland has been listed among the top 20 countries in global rankings for the quality of our scientific research with our ranking in citations moving up to 14th place in 2015.

Ireland's greatest asset has always been our talented people and Ireland is the European country with the highest proportion of young people. We intend to continue nurturing this talent to best serve the needs

of our society and economy, including by increasing enrolments in research Masters and PhDs to meet growing demand for talent from enterprise.

I believe that continuing to enhance our research and innovation capacity will be crucial if we are to continue to develop a strong, sustainable economy and a better society, and this will be a key pillar of our economic policy in the coming years. ■

.....  
**Mary Mitchell O'Connor, T.D**  
**Minister for Jobs, Enterprise and Innovation**

Department of Jobs, Enterprise & Innovation  
[www.djei.ie](http://www.djei.ie)  
[www.twitter.com/JobsEnterInnov](https://twitter.com/JobsEnterInnov)

# Placing education, research and innovation at the heart of Ireland

**D**ublin City University (DCU) is a young and dynamic university which aims to have an impact on Irish society, not only by placing education, research and innovation at the heart of its strategy, but also by ensuring that the knowledge generated is translated into tangible benefits.

The university is in a process of active growth. By September 2016 DCU will incorporate 3 additional higher education institutions and following this process the new DCU Institute of Education will be the largest of its kind in the country. The Institute will lead the provision of teacher education in Ireland and will become a centre of excellence in educational research.

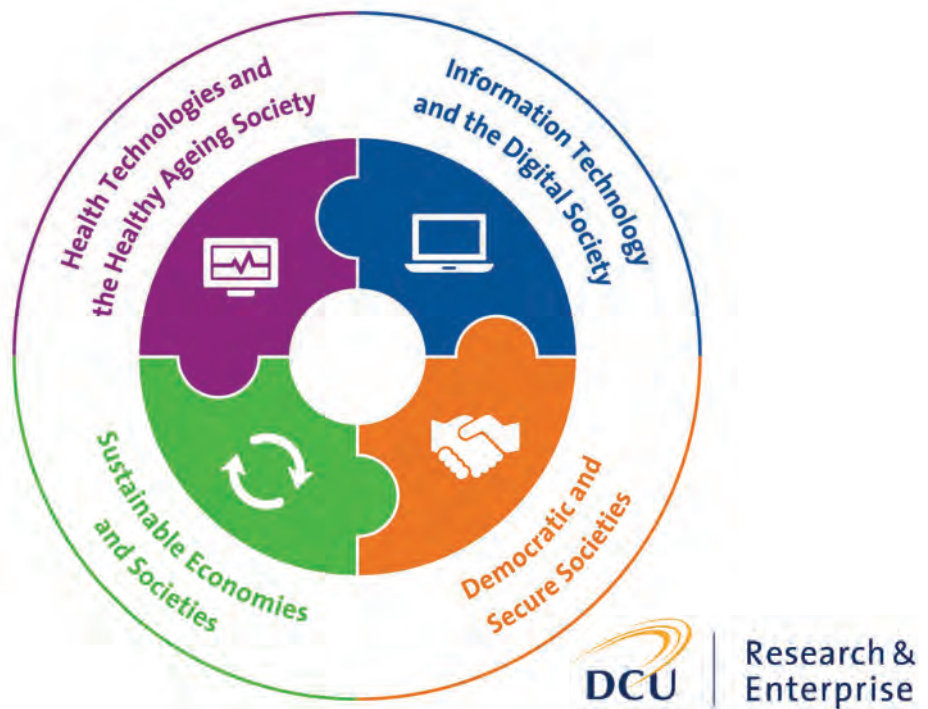
In addition to education, and in order to tackle societal and economic needs, DCU has implemented a novel enterprise – university engagement model: the 4 Research and Enterprise Hubs. “Enterprise” refers to a wide range of external stakeholders, from commercial to non-commercial organisations, industry, charities, NGOs, as well as cultural and social enterprise ventures. Active engagement with these organisations is fundamental to achieve the ambitious government objectives set out in the new Research and Innovation strategy, *Innovation 2020*.

Each R&E Hub focuses on an area where DCU have recognised strengths and at the same time where society is facing significant challenges. The hubs support team can pull together researchers from different disciplines

across the campus to address specific challenges as needed, creating a unique blend of multidisciplinary expertise. The university has an extensive track record of collaboration with enterprise, which provides over 18% of the €40m per year of externally awarded funds for R&I. Informed by years of experience, we understand that agility is paramount: our internal procedures have been simplified to enable a rapid response in relation to IP and contractual issues, and a wide variety of engagement models are available to suit the individual needs of our customers and collaborators.

Research and Innovation must be underpinned by modern infrastructure that enables the advancement of knowledge. DCU is leading the way in relation to open access to its research

facilities, and has created the first University, campus-wide open access research infrastructure network in the Irish Higher Education (HE) sector. This network enables access to high-end research equipment, so that all DCU researchers, as well as national and international collaborators and industrial partners can avail of these facilities ( <http://goo.gl/eXbwWT> ). The Network is structured into centrally coordinated core facilities to ensure that the equipment is properly managed and calibrated, and is supported by an experienced research technical team that enables the development from basic research concepts to prototyping. Key capabilities include microscopy and spectroscopy, materials and surface analysis, biological research, material processing and enhanced specification laboratories.



### DCU Research and Enterprise Hubs

#### Health technologies and the healthy and ageing society

This R&E hub uniquely integrates technology, life sciences and advanced analytics to address unmet needs in health, with one particular focus addressing the challenges of an ageing society.

*"Limbal Stem Cell transplantation is a surgical procedure that aims at restoring vision in patients which limbal cells have been damaged. While this technique has been available in a number of other countries it was not available in Ireland until now. The first Limbal Stem Cell transplant took place recently at the Eye and Ear Hospital in Dublin thanks to a collaboration between scientist and clinicians at the hospital, the National Institute for Cellular Biotechnology in DCU, the Eye Bank and the Irish Blood Transfusion services."*

#### Information technology and the digital society

This R&E hub is at the forefront in developing breakthrough solutions using photonics, data analytics, big data, cloud computing and Internet of Things strategies to address the challenges of next generation ICT.

*"The process of designing exams and managing the examination process in most universities is cumbersome and manual, involving multiple iterations and often requiring the input from external partners. DCU has developed "GURU", a secure, safe and customer friendly web application that manages the process from start to finish, using the latest encryption technology. The appli-*

*cation is fully deployed in several Irish Universities and the team is in the process of bringing this technology to international markets through a new spin-out company."*

#### Sustainable economies and societies

This R&E Hub focuses on advanced and sustainable manufacturing and materials, energy systems and the environment, and water technologies.

*"Numerous severe floods have occurred across Ireland in the last decade. DCU Water Institute and Kingspan, with the support from Dublin City Council have collaborated in the development of an affordable smart sensor network for water level monitoring. This technology has real time capability and an end user app. When water level rises above a certain level, the sensors send out a warning alarm signal to local people, while local authorities can interpret the data to determine when flood defences need to be put in place when an alert of dangerous water level is received."*

#### Democratic and secure societies

This R&E Hub DCU brings considerable expertise in conflict resolution and post-conflict peacebuilding, the relationship between media and democracy, the importance of translation and inter-culturalism in contemporary society, and the role of education as a driver of social change and inclusion.

*"Research at the DCU Anti-bullying Centre shows that a significant digital*

*divide exist between parents and children in Ireland and as a consequence, children are increasingly exposed to the risks of the internet. In collaboration with a consortium of EU universities a new online tool to combat cyber bullying ( [www.parentnets.com](http://www.parentnets.com) ) has been developed. It contains a parent's handbook on best practice for safe internet use and an online game simulating the handbook concepts has been created. Tools like these are essential for the education of parents in this fast evolving digital world"*

Innovation 2020 sets out the government's vision for Ireland "to become a global innovation leader driving a strong sustainable economy and a better society", and DCU will strive to be a major player in ensuring that this vision becomes a reality.



**Dr Ana M Terrés**

**Director of Research Support**

Dublin City University

Tel: +353 1 7007011

[ana.terres@dcu.ie](mailto:ana.terres@dcu.ie)

<https://www.dcu.ie/research/index.shtml>

[www.twitter.com/anamterres](https://www.twitter.com/anamterres)





# Long-term plan for research in Norway

As an area of great importance to the government in Norway, research plays a key role in the long-term welfare of the country. Here Adjacent Government highlights their long-term plan and how open access is seen as important...

Research is seen as integral throughout Norway, with the government attaching great importance to research and knowledge. In response to this, a [long-term plan](#) for higher education and research from 2015-2024 has been developed. Research and higher education are seen as long-term activities, which provide the foundation for welfare and value creation for the future of the country. They are both a key priority for the government, and the long-term plan confirms their commitment to these areas and outlines the course for policy up to 2024.

As well as developing its long-term plan for these areas, the Norwegian government is also aiming to develop a [large number of world-class research](#) groups throughout the country. This is seen as one of the most important focus areas of their long-term plan in order for the country to distinguish itself internationally.

The government understands that in order to bring the country's research and development (R&D) activity to a level which is on par with other nations, the very best

researchers must be given good opportunities to excel and must have the instruments to help generate new knowledge, insight and technology.

In order to achieve this there are plans to intensify the country's focus on research and higher education. The objectives of this are:

- Norway will have world-class research groups that generate new knowledge, improve competitiveness and enhance the ability to address societal challenges;
- Norwegian research groups will attract and produce the most talented researchers;
- The best researchers and students will have access to buildings and infrastructure of high international calibre.

To help achieve these objectives and confirm its commitment to research in Norway, the government aims to create 500 new recruitment positions over 4

years and increase allocations to the national research infrastructure initiative by NOK 400m – which is almost double the current level. They also aim to encourage greater participation in the EU Framework Programme for Research and Innovation, Horizon 2020, by increasing the funding for that by NOK 400m.

The Ministry for Higher Education and Research is the government department tasked with boosting these areas further. Working alongside agencies such as the Research Council of Norway, the Ministry enhances funding in these areas and supports the development of new research and knowledge.

In order to further improve scientific research, Minister Torbjørn Røe Isaksen has allocated NOK 15.9m to help modernise scientific equipment in colleges in Southern and Western Norway.

“The downturn in the oil industry has made the transition Norway must go through, important now,” said Røe Isaksen. “Investment in research and education is a prerequisite for a successful restructuring.

“Several educational institutions are struggling with old, outdated equipment and a lack of equipment. It goes beyond the quality of education. Students must have access to equipment and laboratories that are most similar to what they would encounter in the workplace.”

The allocation of funds was proposed by the government as part of the revised budget for 2016. The institutions in Norway which will receive the funding include: University of Agder; University of Bergen; University of Stavanger; Bergen National Academy; and Stord/Haugesund.

The Ministry of Higher Education and Research has also received a proposal for a national policy for open access to research results. In order to promote both academic work and the use of research in society, the government's aim is for research funded by public money to be freely available to all.

The recommendations come from the University of Oslo, Working Committee, which is chaired by Torkel

Brekke. The recommendations are part of the report – ‘National Guidelines for Open Access Research Results’ – by the Committee which aims to support the goal of transparency throughout Europe by 2020.

“The government's aim is that research funded by public money should be freely available to the same public,” said Minister Torbjørn Røe Isaksen.

“This will promote both academic work and the use of research in society. Therefore, we have been waiting for the committee's work.”

Recommendations from the committee include:

- The committee believes that Norway must support the EU's ambitious resolutions and objectives of full transparency by 2020;
- The European Commission proposes to introduce a requirement that scientific articles must be stored in a national repository. This will affect payments to the institutions;
- Norway must engage actively in international cooperation on negotiations with publishers about the transition to open access;
- It is important that senior managers of research institutions involved in the work ahead;
- It is proposed to establish a national steering committee at management level for monitoring the work ahead.

Minister Torbjørn Røe Isaksen added: “I expect that the recommendations will help us to speed up the work on open access in Norway and also contribute to this important work internationally.” ■

.....  
Adjacent Government  
editorial@adjacentgovernment.co.uk  
www.adjacentgovernment.co.uk

# The role of expertise in policy-making

The research project EUREX looks into the role of scientific expertise in the preparation of public policies. What are the consequences for democracy of increased expertisation and Europeanisation?

Governments rely on informed advice to make political decisions. Policy advice is provided through a number of channels, including the permanent bureaucracy, political advisers, interest groups lobbying, think tanks, consultancy reports, government-funded research and a wide variety of advisory bodies, ranging from permanent advisory boards and expert councils to ad hoc ministerial working groups and independent inquiry commissions.

The specific organisation of policy advice varies considerably across countries. For instance, the US 'knowledge regime' is characterised by competition among multiple private knowledge providers, whereas continental European countries rely more on policy knowledge from public and semi-public research organizations and standing advisory bodies.

## Nordic knowledge regimes

In the Nordic countries, governments rely on policy advice from numerous sources. Yet, temporary commissions of inquiry have traditionally been seen to have a special place. Indeed, the in-depth investigation of policy issues through publicly appointed commissions is often seen as a core element of the Nordic model of government.

Nordic commissions of inquiry have been ascribed multiple functions. Some scholars have seen them primarily as governing instruments of

the state. Others have viewed commissions mainly as a mechanism for generating consensus between societal interests. Others again have emphasised the knowledge aspect of commissions, which constitute a prime channel for incorporating expert knowledge in policy-making.

The traditional Nordic commission model did, however, come under significant pressure from 1980 onwards.

The de-corporatisation of the Nordic political systems led to a dramatic reduction in the number of inquiry commissions and other bodies representing interest groups. Some scholars also point to an increasing politicisation, as setting up a commission has gone from being an 'institutional norm' to becoming a 'strategic choice' in Denmark, or due to the increasing presence of politicians on Swedish commissions.

Image: © colourbox.com



*Is increased reliance on expertise in policy-making good or bad for democracy?*



## PROFILE

### **Expertisation and Europeanization**

Danish studies indicate a steep increase in the participation of academics in commissions since 1980, and preliminary data from Norway suggest a similar trend. But, so far there has been little systematic analysis of the seemingly growing reliance on experts, sometimes referred to as expertisation. To what extent have scientific experts taken over the preparation of policy within Nordic commissions at the expense of political and administrative actors? What has the increased participation of academics meant for the deliberations and output of commissions?

Also the implications of Europeanisation for the commission institution, and the relationship between expertisation and Europeanisation, remain to be explored. To what extent do national policy advice systems adapt to EU-level structures? Existing studies have moreover neglected the comparative dimension: Do we see similar changes across the Nordic countries, and do changes diverge from developments in other regimes? Can we still talk about a distinct Nordic model of policy knowledge?

### **Good or bad for democracy?**

Changes to the public commission systems also raise important normative questions. Is an increased reliance on experts in policy-making good or bad?

Critics of expertisation worry that a widening scope for expert agenda-setting, discretion and decision-making collide with basic democratic procedures and norms of participation and inclusion. They also fear bad governance and low-quality policies as a result of for instance expert biases, monocultures, uneven representation

of expert communities or disciplines, tendencies to reduce evaluative questions to purely 'technical' issues, and private interest-serving behavior.

Others welcome the rise of expertisation, arguing that it contributes to good governance and more effective and knowledge-based policies, granted that expertise is properly organised and institutionalised and that accountability mechanisms are in place. Optimistic voices point to different ways of 'democratising expertise', ranging from the organisation of lay conferences and public hearings to the inclusion of representative concerns and stakeholder interests when selecting committee members.

### **Pilot studies of Norwegian commissions**

The EUREX project started on 1 July 2016, while pilot studies undertaken by the project directors of Norwegian public inquiry commissions in the areas of economic policy and family and gender equality policy, suggest some preliminary findings.

Based on a longitudinal analysis (1972-2014) of the composition and knowledge utilisation of these commissions, we find a clear expertisation. Not only were chairs and members increasingly scientific experts, there was also an increase in the number of citations in commission reports to academic research. There were, however, limits to the role of experts, as the civil service maintained a high presence and control. The normative implications are arguably mixed. Democratically speaking, the concentration of academics in governmental commissions at the cost of politicians, interest groups and civil servants is problematic, in particular when commissions affect policy outcomes substantively

and operate on the basis of broad, political mandates.

On the other hand, the growing reliance on academic experts and evidence indicate that policy-making is increasingly research-based, while the persistent control of civil servants over secretariats signal high scores on administrative and economic feasibility. The lack of political and disciplinary pluralism in many of the commissions, those in the economic area in particular, could however compromise deliberative and output quality.



*Project directors Cathrine Holst (ARENA Centre for European Studies, University of Oslo) and Johan Christensen (Institute of Public Administration, Leiden University)*

**eurex**  
Expertization of public inquiry  
commissions in a Europeanized  
administrative order

**Cathrine Holst**  
ARENA

**Johan Christensen**  
Leiden University

Expertization of Public Inquiry Commissions in  
a Europeanized Administrative Order (EUREX)  
ARENA Centre for European Studies  
University of Oslo  
Tel: +47 22 85 87 00  
cathrine.holst@arena.uio.no  
www.arena.uio.no/eurex

# Diversity innovates

Martin Kern, Interim Director at the European Institute of Innovation and Technology (EIT) highlights the importance of open innovation...

When I am asked how the EIT Community managed to develop more than 900 business ideas, 200 innovative start-ups and 150 new products and services within only 5 years, my answer is – through a diverse and open community.

EIT is a living example of open innovation. With more than 800 partners from across Europe, we have created Europe's largest innovation community, but we are making innovation happen not because of the numbers, but because of our diversity and our openness.

Europe has excellent business, higher education and research organisations, but still lags behind its global competitors. Why? At the EIT, we believe that a big part of the answer is the lack of cooperation between key innovation players. We live in a society where boundaries between organisations and their environment have become more permeable, with ideas passing in and out. However, innovation often occurs at the intersection of different disciplines, because it needs to work across borders and disciplines. These disciplines feed off one another. Innovation needs diverse and inspiring minds with different knowledge, experience and points of view, to meet together in a space that gives freedom to innovate. That's the EIT.

With 30 innovation hubs across Europe, our innovation communities have created pan-European networks that embrace open innovation in all of their activities targeting innovation, business creation and acceleration and entrepreneurial education. We have more than 800 excellent partners from business, education and research, and we are open to more joining. Different experiences and perspectives, different strengths – and weaknesses – but we invite diversity, because we believe that is where innovation happens.

And it works.



*Martin Kern, Interim Director at the European Institute of Innovation and Technology*

With close cooperation with the European Commission, our community supports entrepreneurs across Europe to turn their best ideas into products, services and jobs. Our innovation communities are dedicated to finding solutions to major societal challenges, where we also see the biggest opportunities for innovation to increase Europe's competitiveness, growth and jobs creation. We are increasingly seeing the results emerging from our innovation communities tackling challenges in the areas of climate, digitalisation, energy, healthy living and active ageing and raw materials. Students graduating from our courses are now becoming entrepreneurs and EIT supported start-ups are growing and raising investments. Just recently, a start-ups supported by the EIT Climate-KIC, Tado°, raised investment of €50M. Tado° sells smart thermostats that regulate household heating according to the location data of inhabitants. It has successfully launched its product internationally.





Such success would not have been possible without the strong pan-European cooperation of universities, research organisations and business. And it's just the beginning. I believe it is crucial that we all look to improve collaboration both within our communities and with new stakeholders, to continue to accelerate the innovations that meet the needs of Europe's citizens and society as a whole to address major challenges. Only together and only celebrating European diversity can we change Europe's mind set to be more innovative and entrepreneurial.

### Education for change

We believe that education which celebrates diversity and openness must be an integral part of European innovation policies and activities to boost entrepreneurship. There are currently more than 1000 students enrolled in our entrepreneurial education programmes, who upon graduation will join our EIT Alumni community. All are people with vision, great ideas and the ability to turn these ideas into sustainable solutions for Europe. This year, 5 of the 30 young social entrepreneurs featured by Forbes in its 30 Under 30 Europe list, were supported by the EIT Community, and of

them graduated from our educational programmes. This brings us back to the importance of working together. All our educational programmes are created in close cooperation with leading higher education, business and research institutions.

When our Alumni talk about benefits from their experience with the EIT Community, they often mention the diverse pan-European network. Our programmes are fully focused on the development of entrepreneurial and innovation skills. Students cooperate with business, academia and researchers from across Europe. These programmes change mind-sets and empower top entrepreneurs and the change leaders of tomorrow to work in a way that embraces diversity. We believe this is exactly what Europe needs. ■

### Martin Kern Interim Director

European Institute of Innovation and Technology (EIT)  
<https://eit.europa.eu/>  
<https://twitter.com/EITeu>



# Innovation in Sweden

Adjacent Government highlights how Sweden is strengthening innovation in the country through programs run by VINNOVA – the Swedish innovation agency...

Sweden is seen today as a World leader in innovation. Innovation is closely linked with research and development (R&D) and Sweden is one of Europe's top 3 countries which spends the most money in this area. In 2009, the country invested 3.6% of GDP in R&D, and in 2010 the nation was ranked 8th in the Harvard Business School's National innovation Capacity Index. Which definitely gives it bragging rights when it comes to their innovation capabilities.

In 2012, the government launched their '[Swedish Innovation Strategy](#)', which was produced by the Ministry of Enterprise, Energy and Communications. The strategy aims to "contribute a climate with the best possible conditions for innovation in Sweden with year 2020 in sight."

Introducing the strategy, Minister for Enterprise, Annie Lööf, said: "In Sweden, we need to be more innovative to meet the global societal challenges, to increase the competitiveness and to renew the future welfare and public services. This calls for the innovation climate that provides the best possible conditions for individual, businesses, the public sector and civil society organisations to be innovative.

"The strategy presents long-term guidelines for how the work within many policy areas until 2020 can create better conditions for people in all parts of society to contribute to a more innovative Sweden through their knowledge, skills and creativity."

The strategy states that: "the power of innovation is being able to turn knowledge, expertise and ideas into new solutions in order to meet needs and demands."

In order to strengthen innovation in the country further, the Swedish innovation agency, VINNOVA

funds research and innovation projects for sustainable growth and social benefit. The Agency runs programs and calls, which develops new knowledge and expertise in specific knowledge areas: health services, ICT, transport, environment, production and employment.

One of the key areas, production and employment helps to ensure high employment and economic growth. Sweden has a strong production and manufacturing sector where companies have successfully shifted the focus from mass production to flexible production of advanced goods and services.

[Produktion2030](#) is a program run by VINNOVA, which aims to focus on 6 areas where the Swedish production is competitive today, but where efforts need to be made for companies to remain competitive in order to boost jobs and welfare throughout the country.

These 6 areas are: environmentally sustainable production, flexible manufacturing processes, virtual product engineering and simulation, knowledge work in the production system, production of service-based products, and processes for integrated product and production.

The programs hopes to create an attractive long-term research and innovation infrastructure, including demonstrator and training environments in order to attract new and established companies, large and small. Through programs such of this, Sweden aims to be one of the World's top countries for sustainable production based on ecological, economic and social perspectives. ■

.....

Adjacent Government  
editorial@adjacentgovernment.co.uk  
www.adjacentgovernment.co.uk

# Engineering innovation factory

## Innovation in product realisation

Individualisation and sustainability increase the demand for innovation concerning new materials, technologies and combined system solutions. This rises the needs for collaboration between various disciplines within an organisation, to coordinate perspectives and experiences, and understanding of the common system.

In the domain of developing production systems, the design of a good factory is typically distributed over many disciplines and organisations to cover all involved technologies (process, logistics, machinery etc.). Modelling and simulation of processes, layouts and workspaces is often used to support the design process within each of the disciplines, but these models typically represent different contexts and levels of detail and reside in different IT-systems using different formats and vocabulary.

One challenge is thus to interrelate various human perspectives, as well as digital models to get a common systems understanding. Our research addresses designing a digital factory framework for cross-disciplinary innovation, with principles, methods and technologies for building and using a digital factory, exemplified in one digital factory demonstrator.

### The engineering innovation factory framework

One way of coordinating various disciplines is through an object which can interrelate the different perspectives, while accessing the details of

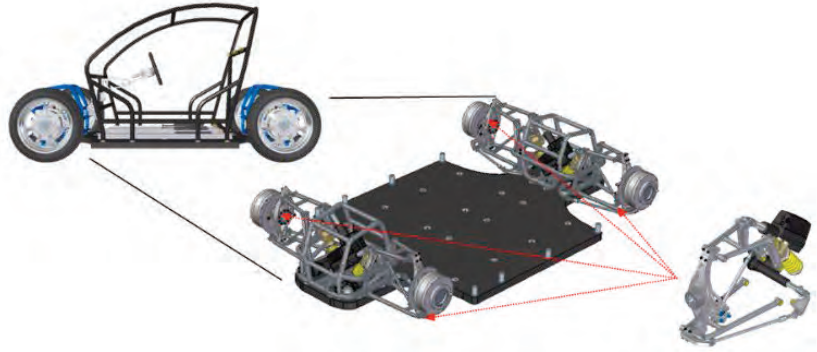


Fig 1. The chosen product – RCV Vehicle with suspension and upright

each discipline. So the idea is to use the digital factory models as a common boundary object to support interdisciplinary design. Our framework is comprised of three parts: The digital factory demonstrator, the digital factory design system, and the work method. The design system and method rests upon principles for choosing and designing contents and visualisations depending on purpose and context.

### Work method – using the digital factory

The digital factory innovation method is inspired by experiential learning, using learning as a means to gain an understanding of the system and its cause-effect relationships, necessary for problem solving. Further, through learning, the goal is to support innovation which occurs when people with different perspectives communicate and share ideas and experiences from their respective domains. A digital factory for learning should thus support explaining the structure and key qualities of the manufacturing system, as

well as active experimentation through the visualisation and simulation of different choices.

It is important to capture the essence of production while hiding unnecessary complexity, and the following industrial challenges were selected together with industrial partners actively working in the automotive industry:

- Ability to compare concepts considering cost, quality and productivity, both from the internal machine/station processing perspective and in the wider factory scope;
- Ability to provide an intuitive understanding of the possibilities and risks with each alternative through modeling and visualisation, in addition to numerical KPIs given by calculations;
- Ability to design for logistics in the final assembly shop – for example balancing the required space for internal buffers with the frequency of supplying material;

## PROFILE

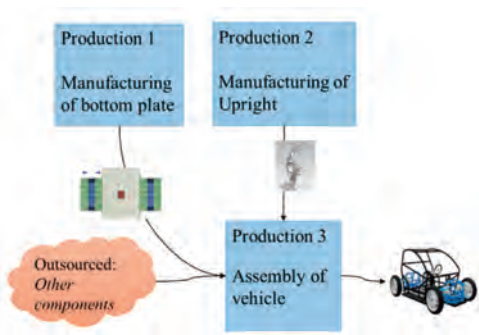


Fig 2. Factories for RCV

- Ability to adjust to fluctuations in the demand of volumes for different product variants in a factory – for example adapting to changed market demands;
- Ability to adhere to ergonomics and safety regulations in layout design – for example making sure that there is enough space so the operators in the assembly shop do not step into the truck lane.

The block layout serves as one boundary object for discussion. It balances the concrete with the abstract, representing the factory on an abstract level with lack of detail in both process sequence, appearance and interconnections of equipment. Still it is concrete enough to provide a good view of the grouping and proportions of processes on the factory floor.

### Design system – implementing the digital factory

The system for developing digital factories, DFDS, is based on a principle for designing models and systems according to the context and needs in the work process. Focusing on required information and functionality, the digital factory models and simulations are mapped to different IT-systems.

Our DFDS has a systems architecture with authoring applications for design and simulation coordinated through a common information backbone, currently implemented in commercial-off-the-shelf systems (COTS).

A common and explicit manufacturing information model together with well-defined functionalities and interfaces facilitate the configuration of digital factories to the context of different companies. Further, these principles contribute to future service oriented systems where independent applications can be plugged in “on the fly” to a common information backbone.

### Digital factory demonstrator – the RCV digital factory

The digital factory RCV demonstrator is simplified to capture the essence of automotive production while hiding unnecessary complexity. It comprises models of the factory processes, equipment and layouts for different design stages from conceptual process planning to placement of the machinery in a detailed factory layout. In this digital factory, virtual manufacturing is performed in terms of 1) simulation of the machining processes for manufacturing the upright and 2) discrete event simulation for simulating the material flow in the assembly line.

The demonstrator concerns creating and using a digital factory for the design of a manufacturing system for a new type of research concept vehicle (RCV).

In the production scenario, the RCV should be produced with a total capacity of 90.000 vehicles per year, with 2 main variants. The production is divided into 3 factories: the manufacturing of the composite base plate;

the machining of the wheel suspension upright – core component – and the final assembly of the whole vehicle. All other components and processes are out of scope and assumed to be purchased/sourced.

A simplified work process model for conceptual factory design serves as a framework for describing how an expert in the domain works: starting by determining the types, and sequence, of processes required to produce the product; then making a rough estimate of required resources and space for each process, estimating time and cost.

In the demonstrator, the block layout can be studied and discussed in a collaborative setting; then elaborated creating a new process plan which is analysed in more depth through the connection to the flow simulation. Details concerning cycle times and buffer sizes can be elaborated and results exported back to the block layout for visualisation and discussion. Thus the demonstrator supports the experimenting, reflecting and conceptualising of the experiential learning cycle.



#### Gunilla Sivard

KTH Royal Institute of Technology –  
Industrial Engineering and Management  
Tel: +46 879 090 80  
gunilla@kth.se  
<https://www.kth.se/en/itm/>



# The European Union's growing innovation divide

Reinhilde Veugelers, Senior Fellow at Bruegel highlights the serious divide between EU member states in terms of their capacity to innovate...

The European Union's lofty ambition is that its future prosperity should be built on foundations of innovation. But ambition has so far not translated into leading performance. According to the European Commission's 2015 Innovation Union Scoreboard indicator (IUS), a composite indicator developed to assess innovation performance, the EU continues to suffer from an innovation-capacity gap relative to other major world economies, and the pace of catch-up is very slow.

The EU's slow overall improvement in innovation performance can be related to a growing innovation-performance divide between its member states. There are substantial differences between EU member states in terms of their innovation capacities. The divide between the innovation leaders in the north and the innovation laggards is proving very persistent. The process of convergence, which was already very slow before 2008, has since stalled, and has more recently moved into reverse. The southern EU countries made considerable progress in the pre-crisis period, but their process of converging with the leaders has halted since 2008. In contrast, in the central and eastern European countries, catching up continued after 2008, albeit at a reduced pace.

A key indicator to assess a nation's capacity for innovation is its private expenditures on research and development. For this component, the EU's score relative to the rest of the world is lowest, and there is no sign of improvement. On the contrary, performance has slipped. This area has persistently been Europe's weakest spot in terms of innovation capacity. This area also displays an increasing divergence between EU member states. In particular, the gap on private research and development (R&D) between the innovation-leading countries and the innovation-lagging

countries in high fiscal consolidation is growing. This holds for countries in central and Eastern Europe, but also southern EU countries have been losing ground relative to innovation leaders. For the southern EU countries, the largest gap with the innovation leaders is for finance as an enabler, with very little evidence of catching up. This could have significant implications for their future prospects, particularly as this combines with a high fiscal consolidation mode.

**“The divide between the innovation leaders in the north and the innovation laggards is proving very persistent. The process of convergence, which was already very slow before 2008, has since stalled, and has more recently moved into reverse.”**

When looking at the innovation policies deployed in the EU member states, the share of public funds dedicated to innovation is in general very low in Europe. While it had been increasing slowly in the pre-2008 period; the increase slowed markedly after 2008. Furthermore, since the crisis, the divide between EU countries in public spending on research and innovation (R&I) relative to GDP has increased. The innovation-leading countries have forged ahead but the followers have not been able to keep up, leaving a wider gap in public R&I spending now than before the crisis. Public spending has therefore aggravated rather than smoothed the growing innovation divide. This falling behind is the case for high fiscal consolidation innovation-lagging countries, but even within this group there is a growing divergence, with Portugal, for example, improving while its neighbour Spain loses ground. Hence, the differences between EU countries in terms of public R&I spending have increased since the crisis, not only because of an increasing divide between fiscally stronger innovation-leading countries



and fiscally weak innovation laggards, but also because of a bigger divide within the group of fiscally weaker innovation laggards. When looking at the major innovation policy instruments deployed by EU countries, the evidence shows that despite the wide and growing divide in innovation capacity performance, member states deploy a relatively similar mix of policies. Overall, the innovation policies that have been deployed do not seem to have been able to address the growing innovation divide in the EU.

**“For the southern EU countries, the largest gap with the innovation leaders is for finance as an enabler, with very little evidence of catching up.”**

The lack of correlation between innovation policy deployment and improvements in innovation capacity calls for a more in-depth evaluation of innovation policy deployment by EU member states, in order to

better understand how to tailor innovation policy to local needs. The way forward for improving innovation policy in Europe is better analysis and diagnosis to guide policy design ex ante, more experimentation with new instruments and combinations of instruments, and better evaluation ex post. Only if the EU understands and addresses the failure of its lagging members to catch up and its growing internal innovation divide, will it be able to achieve its ambition of becoming a world innovation leader. ■

.....  
**Reinhilde Veugelers**  
**Senior Fellow**

Bruegel  
And Professor at KULeuven  
[reinhilde.veugelers@bruegel.org](mailto:reinhilde.veugelers@bruegel.org)  
<http://bruegel.org/>

# Amsterdam – the innovation capital of Europe

The City of Amsterdam highlights how the Dutch capital won the title of innovation capital of Europe and how innovation plays a key role in the city...

Amsterdam has become Europe's Capital of Innovation. The city earned the 'iCapital' title, which comes with a €950,000 investment in the city's continuing innovation, for its 'holistic vision of innovation' in 4 areas of urban life: governance, economics, social inclusion and quality of life.

In Amsterdam, we organise serendipity. We know that we have to address more than research and development (R&D) and scientific quality. Disruptive technologies run faster than any city-government. Innovation processes change and become more distributed, and cities have to act on it by changing their approach, which includes openness, pragmatism, agility and embracing diversity. We do not follow a particular x-year innovation strategy, but we know we have to draw attention to openness, entrepreneurship and livability. Every city can mobilise its social innovation capital, and link societal and urban challenges to local scientific and entrepreneurial quality. We just use a practical approach towards innovation, and what is best: every city can do so.

## City DNA

The necessity to innovate has its roots in the 16th century, when the first Trade Agency was opened on the spot, where the old Stock Exchange is located today. Back then, it was important that the building was near the water. Their constant fight against floods forced the city's residents to collaborate in order to protect the city from further disasters. This created a society that relied upon creativity and collaboration. Applying multidisciplinary skills and knowledge, working together outside of regular activities and thinking with an open mind have always been the driving forces behind big societal changes. Amsterdam miraculously, could always sustain itself due to some of the core assets that are encrypted in the city DNA. These assets are:

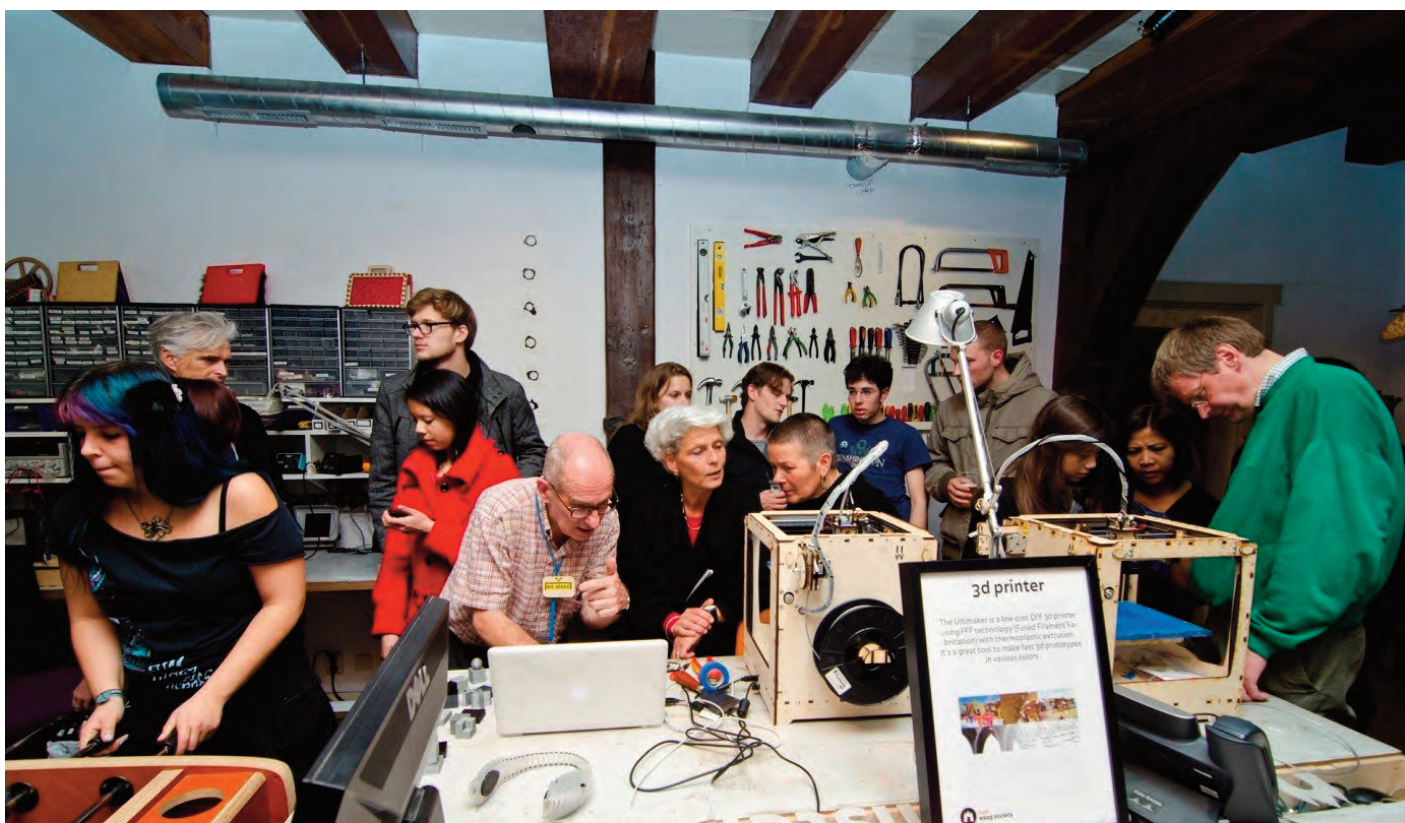


*Amsterdam Smart Citizens Lab at Waag Society empowers citizens to share data about their environment and thereby contribute to innovative solutions for their city*

- Openness: ability to adapt and adjust to sudden, large-scale changes (ranging from floods to migration);
- Courage to reinvent established business models (creative deconstruction): there are regulations but they can always be adjusted or loosely customised. All these cultural aspects are connected to the prevailing economic structure, which mitigated vested interests and ensured they could not become dominant;
- Fairness: equality of ideas and people. The greatest importance is attached to ideas, and barely none to any kind of hierarchical construction. Neither is there a dominant sector or organisation that would prescribe how to act;
- Inclusive communal thinking and acting, but with the ability to conduct concrete action (hence: a pragmatic approach).

In the last few years, innovation processes have been undergoing varying and far-reaching changes. An increasing number of disruptive technologies are





*Fab lab Amsterdam where people meet up to learn about the possibilities of 3d printing. In a Fabrication laboratory, people can realize their ideas using digital equipment in a prototype or product*

emerging and this has a liberating and revolutionary effect on society. This requires shifts in numerous fields: from centralised to distributed, from possession to sharing and from evolution to real-time adjustments. In such a new transitory and innovative city there is an urge to provide feedback to citizens about experimentations and prototypes. Almost every city now has their own living labs, to which often anyone can contribute. After all, the city belongs to everyone.

### **The Amsterdam Cooperative Innovation Model**

Since 2012, a strategy is being developed in Amsterdam that enables the conscious orchestration of 'serendipity'. Constantly more 'meeting places' have been established where the free flow of creative power between very different actors is being actively stimulated, like Pakhuis de Zwijger. So called 'generative brokers', such as Kennisland and The Waag Society have taken the opportunity to build a structure for mass involvement of citizens. A strong link between urban challenges and the scientific and entrepreneurial world of science & business parks is made by the Amsterdam Economic Board, connecting different actors in innovation. Fur-

thermore, the city itself offers a great foundation for being a living lab due to its compact size, its extremely diverse population (there are residents of 180 nationalities in Amsterdam) and the presence of many ground-breaking meeting places. The living labs are supported by the Amsterdam Institute of Advanced Metropolitan Solutions.

The Amsterdam approach is therefore characterised by:

- A vibrant urban society that nurtures innovation, that comes up with self-invented solutions and applies them to concrete situations and that creates various platforms. This requires a supporting role of the city government;
- The fast uptake and application of smart technologies enables city residents to mobilise talent through rapid contacts and meetings;
- Local context: Urban challenges form a basis for continuous discourse between urban stakeholders and this helps the city to respond faster to challenges;



*Hack the Brain Academy to tackle smart ideas for the creation of future solutions. Hack the Brain was initiated in Amsterdam in 2014 when experts gathered to experiment with 'do it yourself' brainhacking at the first time Hack the Brain event in Europe*

- Data/ driven (evidence based) approach with a high level of adoptive and absorbing capability leads to a shorter innovation cycle;
- Innovation in Amsterdam has a purpose: to implement, learn and grow. Go where the energy is, not top-down but rather bottom-up.

### Science, Research and Development

Amsterdam's per capita research output is second only to Copenhagen, and the relative impact of its research is the highest. This enables Amsterdam to attract both young knowledge workers who want to live in a highly educated, collegial city and companies that are seeking to employ that talent.

### The secret of urban innovation

Use the 'urban platforms', which offer opportunities to companies, universities and active citizens, online and off-line. A city has to think about its assets and own qualities, use its inhabitants and rethink its approach towards new ideas and technologies. As an enabler but also in its own citizen-town hall service delivery. Within this context, a number of initiatives were launched that demonstrate Amsterdam's open and innovative spirit. They emphasise a more challenge-based approach, with citizens' cognitive and creative capabilities and some governmental 'guts':

#### • Amsterdam Institute for Advanced Metropolitan Solutions AMS

The Amsterdam Institute for Advanced Metropolitan Solutions is a new, ambitious scientific institute established in 2014 in Amsterdam following a competition initiated by the city council. A new approach for the city in a new role. AMS is a public-private institute co-founded by a consortium of academic partners (the Delft University of Technology, Wageningen University and the MIT Massachusetts Institute of Technology). In this institute science, education, government, business partners and societal organisations are working tightly together to create solutions for the complex urban challenges. Testbed: Amsterdam.

#### • Platform New Amsterdam/smart citizen lab

Pakhuis de Zwijger is a venue, community and platform that serves as an excellent meeting point for the innovation ecosystem to exchange ideas and to discuss and launch solutions in the city (over 80.000 members). So called 'City Makers' initiate small-scale, tailor-made solutions that serve the needs of their community and address societal challenges. They redevelop derelict property or brownfields, engage in urban farming, construct co-housing projects, and start community enterprises that enhance the local welfare and employment rates, and so on. Their initiatives are experiments of new ways of developing the city. Example: in 2016 there is a plan to rethink the function of all 25 public libraries in the city by a fablab-infrastructure.

#### • StartupAmsterdam

StartupAmsterdam was founded by serial entrepreneurs and governmental bodies, and represents the startup ecosystem of Amsterdam, which accommodates over 1000 startups who work in union with incubators, accelerators, corporate partners, universities, talent, investors and a supportive government. StartupAmsterdam launched 15 new ideas, e.g. 'Startup in Residence', in which 10 Startups took the challenge to solve 10 urban issues in 3 months, with a guarantee that the developed solution or service would be implemented by the city government. ■

.....  
City of Amsterdam

[www.iamsterdam.com/en](http://www.iamsterdam.com/en)

[www.twitter.com/iamsterdam](https://www.twitter.com/iamsterdam)

# The value of Horizon 2020

Amanda Crowfoot, Director of Science Europe, highlights to [Adjacent Government](#), how Horizon 2020 is crucial for research organisations across Europe...

Horizon 2020, like the 7 previous R&D Framework Programmes, is a vital source of income for research organisations across Europe. Put simply, this funds thousands of research collaborations, and adds significantly to knowledge and discovery, and to Europe's capacity to innovate. However, it is not just of value as a source of funding per se, but also because it provides funding that is often additional – in that it does something different – to what is funded at national level.

At its best, European-funded research complements what is done in individual countries. For example, most countries fund bottom-up frontier research, but the European Research Council (ERC) creates a European-level competition that essentially benchmarks some of the most excellent research and researchers, raising the quality and profile of European research and supporting the establishment of international teams. Similarly, the Marie Skłodowska-Curie Actions (MSCA) facilitate research training and career development in an international context, fostering global links. Horizon 2020 funds research infrastructure projects that would be beyond the scope of individual countries, and helps to ensure that access to facilities is truly open. The programme is also, crucially, funding numerous collaborative projects that bring together researchers, industry and civil society to address, through research and innovation, some of the greatest societal challenges of our time.

The common thread in all of this is collaboration: working together on things that cannot always be tackled alone, and which are often of a scale that no single country could achieve individually.

The members of Science Europe – 47 national research organisations from 27 European countries – are closely

involved and invested in Horizon 2020. The membership includes some major research performing organisations, who are amongst the most active and successful organisations in the Framework Programme. Science Europe also represents European research funding agencies, for whom the programme supports co-operation and co-ordination with other funders and policy makers, such as through ERA-NETs and Joint Programming Initiatives. Horizon 2020 fosters collaboration and supports scientific breakthrough, for the members of Science Europe directly and for the research communities that they support.

Science Europe has a working group on Horizon 2020, which brings together experts from its member organisations to share information and to develop common views, including on the future of European research funding.

The period from late 2016 to late 2017 will see the interim evaluation of Horizon 2020. This is a crucial opportunity to provide input that will influence the last years of this programme, but, even more crucially, will help to shape the early thinking about the next Framework Programme, FP9.

In the views of Science Europe members, Horizon 2020 has seen some real improvements in terms of simplification of the programme since FP7, such as the creation of a robust participants' portal, and the move to a 'paperless' system, but there are still improvements that need to be made to ensure that there is real clarity of communication and that researchers can access the programme in an optimal way. However, a reflection on Horizon 2020 should not just be about operational aspects – absolutely critical though these are for all concerned – but also about what sort of research and innovation programme is really needed for Europe.





Has the experiment of a single programme for research and innovation worked? Should FP9 build incrementally on Horizon 2020 and seek to improve the existing model, or is something different needed to really capitalise on European investment in research? If there is continuity, is the balance between pillars and instruments the right one? Where would the proposed European Innovation Council sit within this? What impact does the Open Science agenda have on the Framework Programme? These are some of the key questions on which the European research community needs to reflect. Science Europe is most definitely doing so.

Last but by no means least, for Horizon 2020, and any future Framework Programme, to have maximum impact it needs to have an appropriate budget. Science Europe has been active in making the case for protecting the EU research budget, and for stressing the crucial role of basic research in underpinning the research careers, innovation and economic growth of the future.

This is one area where it is important for research organisations to come together and to speak with one voice. Last year, Science Europe worked with partner

organisations in warning against the diversion of Horizon 2020 funding to the new European Fund for Strategic Investments. We will continue to advocate for the right conditions for research, and to seek to ensure that policy- and decision-makers are fully aware of the extent to which research is essential for Europe's future, and that funding for this must be strengthened for the benefit of our collective future. The Framework Programme is critical in this, and must be protected. ■



**SCIENCE  
EUROPE**  
Shaping the future of research

.....  
**Amanda Crowfoot**  
**Director**

Science Europe  
[www.scienceeurope.org](http://www.scienceeurope.org)  
[www.twitter.com/ScienceEurope](https://www.twitter.com/ScienceEurope)

# Building bridges between research and society

Joana Camilo, Executive Director of CREATING HEALTH outlines how Universidade Católica Portuguesa (UCP) is a leading research university and presents its new office dedicated to support institutions to apply to health research and innovation funding...

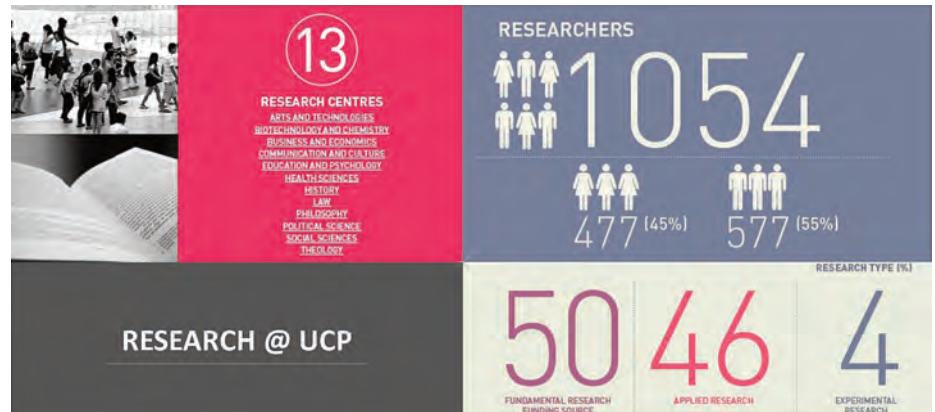
**“A solid reputation, a passion for research, a commitment to a better future. This is Católica – visit us and feel inspired”**

(Maria da Glória Garcia, Rector)

Universidade Católica Portuguesa (UCP) is a leading research university with a humanist vision committed to the well-being of society, with a global outreach and ground breaking contributions in all areas of knowledge.

A propitious environment for teachers and students, along with a competitive hub for research and innovation (R&I), are provided by UCP through its 4 regional campi (Lisboa, Porto, Braga and Viseu), favouring strong intersectoral ties to the surrounding regions. In addition to the commitment to fundamental research, the University is recognised for both the social impact of its research agenda and its contribution to policy making.

UCP's Research Strategy (UCP2020) for the upcoming years focuses on subjects that meet transversal and complex social challenges, gathering research domains with international excellence that produce a differentiating global impact: 1) economy and digital culture; 2) environment, health and sustainability; 3) citizenship and social responsibility; and 4) memory, change and innovation. With an intellectual and inherently international agenda, the UCP2020 Strategy aims to



advance research and impact knowledge production, to foster international and intersectoral cooperation, and to contribute to the global innovation agenda.

UCP is leading research in the areas of business, social sciences and biotechnology, having within the National Scientific System one of the 26 Portuguese Associate Laboratories – the Centre of Biotechnology and Fine Chemistry (CBQF) – and two nationally recognised Excellence Research Centres in Business & Social Sciences – the Católica Research Unit in Business and Economics (CUBE) and the Research Centre for Communication and Culture (CECC), as well as the recently created Interdisciplinary Research Centre in Health (CIIS), which works across different areas to tackle socially relevant scientific challenges in the fields of health and ageing.

The core competences of CBQF are based around biosciences, analytical

chemistry and engineering applied within two main thematic challenges: Health and well-being of the citizen and the competitiveness of agriculture and food. CUBE, hosted by the Católica Lisbon School of Business and Economics – ranking 25 on the Financial Times Business School List – elected as main research areas: economics and evaluation of policy; business and banking, namely proving its capability to translate fundamental research into policy-making tools, such as the Patient Innovation Platform. CECC's research agenda focuses on the development of studies at the intersection of a) culture and conflict; b) cognition and creativity; and c) media and digital innovation. This Centre has done extensive work across the social and cultural impact of risk and hazard. CIIS, under UCP's Institute of Health Sciences (UCP-ICS), has research programmes ranging from dentistry to nursing (in tandem with the national School of Nursing), public health and also excels in the areas of cognition,

## PROFILE



*“Two initiatives of UCP deserve to be highlighted, an effort towards interdisciplinary research and the foundation of a department called CREATING HEALTH, that brokers access to international funding for research in health”.  
Alexandre Castro Caldas, Director of the UCP Institute of Health Sciences*

neurosciences and aged related diseases (Parkinson, Dementia, and Alzheimer).

Recognising the importance of efficiently exploring the European funding opportunities for health R&I in a professional but affordable manner, the researcher and Head of ICS Public Health Department, Ricardo Baptista Leite, felt the need to create an office that could provide the required assistance in applying to European funding for health R&I projects, releasing both institutions and researchers from its time-consuming and sometimes discouraging technical procedures.

In current moments of budgetary restraints, the European Union HORIZON 2020 programme is the oxygen mask many researchers and companies are looking for to allow their research and innovative projects to breathe and hopefully improve people's health.

Within this context, «CREATING HEALTH – Research and Innovation Funding» Office – launched by the UCP-ICS – opened its doors to any institution in 2015, providing support at the pre-application stage, throughout the preparation and submission

of the application, and if necessary post-award assistance.

To accomplish its mission, the office gathered the support of 16 private institutions and the High Patronage of the President of the Portuguese Republic and of the Portuguese Government.

**Who we are:** CREATING HEALTH is a non-profit office that provides support for applying to the multiple health R&I funding opportunities under HORIZON 2020 and other programmes, with the guidance of a Scientific and Ethical Council and a Social Council, aimed at extending the social impact of its mission by bridging research and society.

**What we do:** endorse the fulfillment of the national R&I potential by providing a tailored support to access European and national funds for health related projects. This office also bestows international collaborations by bridging local and international players in order to establish strategic and synergetic partnerships for building competitive consortia.

**Who can rely on us:** all entities (academia, scientific institutions, health

care providers, NGOs like patient associations, public and private companies, etc).

**Why CREATING HEALTH:** this office distinguishes itself by its public, academic based, non-profit and specialised in health R&I funding services.



**Joana Camilo**  
**Executive Director**  
CREATING HEALTH – Research and Innovation Funding  
Tel: +351 217214275  
joana.camilo@ucp.pt  
geral.creatinghealth@ucp.pt  
www.creatinghealth.pt  
www.ucp.pt



# Embracing Horizon 2020

The French National Research Agency explains their investment in Horizon 2020 in order to tackle societal challenges, such as climate change and food security...

**A**s a funding agency, one of the greatest challenges of The French National Research Agency (ANR) lies in coordinating the different funding instruments that exist at the national and European levels. This is one reason why ANR has threaded together much of its Work Programme (WP) with the funding programme Horizon 2020 (H2020), and more broadly with the European policy agenda. Its programming is then structured around major societal challenges, such as climate change or food security that are common to national and European societies.

## ANR's unique role on the international stage

ANR has positioned itself as a key player in the construction of the European Research Area (ERA) alongside other institutional stakeholders. ANR is forging strong partnerships and facilitating collaboration among European researchers through project-based funding. It has continued to play a crucial role in debates and reflections led by European research actors on the scientific policy issues.

Work Programme 2016 (WP) is ANR's roadmap for 2016. The WP falls within the scope of the Strategic Agenda for Research and Transfer and Innovation "France Europe 2020", elaborated in coordination with the European Framework Programme "Horizon 2020". WP 2016 was also drafted in accordance with the National Research Strategy (SNR).

## Two major challenges

The challenge 1 ("Efficient resource management and adaptation to climate change") calls for substantial international initiatives. Priority is given to multilateral initiatives backed by European Joint Programming Initiatives (JPIs) in conjunction with ERA-NET projects, giving rise to possible complementary funding from the European Commission.

The climate domain is one of the main themes of the challenge. Global warming, which is chaotic and marked by extreme events, leads us to raise questions about natural variability and distinguishing between natural and anthropogenic signals (induced by gas and substance emissions).

## Focus on JPI Climate: transforming Europe's future through climate issues

The Joint European Programming Initiative on the Climate (JPI Climate) is a collaboration between the ministries of 16 European countries, which jointly develops coordination on research concerning climate issues by aligning national activities, funding novel initiatives, and forging a continental strategy in synergy with the European Commission.

ANR served as vice chair of the JPI from 2013 to 2015 and assumed chairmanship in May; it will be serving in this capacity over the 2015-2017 period. ANR also took part in 2 calls for proposals under JPI Climate. It served as call secretariat for European call 2013 "Societal transformation in the face of climate change" as well as International call 2015 "Climate 2 predictability and inter-regional linkage," alongside the Indian Ministry of Earth Sciences. An ANR-coordinated ERA-NET co-fund scheduled for 2016-2020 is currently being prepared on the topic of climate services involving 16 countries, 13 funding agencies and 28 research organisations, with potential funding in the amount of €75m.

The challenge 5 ("Food security and demographic challenges") is also based on international programming initiatives. The theme n°4 of this challenge is dedicated to food security. Food systems at all levels – whether local, regional, national or international or whether they involve western, emerging or developing countries – are facing global changes that question their sustainability.



Food products in particular should meet the nutritional needs and pleasure expectations of consumers and be accessible to all and favour health and well-being.

### **Focus on FACCE SURPLUS: strengthening European collaborative research for sustainable agriculture**

The objective of FACCE SURPLUS is to support sustainable intensification of agricultural production. As part of the Joint Programming Initiative on Agriculture, Food Security and Climate Change (FACCE-JPI), this research funding programme brings together many European partners, including the ANR. Rising demand for food, renewable energy and materials from biomass is among the major societal challenges of the 21st century.

The JPI concept was launched in 2008 to bolster the European Research Area (ERA). The aim of these intergovernmental initiatives is to reduce the fragmentation of European research efforts by uniting and coordinating activities and establishing joint research

programmes to address the major challenges facing our societies. To do so, members (research organisations and funders) jointly develop a shared vision and draw up a joint strategic research agenda.

Therefore, ANR endeavours by various means to facilitate collaborations between French researchers and the top European researchers: launching bilateral or multilateral calls for proposals with the major countries contributing to European research, building strategic partnerships with sister agencies on specific topics, sharing best practices with European counterparts, or making the most of the European Commission's instruments. ■

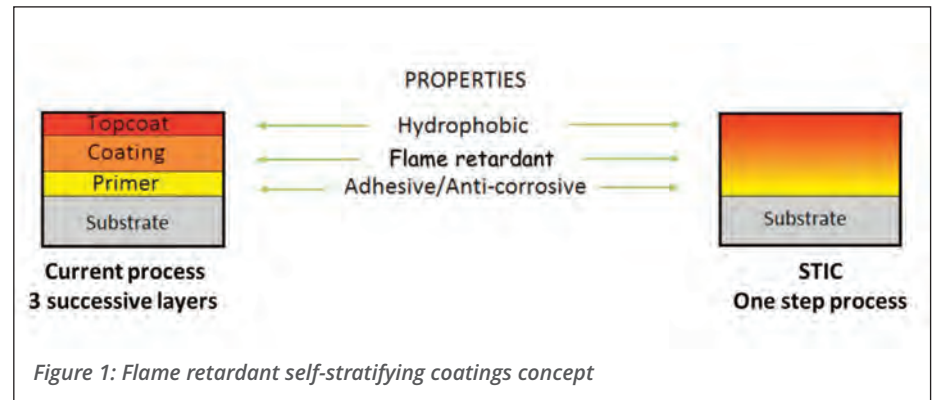
.....  
The French National Research Agency (ANR)  
[www.anr.fr/en](http://www.anr.fr/en)  
[www.twitter.com/AgenceRecherche](https://twitter.com/AgenceRecherche)

# New concept of flame retardant coatings

Dr. Jimenez Maude, Associate Professor at Lille University outlines how flame retardant coatings can give better protection to major structures such as buildings...

Fire is undoubtedly an emotive subject, especially when it comes to scenarios occurring in a “closed system” (e.g. ship, aircraft or skyscrapers) i.e. where the possibilities to escape are restricted. Everyone remembers the tragic collapse of the twin towers in New York on the 11th of September 2001. Unfortunately, it is one of the most famous examples of a building with poor fire protection, where the steel structure collapsed because of intense fire. Moreover, with the increasing trend of more stringent fire safety regulations, demands for reduction of the fire hazard posed by highly combustible materials, such as plastics have gained importance in recent years. A suitable flame retardant (FR) treatment might be able to retard the ignition of these materials and/or decrease flame spread, thereby preventing fire hazards, loss of life and degradation of property.

Flame retardant coatings, can be used successfully both for fire retard plastics and fire protect steel structures, even if these coatings can be different in terms of formulation and thickness (thick coatings are usually used in the fire protection of steel, whereas thin coatings are needed to obtain polymer with acceptable fire retardant properties). These flame retardant coatings constitute one growing branch of the coating industry. However, exposure to long-term environmental conditions can cause these materials to lose



some of their functional properties, thus reducing their effectiveness over time. Because fire safety is required throughout the entire life of a building structure, i.e. up to tens of years, it is important to investigate the long-term protection performance of these coatings under exposure to environmental conditions (UV rays, moisture, water, chemicals...). Degradation occurs as the result of environment-dependent chemical or physical attacks, often caused by a combination of degradation agents, and may involve several chemical and physical mechanisms. In order to avoid the decrease of the fire properties of the coating, a topcoat is usually applied. Moreover, the adhesion properties at the coating/substrate interface are usually improved either with a surface pre-treatment or with a primer layer to ensure the good adhesion of the intumescent coating, whatever the substrate (steel or plastic).

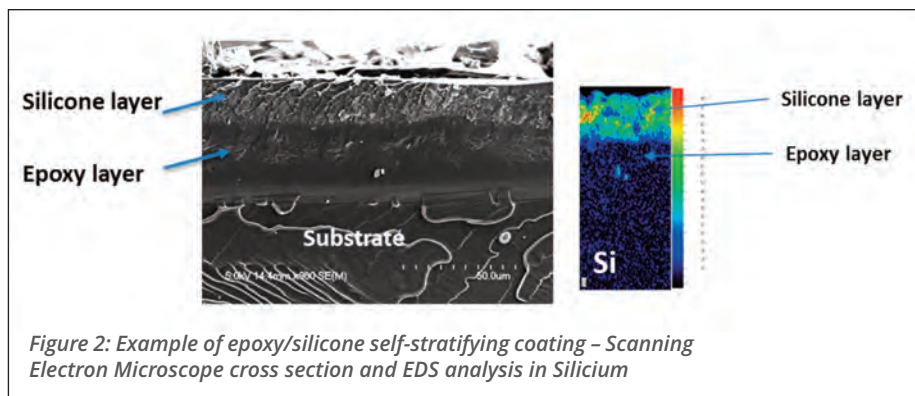
Thus, two or three different layers with three specific properties (e.g. adhesive, fire retardant and hydrophobic) are generally needed to provide durable

fire retardant capabilities to the polymer or fire resistance to steel. These multilayered systems usually require complex application and curing procedures which are sometimes incompatible with industrial constraints. Indeed, multiple formulation, application and processing steps not only contribute to environmental waste generation and pollution but they also use excessive amounts of energy until a solid film has been produced. In addition, in most cases, including aerospace and industrial maintenance applications, the primer or undercoat must be top-coated within a specific period of time otherwise inter-coat adhesion will be compromised. The processing time could thus be very long with economic consequences. The reduction of the number of layers is highly desirable, so as to form multilayered films from a single coat system that stratifies, while providing equivalent or better overall performance compared to the current systems.

As presented in Figure 1, the self-stratifying approach allows a one-step



## PROFILE



formation of complex multi-layer or gradient coating structures directly onto plastics or steel, combining optimised surface and adhesion properties in one coating composition.

A homogeneous mixture of incompatible polymers forming a polymer/polymer composite structure is necessary for self-stratifying phenomenon to occur, and the resulting coating should possess unique properties in a wide range of uses. These coatings have been developed mainly for automotive, self-healing and weather-resistant applications, but the self-stratifying approach has never been considered in the fire retardant and fire protection fields. This concept thus constitutes a great possible versatile process for a broad range of fire retardant applications and could thus favor an industrial eco-efficient development of products, taking into account the reduction of solvents and labor cost. A flame retardant self-stratifying coating would thus completely fit the needs of both the finishing industry in general and the flame retardant coating industry in particular, and opens the door to a real breakthrough and challenge in this field.

The “Self-stratifying Intumescent Coating” or STIC project, funded by the French National Research Agency (ANR), started in 2015 in Lille Univer-

sity. It gathers researchers specialised in the development of flame retardant materials and in the formulation of coatings. First results obtained are extremely promising, as perfect self-stratifying systems have been obtained when applied on plastics, based on fluoropolymer / epoxy resins and silicone / epoxy resins. As depicted in Figure 2, perfect self-stratifying coatings are obtained, giving rise to two well distinct and homogeneous layers.

The addition of a low percentage of a fire retardant filler in the coating formulation allows decreasing drastically the flammability of these plastics, without altering the self-stratification process of the coatings, leading to a high Limiting Oxygen Index (LOI) of 33vol.% (versus 27 for raw plastic) and a V0 rating at the standardized UL-94 test (versus non classified for raw plastic).

### Key collaborators

The project gathers two teams of Lille University:

In the Unit of Materials and Transformations (UMET), team Engineering of Polymeric Systems (ISP): Dr. Maude Jimenez (coordinator), Agnès Beaugendre (PhD student), Dr. Mathilde Casetta, Prof. Sophie Duquesne, Dr. Séverine Bellayer and Dr. Stéphanie Degoutin.

In the Unit of catalysis and solid chemistry (UCCS), from the team Molecular Chemistry and Formulation (LCMF): Dr. Christel Pierlot and Dr. Raphaël Lebeuf.

French National Research Agency (ANR) – ANRJCJC-14-CE27-0010-STIC



**Dr. Jimenez Maude**  
Associate Professor  
Lille University  
Tel: +33 320337196  
maude.jimenez@univ-lille1.fr  
<http://umet.univ-lille1.fr/Polymeres/index.php?&lang=en>

# Supporting next generation scientists

Adjacent Government details how the Israeli Minister of Science, Technology and Space, Ofir Akunis is hoping to encourage more children into science...

Science and technology is said to be one of the most advanced sectors in Israel. Ranked 13th in the World for scientific activity, the nation boasts the highest number of scientists, technicians and engineers per capita in the world.

In 1998, Tel Aviv was named as one of the 10 most technologically influential cities, with scientists in the country contributing to a number of different areas, such as agriculture, computer sciences, electronics, health care and solar energy.

**“The Ministry recently launched their ‘basket science’ program, which aims to encourage local authorities to support cities and events in the field of science, technology, cyber, robotics and space.”**

At a meeting of the Science and Technology Committee in the Knesset in June, Science Minister Ophir Akunis, said: “The Ministry of Science will continue to work to achieve the dream to be a leading factor in advancing the state of Israel in science and technology – for economic growth, increased social resilience and strengthen the international standing of Israel. We are investing millions in the next generation of high-tech industries. We cannot reach a situation in which we will import engineers from abroad.”

In addition, the science minister said that, “contrary to other Israeli high-tech markets which are strong, stable and healthy, there is healthy competition with other countries. Our investments today are the basis for industry and its continued success.”

The Ministry of Science, Technology and Space is responsible for advancing and encouraging science to its highest level. As well as promoting science and research conducted in the country, the Ministry also

encourages children and young people to get into the science sector. Hoping to grow their talent in their own country, the Ministry is looking to inspire the young engineers and scientists of the future.

The Ministry recently launched their ‘basket science’ program, which aims to encourage local authorities to support cities and events in the field of science, technology, cyber technology, robotics and space.

Minister of Science, Ofir Akunis, said: “The program we are launching here today will lead to a revolution of tens of thousands of teenagers interested and engaging in science, technology and innovation. We also hope to build the next generation of women scientists and researchers, investigating cyber, robotics experts and engineers nano-materials.

“We must give access to the science, digital literacy, robotics, satellite, computer science and cyber all levels of society, across the country. I believe that every child in Israel has the right to an equal starting point. But more importantly, we need to stimulate the curiosity of children and youth. Ignite the imagination, and show them that the sky is not the limit – the limit is much more than that. ”

Through programmes such as ‘basket science’, which was launched at the Jerusalem International Conference Centre in May, the Ministry hopes to broaden its activities in science fields amongst children in particular in order to encourage scientists of the future. ■

.....  
Adjacent Government  
editorial@adjacentgovernment.co.uk  
www.adjacentgovernment.co.uk

# Combining the environmental and personalised medicine aspects of microRNA ‘guardians’

Hermona Soreq, The Edmond and Lily Safra Center of Brain Science at The Hebrew University of Jerusalem...

**T**he risk of developing post-trauma symptoms and related diseases due to previous generations exposure presents a persistent burden on holocaust survivors, their descendants, caretakers and society. We believe that these issues reflect combined inherited, epigenetic and personal experience-related causes. Much effort is being invested these days in identifying those genomic, epigenomic and experience-related elements that differ in descendants of holocaust survivors with post-traumatic symptoms, with the hope to discover the causes of their symptoms and to develop new and better therapeutic avenues. Timing is right, because geneticists have only recently realised that much of the human genome, and especially those parts that do not produce proteins, and were until not too long ago called ‘junk DNA’ is actually very important. Our part in the Israeli Government-supported I-core center of excellence on Mass Trauma, where I belong to the Scientific management is focused on the role in the human brain of those thousands of tiny genes called microRNAs, which constitute part of that mal-famous ‘junk DNA’. In the brain, microRNAs are known to guard and balance between complete groups of protein-producing genes, keeping brain processes running and preventing functional impairments such as those occurring in psychiatric symptoms. To our surprise, we

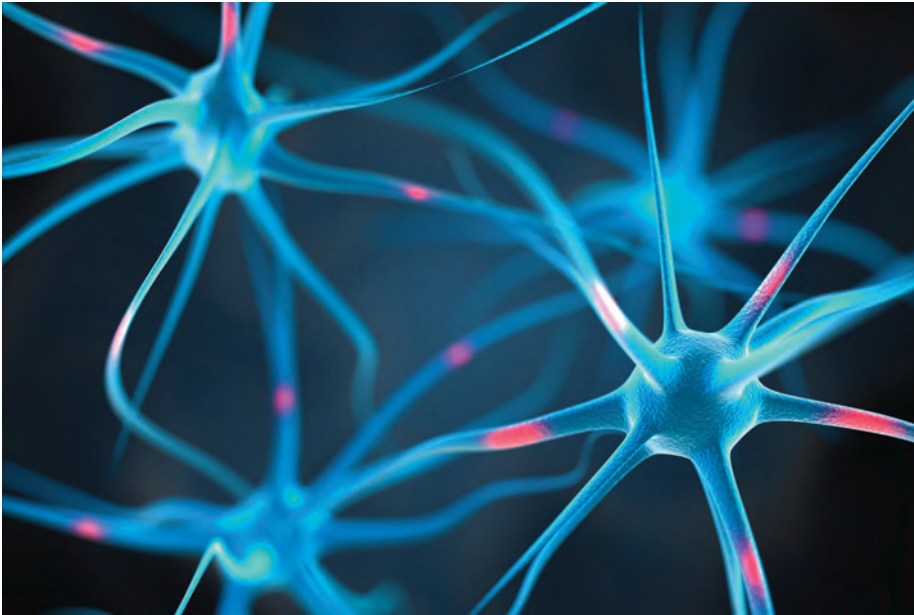
have recently learned that in human brain neurons, microRNAs also guard another group belonging to the category of ‘junk DNA’. Those genes are called ‘pseudogenes’, because they do not produce any protein. They emerged during evolution by duplication of protein-coding ‘mother’ genes, accumulated mutations that prevent them from yielding proteins and were largely considered unimportant, a concept which was changed by our study (under review).

MicroRNAs can only recognise a very small part of the pseudogenes. There are over 17,000 pseudogenes in our genome, but only 123 of them carry recognition signals for some of the 4,000 microRNAs that are expressed in our brain. This makes this group of pseudogenes really special. Importantly, the microRNAs that bind these pseudogenes also need to interact with and control protein production by many other genes; so there is competition going on between ‘real’ genes and those 123 pseudogenes on the microRNAs they share. Since pseudogenes do not produce any protein, they are free to compete with all their might, which implies that they may complicate the job of those microRNAs they recognise, such that any error in their function would interfere with the other roles of the ‘real’ genes that are otherwise controlled by those microRNAs. What we discovered

is that such interference is unique to the human brain and that it may lead to psychiatric symptoms.

Psychiatric genetics teaches us that most of the patients with psychiatric manifestations do not carry single mutations in any important gene that could by itself cause, for example post-traumatic disease, schizophrenia or manic-depressive disorder. Rather, it is believed that such patients may carry many small changes in their DNA, each of which cause little modifications that make small differences in how the brain functions; and when those changes appear together, their cumulative impact (sometimes called ‘quantitative trait’) may lead to psychiatric condition through yet incompletely understood mechanisms. The appearance of many such changes in the genome of a patient may hence indicate a somewhat larger risk of inherited disease, especially if exposed to traumatic experiences and/or when being born and raised by traumatised parents such as holocaust survivors. Therefore, the genomic sites where such changes occur are followed carefully by international groups of researchers, and finding the same changes in large groups of patients may raise alert signals. For the investigator, finding these flags near important genes may also suggest that those genes that are located near to the genomic change fail to do their





regular job. This may further hint at what went wrong in the brain of a patient, and yet more importantly-which personalised treatment may best fit the needs of that patient.

Pseudogene-adjacent genomic ‘flags’ were largely ignored in previous studies, because they were considered functionally irrelevant. However, once we discovered that the small group of microRNA-recognising pseudogenes may compete in the human brain with protein-coding genes on their microRNA suppressors, we explored their genomic locations more closely. We found ‘our’ group of pseudogenes to have emerged relatively late in evolutionary terms by gene duplication. They were also carefully conserved through evolution, meaning that keeping them intact may have an added value; and they compete on the same microRNAs with many genetically unrelated protein-coding genes. Moreover, we discovered that these microRNA-recognising pseudogenes are highly expressed in brain neurons, that they actively participate in brain communication processes, and that their cumulative genomic locations are enriched in frequently

occurring DNA changes that are relatively common in patients with psychiatric symptoms.

While this information supported the new concept that brain pseudogenes which recognise microRNAs may be important, we needed more concrete findings. To this end, we analysed the expression of ‘our’ pseudogenes in embryonic stem cells from psychiatric disease patients and healthy donors, and found that ‘sick’ stem cells failed to produce their ‘healthy’ levels. Furthermore, when we blocked or increased the expression of such pseudogenes in cultured cells, these interference tests also caused parallel changes in the levels of those ‘real’ gene products that compete with them on microRNAs. Our findings transform the understanding of the so-far neglected small group of microRNA-interacting pseudogenes, opening new avenues for neurogenetics, diagnostic and therapeutic directions of mental diseases.

At the personalised medicine level, we strongly suspect that carriers of risk-prone genomic changes may be at specific danger of developing post-

traumatic stress disorder. Supporting this notion, we discovered elevated trait anxiety in carriers of a genomic change that links to one of the suspected pseudogenes (Hanin et al., 2014). In some circumstances, elevated brain functioning may overcome this enhanced anxiety; therefore, soldier carriers of this genomic change do not present post-traumatic stress symptoms (Lin et al., 2016). However, prolonged or more drastic exposure to stressful conditions, for example, in descendants of holocaust survivors, may be totally different. Pursuing this direction of research is hence of particular importance.

Lin, T.\*.....and Soreq H. (2016) Intensified vmPFC surveillance over PTSS under perturbed microRNA-608/AChE interaction. *Translational Psychiatry*, in press.

Hanin, G... and Soreq, H. (2014) "Competing Targets of microRNA-608 Modulate the Risks of Anxiety and Hypertension". *Human molecular genetics*, 23, 4569-4580.



**Hermona Soreq, Ph.D.**  
**Professor of Molecular Neuroscience**

The Edmond and Lily Safra Center  
for Brain Sciences  
Department of Biological Chemistry  
The Alexander Silberman Institute  
of Life Sciences  
The Hebrew University of Jerusalem  
Tel: 972 2 6585109  
hermona.soreq@mail.huji.ac.il



## Space: A new frontier?

The European Space Agency has the ability to deliver innovative technologies and become a world leader in space sciences...

Exploring our surrounding universe has become one of the many challenges of the 21st Century. With advances in technology, we are able to look further into the depths of space and understand more about what surrounds earth. Space plays an essential role to our environment, from greenhouse gas emissions to our oceans.

Space is a multimillion pound sector, which has the ability to significantly drive innovation, as the sector pushes forward with new technologies to address new challenges.

In Europe the industry is represented by the European Space Agency (ESA). With the support of 22 member states, ESA can achieve more as a collaboration than individual countries would be able to alone.

According to ESA, its main objective is to discover more about the space environment, develop satellite-based technologies, and promote European industries. To do this it has a significant budget, which totalled €5,250m for this year.

When thinking about space, the immediate thought is of humans in rocket ships. However, the majority of space-related research does not involve humans. This is clear from the way the funding is split. Of this year's budget, a total of 30.5% (€1,603.5m) will be spent on earth observation, while only 7% (€365.1m) will be spent on human spaceflight.

### European Space Station

There is little doubt ESA is willing to push boundaries and reach both literally and figuratively for the stars.

Undoubtedly, the aims of the agency are ambitious. Earlier this year plans were revealed for a space base between Earth and the Moon. ESA hopes to have this waystation for lunar expedition in position within a decade.

The facility would fill the gap left by the International Space Station, which comes to the end of its lifecycle in 2024, after which time it will fall out of orbit.

ESA said the 'human outpost' would be situated between Earth and the Moon, allowing astronauts to research Earth's closest neighbour.

Later this year a conference will be held with European Ministers to discuss the project. Speaking in June, head of human spaceflight at ESA Dave Parker said: "Let me take you on a thought experiment about 10 years into the future," he said.

"After 25 years of service the International Space Station is coming to the end of its life but now one thousand times further out in space a new star has risen.

"A human outpost in deep space, located far out, where the Earth and Moon's gravity balance, a kind of crossroads in space.

"This is our deep space habitat, a new place to live and learn how to work in space, a kind of base camp for exploring the solar system and reaching back down to the surface of the Moon."

Initially, it is expected the facility will house 4 astronauts, who will live on minimal resources.

### UK's role in European space

One of the main conversations of the summer has been the EU referendum held in the UK. It has dominated the consciousness of both the UK and other EU member states.

**"According to ESA, its main objective is to discover more about the space environment, develop satellite-based technologies, and promote European industries. To do this is has a significant budget, which totalled €5,250m for this year."**

The UK is one of the 22 member states involved with ESA. In fact, the UK has always been a big proponent of space and has supported numerous space missions and programmes over the years via the UK Space Agency.

While ESA is not an EU-based organisation so technically the UK's relationships here should remain unaffected by the EU vote, there is still a risk that UK could be left behind in future ESA space expeditions.

There have been concerns raised that plans for the UK to exit the EU could lead to home-grown scientists becoming alienated from their EU colleagues. In particular, 'brain drain' could be a significant problem, leading to UK-trained scientists moving to other EU nations.

Time will tell what the long term impacts of Brexit will be, but this will be a concern for UK space scientists working with ESA. ■

.....  
Adjacent Government  
editorial@adjacentgovernment.co.uk  
www.adjacentgovernment.co.uk  
www.twitter.com/Adjacent\_Gov



# Mapping the Universe to understand its origin

European-supported research in Milan is paving the way to next-generation cosmology experiments, as explained by Luigi Guzzo from the Istituto Nazionale di Astrofisica (INAF) & Università Statale di Milano (Italy)...

**W**hat is the nature of the mysterious “dark energy”? How does it relate to the ubiquitous “dark matter”? These are some of the key open questions in cosmology, which the group led by Professor Luigi Guzzo at the National Institute for Astrophysics and the University of Milan in Italy, is addressing in their research. Their work is supported by a 5-year ‘advanced grant’ of €1.7m by the European Research Council (ERC). Findings of this project, dubbed Darklight, will add an important piece to the puzzle of the origin and evolution of the Universe.

We live in an expanding Universe: galaxies, agglomerates of a hundred billion stars like our Sun, appear like glued on a cosmic fabric that expands with time. This was first quantified by the work of Edwin Hubble and collaborators in 1929, when the expansion of the Universe was discovered. It implies that, if we rewind the movie back in time, there must have been a specific moment in the distant past when all matter and energy were concentrated in one point, what is called the “Big Bang”. Much more recently, (1998) researchers made an unexpected discovery: about 7 billion years ago the expansion rate of the Universe started increasing again, entering an acceleration phase that requires a kind of “dark energy” to drive it – a phenomenon that still remains obscure. This discovery led to



Professor Luigi Guzzo

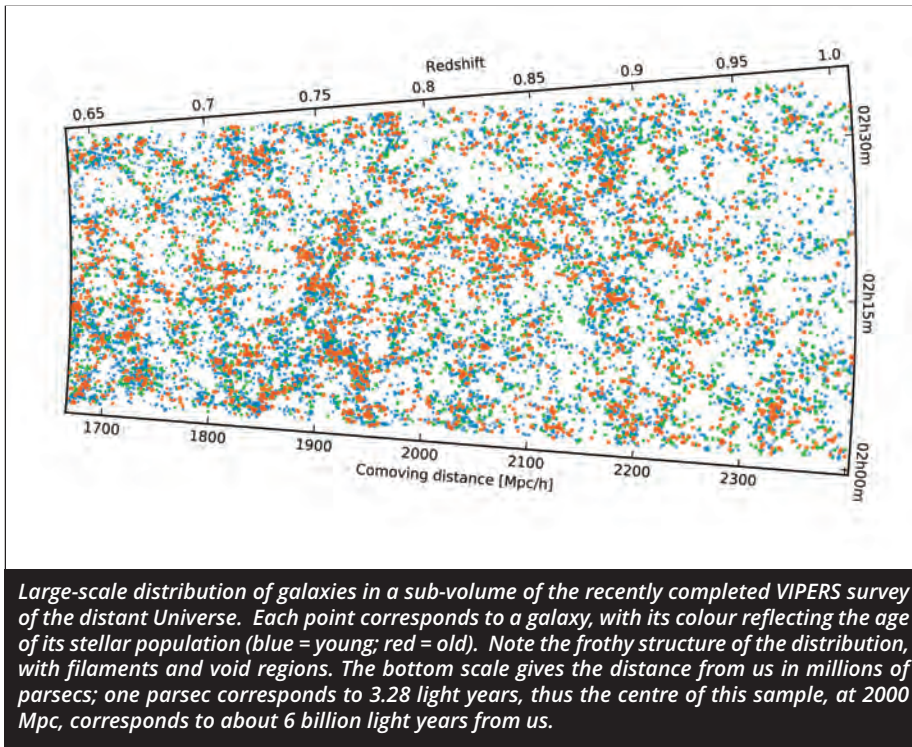
the 2011 Nobel Prize to Perlmutter, Riess and Schmidt and added a final piece to complete the puzzle of what we call the Standard Cosmological Model, based on Einstein’s theory of General Relativity. Yet, it implied the existence of another obscure and not understood ingredient.

Large-scale “redshift surveys”, reconstructing the large-scale distribution of millions of galaxies in space and time over enormous volumes represent one of the pillars of this standard model. The way galaxies are distributed in space, their level of inhomogeneity at different scales, are intimately connected to the Universe properties. However, we observe them projected on the sky: their 3D distribution is

reconstructed by measuring the “redshift” of their spectral lines with respect to the laboratory value, induced by the expansion of the Universe. This is proportional to their distance and represents nowadays a formidable tool to map the Universe structure. Even larger redshift surveys, using spectrographs capable of observing thousands spectra at once, will start in the coming years; they aim at high-precision measurements of the expansion history – which follows the behaviour of dark energy – and of the growth rate of cosmic structures, which may evidence deviations from Einstein’s gravity.

With Darklight, an international team led by Professor Guzzo has been developing new mathematical and

## PROFILE



statistical tools to meet the required high levels of precision and accuracy for the cosmic measurements. These novel methods are tested on large numerical simulations and then applied to new data, such as those provided by VIPERS, a large redshift survey of ~100,000 galaxies, recently completed at the European Southern Observatory (ESO), under coordination of the same team. VIPERS (of which a section is shown in one of the figures) used the ESO Very Large Telescope in Chile to reconstruct the 3D galaxy distribution within an unprecedentedly large volume, at an epoch when the Universe was about half its current age (i.e. around 7 billion years old). The central part of Darklight is to develop the techniques that will eventually help scientists to fully exploit such surveys, in particular for the next generation of projects promising to collect samples of tens of millions of

galaxies. This is in particular the case of the European Space Agency Euclid mission, of which Professor Guzzo is one of the science coordinators. "Euclid will be launched at the end of 2020 and will map the distribution of 50 million galaxies, as well the distribution of dark matter through the gravitational lensing effect, over 15,000 square degrees, i.e. one-third of the sky", says Professor Guzzo. "With so much data, statistical errors on the parameters describing the cosmological model – as e.g. the density of matter and dark energy – will be measured to exquisite precision. Techniques like those we are developing with Darklight will make sure that, in parallel, the systematic errors that are intrinsic in our modelling of the observed effects will not jeopardise this precision; this is a daunting task given the predicted tiny size of the error bars".

Such a combination of new data and new analysis techniques will allow us to understand how, from its original state, the Universe has taken its current form and how galaxies, clusters and the cosmic web have developed under the joint effect of dark matter and dark energy. It will represent a decisive step to understand the origin of these mysterious dominant components – dark matter and dark energy – whose existence needs to be advocated in the standard cosmological model. While the recent discovery of gravitational waves represents a further impressive confirmation of Einstein's theory of gravity, the exploration of the Universe by galaxy surveys will allow cosmologists to verify whether General Relativity also identically holds on the largest scales, or rather its equations need to be further generalised. Alternatively, we may learn the nature of dark energy as perhaps the final stage of a relic energy field from the Universe first moments. Needless to say, either explanation would revolutionise the world of physics.



### Professor Luigi Guzzo P.I., DARKLIGHT ERC Advanced Grant Project

Istituto Nazionale di Astrofisica (INAF) &  
Università Statale di Milano (Italy)  
[luigi.guzzo@brera.inaf.it](mailto:luigi.guzzo@brera.inaf.it)  
<http://darklight.brera.inaf.it/>

# The future of quantum technologies in the UK

In an interview with Editor Laura Evans, Richard Murray, Lead Technologist in Emerging Technologies and Industries at Innovate UK, highlights quantum technologies and the impact they hope to make on the UK...

Quantum technologies is a new industry aiming to make a big impact in the UK. The UK government has invested £270m in the UK National Quantum Technologies Programme. The programme is a joint effort coordinated between, the Department for Business, Innovation and Skills (BIS), the Engineering and Physical Sciences Research Council (EPSRC), Innovate UK and the National Physical Laboratory (NPL).

A number of key sectors throughout the UK could benefit from new quantum technologies, including: construction; finance; energy; defence; aerospace and telecommunications. The European Commission has also recently committed €1bn for quantum technologies, which highlights the potential of the new industry, not only in the UK but Europe-wide.

As one of the partners involved in the quantum technologies programme and a key driver of this new industry, Innovate UK's Richard Murray spoke to Adjacent Government Editor Laura Evans about how this exciting new industry could benefit the UK, how quantum technologies are all around us, and the importance of closing the gap between business and academia.

## What are quantum technologies and how do they benefit the UK?

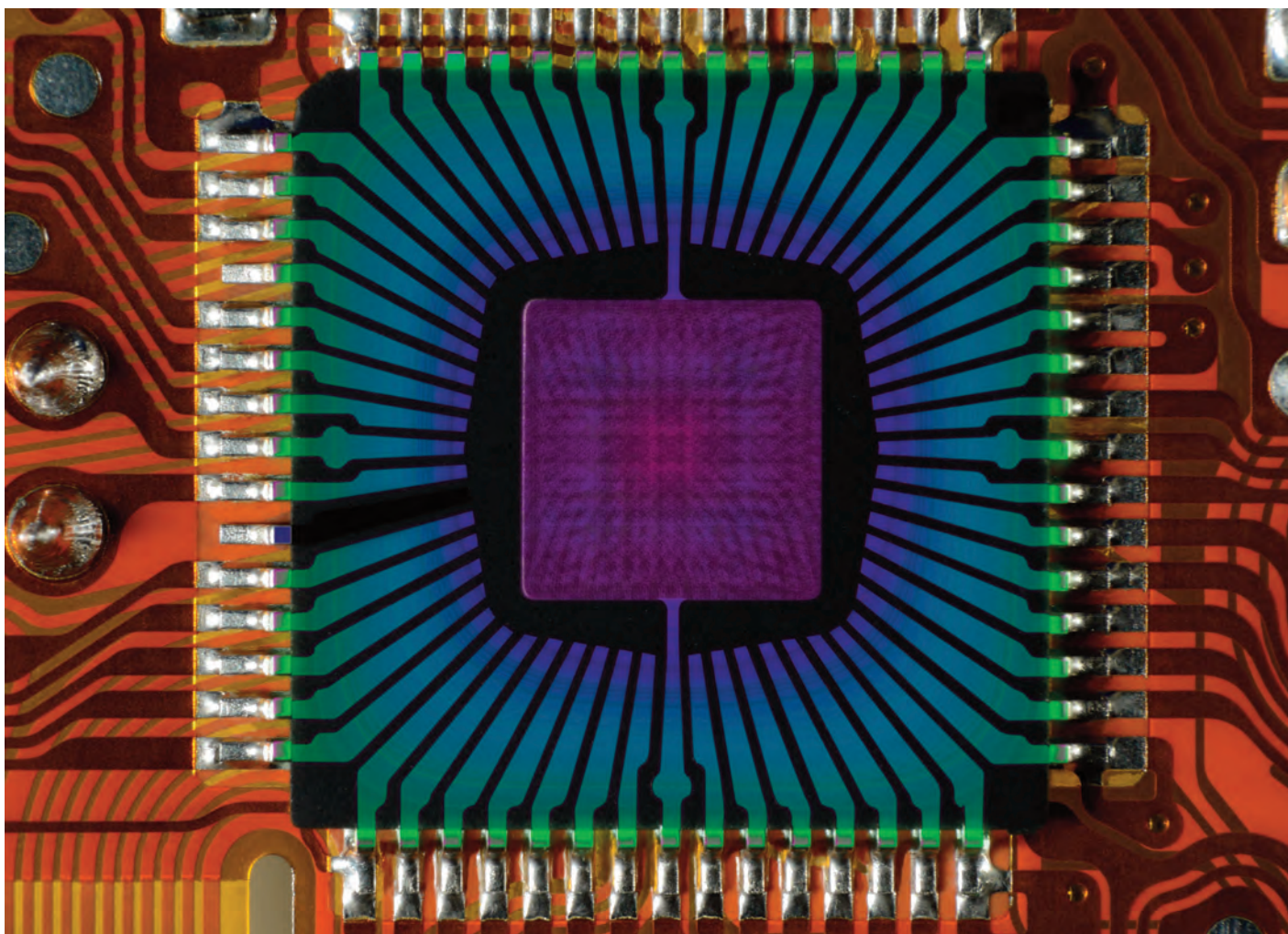
The idea of quantum technology is not new. At the moment, quantum technologies are everywhere, in a number of technologies that you rely on every day, such as mobile phones and telecommunications. What we mean when we talk about quantum technologies is the next generation of technologies, which are being developed at the moment. These specifically use 2 effects which come out of quantum mechanics and quantum physics, namely superposition and entanglement. At the moment neither of these effects are being used in any technologies currently on the market.



*Richard Murray, Lead Technologist in Emerging Technologies and Industries at Innovate UK*

Those are the 2 broad effects but there are a range of applications that can be useful. For example, with the sensors, you can measure acceleration very accurately and that could be used in the future as a way to navigate without relying on connection to a GPS satellite. If you have in your hand a device that measures acceleration, you add up all the accelerations it will tell you where you are, regardless of whether you can connect to a satellite. This means it could be used inside a building or an underground car park, for example, where GPS doesn't work. The UK MOD are





very interested because in hostile environments it is possible to block or intercept GPS. Quantum technologies will allow them to navigate without it.

**“...there is the flagship aim to connect different national initiatives around Europe – the idea of developing more ideas together rather than as one country. We can achieve more together, than alone. By connecting these initiatives you collect all the good ideas being developed across Europe...”**

The Holy Grail is this idea of a quantum computer. The quantum computer will enable you to do things which current computers (known in the field as classical computer) simply are unable to at the moment. Like machine learning algorithms, classical computers can be quite dumb really. A current computer will start with one question and will answer yes or no, then it will

move on to the next question. Whereas a quantum computer has the potential to ask or check multiple questions in parallel, all at the same time, so it has greater power when you're trying to answer really difficult questions.

### **How are societal challenges driving the need for quantum technologies?**

The main one for me at the moment is we really hope quantum technologies will turn into a new industry for the UK. It might not be the same as what most people mean by way of societal challenges, but for me preserving high value economies and our way of life in the developed world is key. Making sure the UK has lots of new products and industry that we can use to manufacture, sell and export is really important.

The UK government are really interested in translating research into new products because countries like our



own have a strong research advantage. Our universities are world leading; how we convert that world leading strength into societal benefits is really important. Of course there are a number of other different important societal challenges that quantum technologies could be useful for. For example, the Home Office might be interested in quantum technologies to give better border protection in order to detect substances like plutonium, which is very dense and would register very strongly on a gravity sensor. Researchers at the moment are also using quantum technologies to help diagnose neurodegenerative diseases such as schizophrenia.

**“The Holy Grail is this idea of a quantum computer. The quantum computer will enable you to do things which current computers (known in the field as classical computer) simply are unable to at the moment.”**

### **How does Innovate UK support quantum technologies in the UK?**

We sit within a much larger investment. One of our main roles is to act as a connector between different groups which are important to develop these new technologies. The 2 lead groups in this area are



academics and companies, and in large part there are very big cultural differences between the 2 groups. Our job involves getting all those people together in the same room and acting as a mediator to try and help them to communicate better. To get the academics to think in the same way as a businessperson would and vice versa. For example, companies will be thinking in profit and lost pounds and understanding the business case prior to investing in anything.

We're also working with the investment in the UK Quantum Hubs. These have been set as academic centres looking at the technology side of things. Innovate UK's job within that £270m of investment, is to attract interest from companies and help them to make informed investment decisions in this new technology. We don't just provide investment for the academics but invest in the companies to develop those products for themselves.

### **How are UK quantum technologies helping to shape the middle ground between academia and industry?**

This question really hits home, what we're trying to do. Which is exactly as you have asked, to develop that middle ground between industry and academia. If you look at the Quantum Technologies Programme, it's a collaborative effort within government. You've got BIS working with The MoD and Dstl, then similarly there is a close collaboration between Innovate UK and EPSRC. We're hoping to achieve much better connections within government, join up the gap between all our individual organisations and make it easier for people in the middle ground, who are translating technologies to have support from government.

### **What is the aim of the UK National Strategy for Quantum Technologies and how can that help?**

The strategy is about us writing down how we hope to do our work of helping the middle ground and publicising our primary mission, which is to translate research into new companies and economic growth. The first thing the strategy does is make that goal very

clear, to remind them of its importance. The strategy also looks at ways we're hoping to achieve that mission, so it highlights the importance of showing marketing opportunities, using demonstrators and getting private investors interested in the work we're doing.

**“A number of key sectors throughout the UK could benefit from new quantum technologies, including: construction; finance; energy; defence; aerospace and telecommunications. The European Commission has also recently committed €1bn for quantum technologies, which highlights the potential of quantum technologies, not only in the UK but Europe-wide.”**

It's also about international engagement. In the strategy we say it's important to understand that the UK isn't the only country investing in quantum technologies. In fact there are a number of other countries around the world that are investing. Not quite as much money as the UK, but still significant amounts, so its important that we not only understand more about what those other countries are doing, but have a strategy around either working with them, or in a way that is in knowledge of what they are doing, so that the UK can benefit from those other programmes around the world. ■

.....  
**Richard Murray**

**Lead Technologist – Emerging Technologies and Industries**

Innovate UK

[www.innovateuk.org](http://www.innovateuk.org)

[www.twitter.com/innovateuk](https://www.twitter.com/innovateuk)



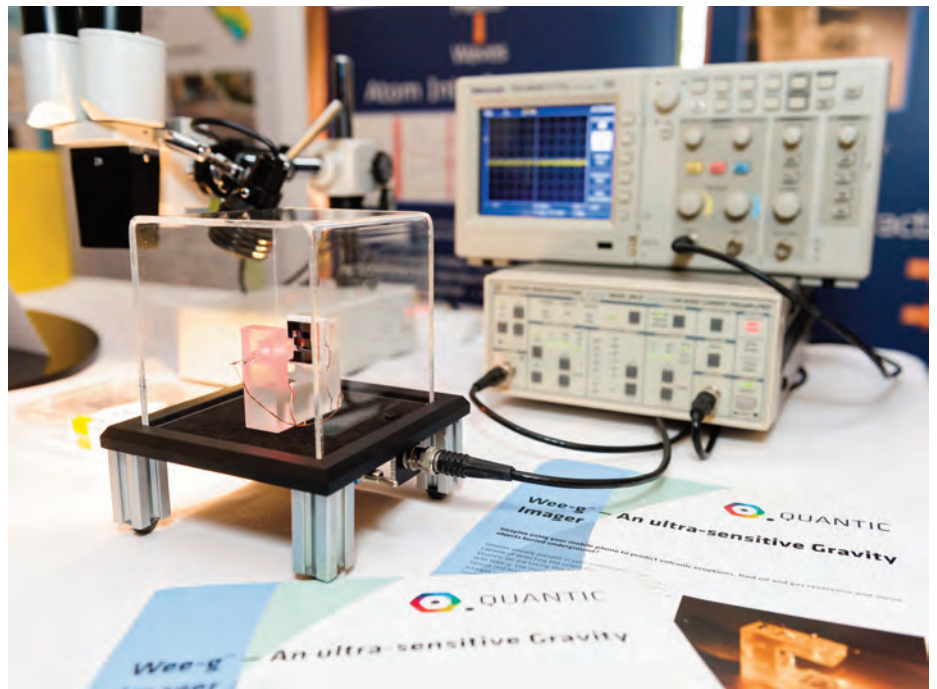
# Imaging the future

Professor Miles Padgett, Principal Investigator of QuantIC, the UK Quantum Technology Hub in Quantum Enhanced Imaging, explains how quantum science is leading to new technological applications in imaging

Quantum physics is the science of the very small and is often thought of as something that belongs to the realm of science fiction, not least because many aspects of quantum physics are counterintuitive. However, despite these popular misconceptions, there is an abundance of technological products already on the market that make use of quantum physics. For instance, the Global Positioning Systems (GPS) that underpin our transport network is based on the timing technology used in atomic clocks – the most accurate clocks on Earth. Moreover, without quantum mechanics, there would not be lasers or semiconductors, which are at the core of our modern electronics.

## Harnessing quantum mechanics for the future

The second Quantum Revolution is now upon us and is set to bring new technological advances to science, industry and society. The EU has launched a “Quantum Manifesto” to formulate a common strategy for Europe and in recognition of the growing importance of quantum science, the UK Government has invested £270m in the [National Quantum Technologies Programme](#). QuantIC is one of 4 Quantum Technology Hubs that has been established in December 2014 to explore the properties of quantum mechanics and specifically how it can be harnessed for use in new technology.



There is a wide range of imaging technologies currently available on the market and quantum technology can provide significant improvements to state-of-the-art imaging systems. Such improvements require both the development of new, or improved sensor and light source technology and the development of better optics, cooling, data analysis and inversion techniques, all aspects of QuantIC’s research and innovation programme. The Hub’s vision is to pioneer a family of multidimensional cameras operating across a range of wavelengths, timescales and length-scales to create a new landscape for imaging systems and their applications internationally.

## Leading the way for innovative imaging solutions

The team at QuantIC, led by the University of Glasgow, comprises world-leading quantum technologists from the universities of Bristol, Edinburgh, Glasgow, Heriot-Watt, Oxford, Strathclyde and Warwick, who are working closely with more than 30 global industry partners to exploit the potential for quantum imaging. Examples of the Hub’s cutting-edge research include the use of ultrasensitive cameras to see round corners, producing cameras that can see through smoke and tree canopies, enhancing imaging through turbid media and sensing gravity.

QuantIC has a £4m [Partnership Resource Fund](#) to support collaboration with industry and has a dedicated [Innovation Space](#) at the University of Glasgow where companies and academics can co-locate to develop new technology and prototype ideas. All of the Hub's Partnership Resource Fund projects are approved by the QuantIC Market Opportunities Panel. This Panel comprises industry leaders ranging from innovative and dynamic SMEs like M Squared Lasers and Andor to large companies such as BP and Thales and technology investors (IP Group). Some of the companies that we have started Partnership Resource Projects with include M Squared Lasers, Lockheed Martin, Thales, Leonardo (formerly Finmeccanica - Selex), Bridgeport, Clyde Space and Horiba Jobin Yvon.

Innovation requires the ability to collaborate and share ideas, and QuantIC invites participation and engagement with all stakeholders that could lead to further discussion on how the Hub's work could benefit industry and society. The potential applications for quantum-inspired technologies are still being discovered; and if reading this article sparks an idea about how our technology could be used or if there is an opportunity to explore working together, why not get in touch?



**Professor Miles Padgett**  
**Principal Investigator**

QuantIC  
quantic.ac.uk  
www.twitter.com/QuantIC\_QTHub



## New technologies shaping the future of imaging

QuantIC has developed several technological innovations that rethink imaging and what is possible. What would you use them for?

**QuantiCam™** is a visible Single Photon Avalanche Diode (SPAD) camera system that can detect a single photon at the same time as noting when it arrived, with unprecedented resolution. This incredible level of sensitivity and performance has enabled the team to develop new imaging applications. Using a pulse illumination light source, the light bouncing off an object is triple scattered as a curve of light on the surface which the QuantiCam™ is able to detect, thereby allowing it to track moving objects around corners and inside buildings (Garipey, G. et al. Nat. Photon. 10, 23-26 (2016)). This technology has potential applications in autonomous vehicles, collision avoidance in traffic, search and rescue for emergency services and hostage situations.

**Gas-Sight™** camera combines state of the art laser systems with single-pixel infrared cameras to deliver low cost-infrared imaging. Although gases are invisible to the naked eye, they do interact with light, just not at wavelengths one can see. The key to imaging invisible gases is making a camera that can see at the correct wavelength. By

using the single-pixel camera approach, QuantIC's researchers (Edgar, M et al. Nat. Sci Rep 5, 1-8 (2015)) have been able to produce real time video of leaking gas at a fraction of the price of using an infrared multimillion pixel array camera that is currently available in the market. Working with M Squared Lasers, the Hub is developing these cameras for applications in security and defence, emergency services and environmental monitoring.

**Wee-g™** is an ultrasensitive gravity imager that is the most sensitive Micro Electro Mechanical Sensor (MEMS) device ever developed (Middlemiss, R et al, Nat 531, 614-617 (2016)), with a target sensitivity of 10ng/√Hz. MEMS sensors are already present in mobile phones and use the Earth's gravity field to detect the orientation of the phone's screen. The compact size and low cost for Wee-g™ has potential applications in gravity mapping, land surveying and exploration and in multi-pixel density-contrast imaging arrays. The device is entirely fabricated as a single component from silicon, offering the most attractive cost to performance ratio in the marketplace. QuantIC is further developing the sensor and taking this device to the next level by integrating on-chip interferometry and quantum effects such as squeezing of light.



# The Institute of Structural Materials – A Major Research Facility at Swansea University

Dr Helen M Davies, Senior Lecturer at the Institute of Structural Materials at Swansea University highlights microstructural characterisation...

Swansea University is well known for its longstanding expertise in the area of mechanical and microstructural characterisation of high performance materials. A succession of academics has promoted an intimate relationship with the power generation industry, in particular working on alloys aligned to gas turbine technologies. A world renowned research group has been developed over the years, focussing on high temperature creep, fatigue and associated modes of operation, supported by world class mechanical test facilities. This provenance has culminated in the Institute of Structural Materials (ISM), recently awarded Major Research Facility status by Swansea University and housed in a purpose designed, bespoke facility on the new Bay Campus to the east of the city.

Completed in 2014, the ISM Building houses a mix of academic and commercial activities. In 2009 the University incorporated a wholly owned “spin out” company – Swansea Materials Research & Testing Ltd (SMaRT) – an ISO 17025 accredited test facility sitting under the ISM umbrella, supplying design quality mechanical property data to the wider structural integrity sector.

The Rolls-Royce University Technology Centre in Materials, also based within the ISM, results from the links forged with this major multi-national enterprise since the early 1970s. The UTC activities currently support a team of 6 academics, 15 research officers, 8 support staff and 30-plus EngD/PhD students.

All mechanical testing undertaken by SMaRT can be supported by metal-



Figure 2. High resolution Keyence VHR700F Optical image of a Ti834 alloy

lographic preparation facilities, a well-equipped microscopy suite and immediate academic understanding. Metallographic sections of novel and high specification alloys can be expertly prepared in-house for subsequent analyses.

The imaging suite hosts a range of characterisation equipment including: a high resolution Keyence VHX-700F optical microscope, an Hitachi SU3500 scanning electron microscope (SEM) with integrated electron backscatter diffraction (EBSD) and energy dispersive X-ray analyses equipment and a Nanovea PS50 surface profilometer, as shown in Figure 1. A titanium alloy prepared using our metallographic facilities and imaged using the Keyence VHF700F is shown in Figure 2.

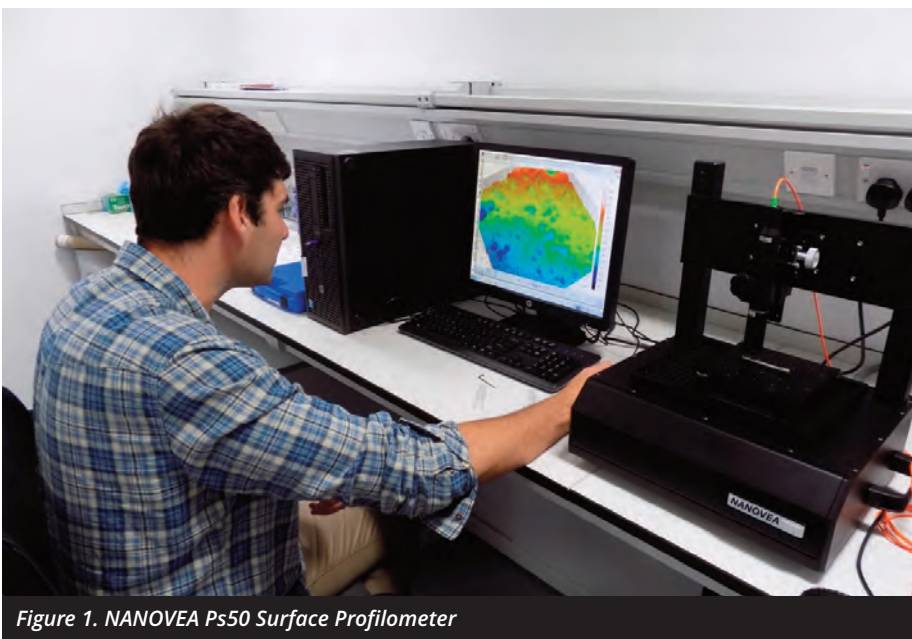


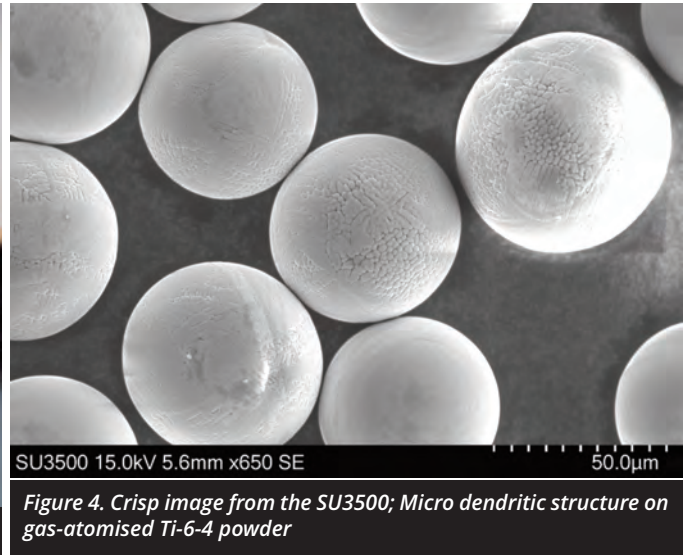
Figure 1. NANOVEA Ps50 Surface Profilometer



## PROFILE



**Figure 3. Hitachi SU3500 with Integrated EDX and EBSD functionalities**



**Figure 4. Crisp image from the SU3500; Micro dendritic structure on gas-atomised Ti-6-4 powder**

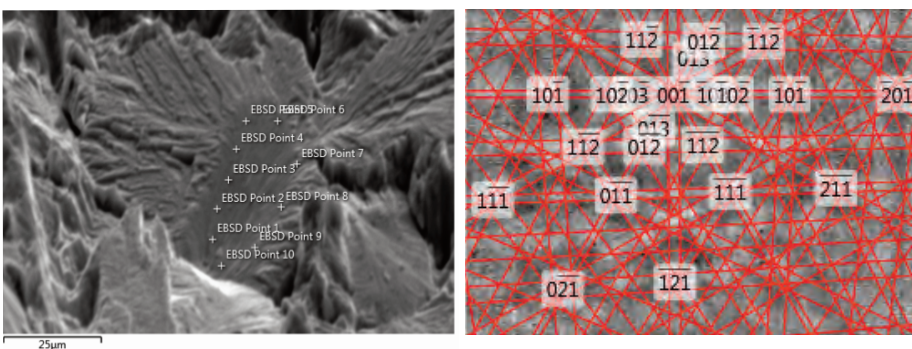
As well as high resolution optical imaging, the Keyence VHX-700F, has a detachable camera, allowing inspections of larger scaled specimens, either as a post-test fracture surface or in situ on a mechanical rig during testing. In addition, a host of features such as a depth composition function and 3D imaging feature, allow easy observation and imaging of uneven surfaces.

Higher resolution imaging (up to x 800k screen display) and analyses can be conducted on the Hitachi SU3500 SEM, Figure 3 and Figure 4. The EDX system is used for elemental analysis or to perform chemical characterisation of samples, while EBSD analysis can deliver a wealth of information ranging from bulk texture information, grain boundary character distributions (GBCDs) to fracture surface feature

orientation measurements (e.g. facet inclinations). Facet orientation determination via EBSD was first developed at Swansea almost twenty years ago. The ISM's state of the art integrated SEM/EDX/EBSD facilities are being utilised to advance such research and gain a much deeper insight into how grain orientation/microstructure relationships affect fracture behaviour. Figure 5 shows a fatigue facet on the fracture surface of a titanium alloy along with an example of an indexed Kikuchi pattern.

The Hitachi SU3500 SEM also contains a novel SEMtester 1000EBSD system, a temperature controlled tensile testing chamber. This compact mechanical testing stage, capable of applying up to a 4500N tensile/compression load, allows in-situ tensile tests to be performed with real-time high magnifica-

tion imaging and analyses of “real time” deformation and failure. The system is also equipped with a tilting sample heater for EBSD applications, designed to mount onto the EBSD tensile stages and heat to 1200°C in high vacuum. These additional capabilities of the SEM system are being used to develop unique insights into fracture mechanisms on a micro-level.



**Figure 5. Fatigue fracture facet and indexed Kikuchi pattern showing Near-basal plane facet orientation - measurements taken using the Hitachi SU3500 and integrated EBSD system**



Swansea University  
Prifysgol Abertawe

**Dr Helen M Davies**

**Senior Lecturer**

Institute of Structural Materials

Tel: +44 (0)1792 602511

h.m.davies@swansea.ac.uk

[www.smart-swansea.com](http://www.smart-swansea.com)

[www.swansea.ac.uk/engineering/bay-campus/engineering-quarter/institute-of-structural-materials/](http://www.swansea.ac.uk/engineering/bay-campus/engineering-quarter/institute-of-structural-materials/)

# Bioinspired green methods for functional nanomaterials

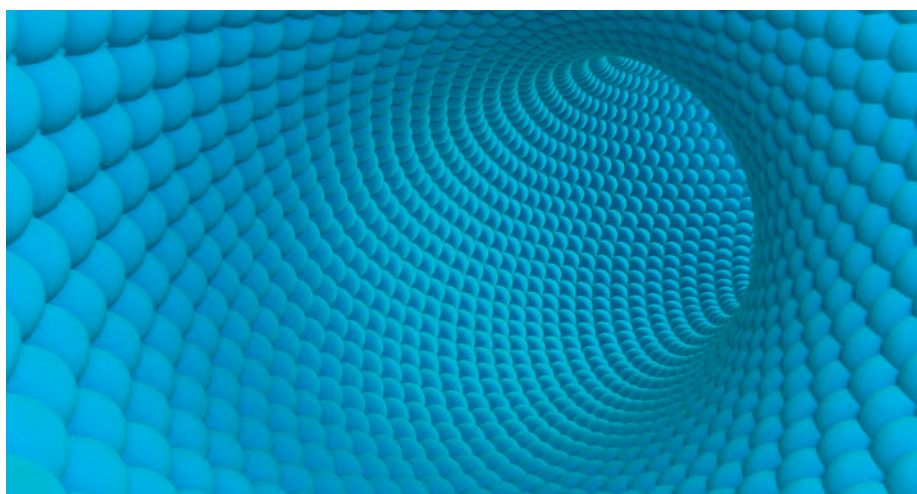
Nanomaterials are worth multibillions of dollars globally but their production is wasteful and environmentally damaging. The Green Nanomaterials Research Group, University of Sheffield, focuses on discovery, design and manufacturing of functional nanomaterials.

## Functional Nanomaterials

Nanomaterials exhibit critical size, at least in one dimension, on the scale of 1 to 100 nm and have interesting properties such as electrical, optical and catalytic activities. As a result, nanomaterials are widely used in many consumer products and various industrial sectors including oil refining, food, coatings, cosmetics, textile, transport, healthcare, electronics and communication. The functional properties of nanomaterials typically depend on particle size, shape, surfaces chemistry and crystallinity. A recent inventory has documented more than 1800 consumer products that contain nanomaterials and many more non-commodity products such as industrial catalysts and separation media. The total global production of all types of nanomaterials is of the order of several million tons per annum, with a global market worth \$3.4bn, which is expected to reach more than \$10bn by 2020 given the continuous growth in this field.

## Current methods: problems and challenges

Current nanomaterials manufacturing methods suffer from many problems leading to high costs, an extremely adverse environmental impact (e.g. hazardous waste) and unsustainable production. At present, nanomaterials are manufactured using top-down (lithography, milling and etching) or



bottom-up (vapour deposition, sol-gel, precipitation, pyrolysis, solvothermal) approaches. Top-down approaches predominate current manufacturing processes for nanomaterials. Bottom-up approaches are promising and are known to precisely control properties of nanomaterials, but they also suffer from various issues such high consumption of water and energy, poor materials utilisation efficiencies, need for ultrapure reagents and use or production of toxic or hazardous chemicals. These issues clearly stress the urgent need for developing fundamentally new production methods for nanomaterials that are green and sustainable.

## Bioinspired Green Nanomaterials

Biology, via biomineralisation, produces large quantities of sophisticated and hierarchically organised nanostructured biominerals under mild

conditions. Harnessing this biological approach to sophisticated nanomaterials has exciting prospects and it encompasses most of the 12 principles of green chemistry. Learning from biomineralisation, we have developed green routes to functional nanomaterials. The key benefits of this method are as follows:

- A rapid process (takes only minutes), operates at room temperature and in water;
- It is a one-step route, with substantial reductions in time and energy usage;
- A mild and facile processing using non-hazardous chemicals;
- It offers superior control for producing tailored materials for desired application;

## PROFILE

- It is a scalable process with the potential for industrial scale implementation.

This method is applicable to a wide range of nanomaterials and to date over 50 materials have been produced using a bioinspired green synthesis. Ultimately, our aim is to develop processes that will help reduce the environmental burden from nanomaterials, yet without compromising on their utilisation.

### Applications of Green Nanomaterials

Research in the group undertakes the synthesis of bespoke nanomaterials using biologically inspired green routes in order to design novel materials for a range of applications. We have demonstrated the potential of green methods for nanomaterials synthesis by realisation of their real-life applications. The focus is on increasing technology readiness level (TRL) and delivering technologies that are ready for commercialisation. Currently, we are developing green nanomaterials for 4 distinct sectors:

- Carbon capture: design and testing of novel sorbents for CO<sub>2</sub> capture and its conversion/ sequestration.
- Environmental remediation: discovery of nanomaterials for removal of pollutants from air and water via catalytic degradation or selective adsorption.
- Catalysts and biocatalysts: metal or enzyme supported catalysts for Fischer-Tropsch synthesis, catalytic reduction, C-C coupling reactions of pharmaceutical relevance and hydrolysis reactions for biofuels/chemical feedstock production.

- Biomedical applications: development of new drug delivery systems and testing their biocompatibility.

A major theme in our group is generating technologies enabling scaled-up manufacturing of these novel materials.

### Services offered

We provide consultancy and research and development (R&D) services to a wide variety of sectors and markets including energy, waste derived products, petrochemicals, pharmaceuticals, natural products. We have vast experience of working with large multinational as well as small and medium size industry. Specific examples of services offered include:

- Techno-economic and market evaluation of processes and materials;
- Services to test scalability and optimisation of production of particles and particulate formulations;
- Synthesis and characterisation of nanostructured and porous materials;
- Technologies for air and water decontamination.

### Funding

The group has received funding from EPSRC, Royal Society, Nuffield Foundation, Carnegie Trust and Royal Academy of Engineering.

### Biography of the group leader

Dr. Patwardhan, a Chartered Chemist, obtained a B.Eng. in Petrochemical Engineering, followed by M.S. and Ph.D. in Materials Science and Engineering. He gained post-doctoral experience in materials science and inorganic chemistry. He became a Lecturer in Chemical and Process

Engineering, University of Strathclyde. He moved to the University of Sheffield to take the position of Senior Lecturer in Chemical and Biological Engineering, where he leads the Green Nanomaterials research group. Dr. Patwardhan is an Associate Editor of SILICON. He is affiliated with several professional bodies and has been a member of the Royal Society of Chemistry's Materials Chemistry Division Council, EPSRC's Early Career Forum for Manufacturing Research and funding panel at the British Council. He has held various visiting positions including at RIKEN, Japan, IIT Bombay, and University of Akron, USA.

### References

Biomimetic and bioinspired silica: recent developments and applications, Chem. Commun., 2011, 47(27), 7567 - 7582.

Scalable Continuous Solvothermal Synthesis of Metal Organic Framework (MOF-5) Crystals, Chemical Engineering Journal, 285, 718-725, 2016.

A Feasibility Study of the Biologically Inspired Green Manufacturing of Precipitated Silica, Chemical Engineering Journal, 244, 483-492, 2014.



The  
University  
Of  
Sheffield.

**Dr. Siddharth V. Patwardhan**  
BE MS PhD CChem  
Head of the Green Nanomaterials  
Research Group  
Department of Chemical and  
Biological Engineering  
The University of Sheffield  
S.Patwardhan@sheffield.ac.uk  
www.svplab.com



# Boosting research and innovation in the UK

Adjacent Government looks at what Brexit means for UK science and research and how the Minister for Science Jo Johnson and EPSRC are working together to strengthen innovation capabilities in the country...

It's an uncertain time for the UK at the moment with regards to the EU referendum result. With a new Prime Minister beginning her role last month, the UK is set for major change. Despite the referendum result, the UK government are still committed to continue taking forward the legislation that was set before Parliament in the Queen's Speech. This includes the Higher Education and Research Bill.

The government has confirmed that the Brexit result will have no immediate effect on those applying to or participating in Horizon 2020. Stating, that they are determined to ensure that the UK continues to play a leading role in European and international research and innovation.

As part of a [statement released](#) following the vote, Jo Johnson, Minister for Universities and Science, said: "There is no doubt that UK researchers and businesses do extremely well in EU research funding programmes. And we helped shape the European Research Council in our own image, with its emphasis on peer view and funding excellence."

He also said: "EU and international students make an important contribution to our world-class universities, and our European neighbours are among some of our closest research partners. There are obviously big discussions to be had with our European partners, and I look forward to working with the sector to ensure its voice is fully represented and that it continued to go from strength to strength."

The UK leads the way in many areas of science and research. One area where the UK is hoping to make an impact is quantum technologies. In March this year the UK Science Minister announced 2 major investments

in science and engineering research, which adds up to £205m.

In total, 40 universities are expected to share in £167m of funding that will support doctoral training for over a 2 year period, with £37m to be used for developing the graduate skills, specialist equipment and facilities that will put UK quantum technologies at the forefront of the field.

**"EPSRC invests around £800m a year in research and postgraduate training in order to help the UK handle the next generation of technological change."**

The funding for quantum technologies will be split between 3 quantum training and skills hubs in quantum systems engineering, and 7 strategic capital investment packages. The hubs are expected to receive £12m, and £25m will be allocated via capital.

Speaking about the funding at the University of Oxford, in March, Johnson said: "We are committed to securing the UK's position as a world leader in science and innovation. The government is ensuring major new discoveries happen here, such as the creation of super-powerful quantum computers, which scientists are working on in Oxford.

"This new funding builds on our protection for science spending by supporting research in our world-leading universities and helping to train the science leaders of tomorrow."

This funding is part of the government's commitment to UK science. They have invested a total of £6.9bn in science labs and equipment up to 2021, with the

protection of the science budget of £4.7bn per year in real terms for the rest of the parliament.

Also involved in the funding is [The Engineering and Physical Sciences Research Council \(EPSRC\)](#) – the main funding agency for engineering and physical sciences research.

[Commenting on the investment](#), chief executive of the EPSRC, Professor Philip Nelson, said: “This year we are allocating £167m to universities via Doctoral Training Partnerships (DTPs). These cover a 2 year period and give institutions greater certainty and increased time to plan their DTP programmes, and support excellent doctoral students.

“In addition, we are investing in training and providing capital for research to ensure that the National Quantum Technologies Programme can make the most of the country’s research talents. These strategic investments will help science push at the boundaries and make discoveries that are taken through into innovations.”

EPSRC invests around £800m a year in research and postgraduate training in order to help the UK handle the next generation of technological change. The funding council works alongside the UK government and other funding organisations such as Innovate UK to give a much needed boost to science and innovation.

Another area that the UK is making great strides in is Robotics. July marked the first UK Robotics Week, with the UK Science Minister announcing a £5m challenge to encourage UK companies and academics to develop robotic innovations. The competition was devised by Innovate UK and the EPSRC.

[Speaking at the end of the EPSRC’s robotics week](#), Johnson said: “The UK is a world leader in advanced robotic technologies that promise to transform so many aspects of our lives. Through this £5m competi-

tion we will build UK expertise in robotics and autonomous systems and open up new opportunities for innovative businesses and economic growth.”

In order to further develop innovation in the UK, the government have created the formation of [UK Research and Innovation \(UKRI\)](#), which will be lead by John Kingman. The government aims to publish a new national innovation plan, to help steps taken to strengthen the research and innovation landscape in the UK.

**“The UK leads the way in many areas of science and research. One area where the UK is hoping to make an impact is quantum technologies. In March this year the UK Science Minister announced 2 major investments in science and engineering research, which added up to £205m.”**

UKRI aims to serve as a single, overarching and protective funding body and provide a strong voice for the research and innovation community.

“Now, more than ever, as these communities face a unique set of global challenges, we need a powerful voice to represent UK research and innovation on the world stage and ensure we maximise opportunities from all our global research collaboration,” Johnson said.

“Through UKRI, we have the promise of the best of both worlds – combining what works so well, while ensuring we meet the challenges ahead.” ■

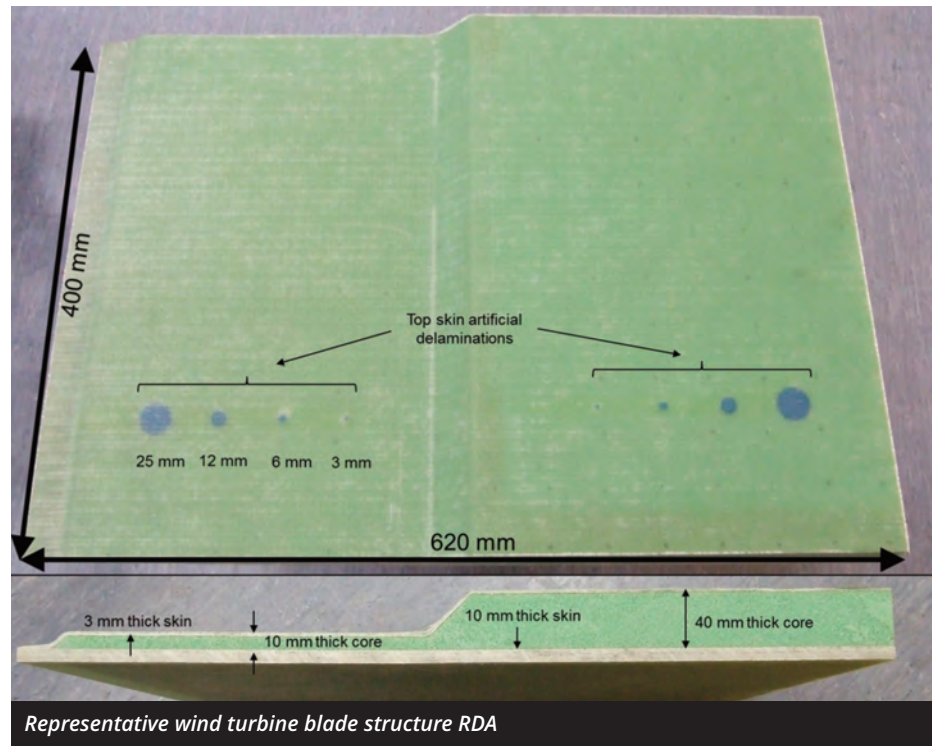
.....  
Adjacent Government  
[editorial@adjacentgovernment.co.uk](mailto:editorial@adjacentgovernment.co.uk)  
[www.adjacentgovernment.co.uk](http://www.adjacentgovernment.co.uk)  
[www.twitter.com/Adjacent\\_Gov](https://www.twitter.com/Adjacent_Gov)

# Validated inspection techniques for composites in energy applications

Michael Gower, Principal Research Scientist (Polymer Composites) from the National Physical Laboratory highlights The VITCEA project

The excellent mechanical properties, low weight, fatigue and corrosion resistance of fibre reinforced plastic (FRP) composites gives them considerable advantages in renewable energy (wind, wave and tidal), oil and gas, and transport applications. The use of FRP composites has the potential to reduce fossil fuel reliance, consumption and greenhouse gas emissions. However, full exploitation is hindered by the diverse range of defects and damage mechanisms that reduce the strength, stiffness and life of FRP structures. A consortium of five leading European research organisations, led by NPL (UK) and consisting of BAM (Germany), PTB (Germany), CMI (Czech Republic) and CEA-LIST (France), are collaborating on a three year (2014-2017) project entitled 'Validated Inspection Techniques for Composites in Energy Applications' (VITCEA) that aims to address the issue of a lack of standards in the area of non-destructive evaluation (NDE) for defect detection in FRP composites in the energy sector. The VITCEA project is funded by Euramet within the 2013 Energy call of the European Metrology Research Programme (EMRP).

Non-destructive evaluation (NDE) is the process used to ensure material quality (e.g. maximum defect size) of a component and that parts are fit for purpose. There is a need for a range of validated NDE techniques with contrasting detection capabilities for the



identification and sizing of defects that directly impact component performance and working life of FRP composites.

Defects in FRP structures may be introduced during the processing and fabrication of composite components and can initiate or grow in-service. The term 'defect' refers to imperfections introduced during manufacture/processing and/or secondary machining operations, as well as damage sustained during a component's service life.

One of the challenges facing accurate and repeatable defect detection in FRP composites is the multitude of defect types that exist, each with char-

acteristics that present different challenges to the NDE practitioner. In order for a particular NDE technique to achieve broad acceptance by industry, it is desirable for the technique to be able to detect a range of defect types with a high level of confidence.

Despite many innovations in the development of NDE for the assessment of defects, relatively few methods are commonly used. This is mainly due to the fact that standardised operational procedures are not available and perceptions that NDE is too unproven, costly or complex. There are currently no ISO NDE standards in existence that are specific to defect detection in composites. Several



## PROFILE

ASTM composite NDE specific standards are available, but these tend to be focussed on the aerospace sector and do not provide enough detail and validated data addressing issues, such as probability of detection (POD), defect size and location sensitivity.

The VITCEA project is working on developing and validating traceable procedures, as pre-cursors for future standardisation, for microwave, active thermography, laser shearography and phased array/air-coupled ultrasonic NDE techniques. These NDE techniques have contrasting detection capabilities, which will underpin the increased use of FRP composites for improved efficiency and reliability in energy related applications e.g. wind and marine turbine blades, nacelles, oil and gas flexible risers. The project is also developing state-of-the-art simulation techniques for all of the aforementioned NDE techniques with the exception of laser shearography. The objective of developing accurate predictive capability for NDE techniques is to generate theoretical inspection results that can be used to supplement labour intensive and expensive probability of detection (POD) studies.

At the onset of the project, an industrial survey was undertaken that established the material systems, components/structural elements and defect types (including size and location), that are most routinely required to be inspected and those that present significant challenges to NDE inspection. From the findings of the survey a total of 20 reference defect artefacts (RDAs) and natural defect artefacts (NDAs) were designed and fabricated, covering marine and automotive transport, renewable energy and oil and gas sector applications.

For the RDAs, the defect sizes and locations are well defined and controlled which necessitated the design and manufacture of artificially created defects e.g. sealed PTFE 'pockets' which mimic delaminations or debonds. For the NDAs, defects such as porosity, voids, matrix cracking and delamination were produced via controlled processing techniques and/or loading mechanisms (tensile loading, low velocity impact). The NDAs are more representative of real defects than the RDAs, as they are comprised of multiple defects of unknown size, specific location and nature. Therefore, NDAs are less suited to assessing the accuracy of the NDE techniques, but are essential for determining the limitations of each technique for real energy applications.

The range of materials used in the RDAs and NDAs include composites based on thermoset and thermoplastic matrix systems reinforced with glass and carbon unidirectional and multi-directional tape and fabric formats. The defect types included cover artificial delaminations, porosity, kissing bonds, fibre misalignment, pipe wall thinning (back-face drilled holes), core damage, impact delaminations and matrix cracking. The assessment of defects in the RDAs and NDAs is currently underway, utilising all of the inspection methodologies listed. In addition, each of the materials used has been thoroughly characterised to determine the elastic, dielectric, thermal and optical material properties required for the simulation techniques and optimisation of the practical application of each NDE technique.

Following an extensive evaluation of each NDE technique by the VITCEA consortium using the RDAs and NDAs

to determine limits of detection and sizing capability, technique specific operational procedures will be written. To ensure the robustness and suitability of the operational procedures, a series of intercomparison exercises and field trials in collaboration with organisations from the renewable energy (wind, wave and tidal), oil and gas and transport sector supply chains, is currently being organised. In addition, a benchmark probability of detection study is being undertaken in which the POD methodology based on modelling simulations will be evaluated. The outcome of the POD modelling simulation work will determine whether modelling can effectively be employed to reduce cost and time requirements for intensive experimental POD trials.



**Michael Gower**  
**Principal Research Scientist**  
**(Polymer Composites)**

National Physical Laboratory

Tel: +44 (0)20 8943 8625

[michael.gower@npl.co.uk](mailto:michael.gower@npl.co.uk)

<http://projects.npl.co.uk/vitcea/>

# High temperature particulate erosion: Setting limits with confidence

Lord Kelvin is credited with saying that, "When you can measure what you are speaking about and express it in numbers you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge of it is a meagre and unsatisfactory kind". Modern advanced manufacturing and design approaches require more than simple ranking of performance. There is requirement to measure and fully understand the performance of engineered surfaces quantitatively and not purely qualitatively. It is critical that definitive measurements are obtained of a materials performance, to drive innovation and improve system performance. In 2013 high temperature solid particle erosion (HTSPE) was one such area identified as needing improved measurement capability to truly understand materials performance. Erosion can be defined as the degradation of a materials surface due to mechanical action, often by impinging liquid, particles, bubbles or droplets, cavitation, etc., and can have a great impact on industry with far reaching impact for safety critical systems, as demonstrated in 2010.

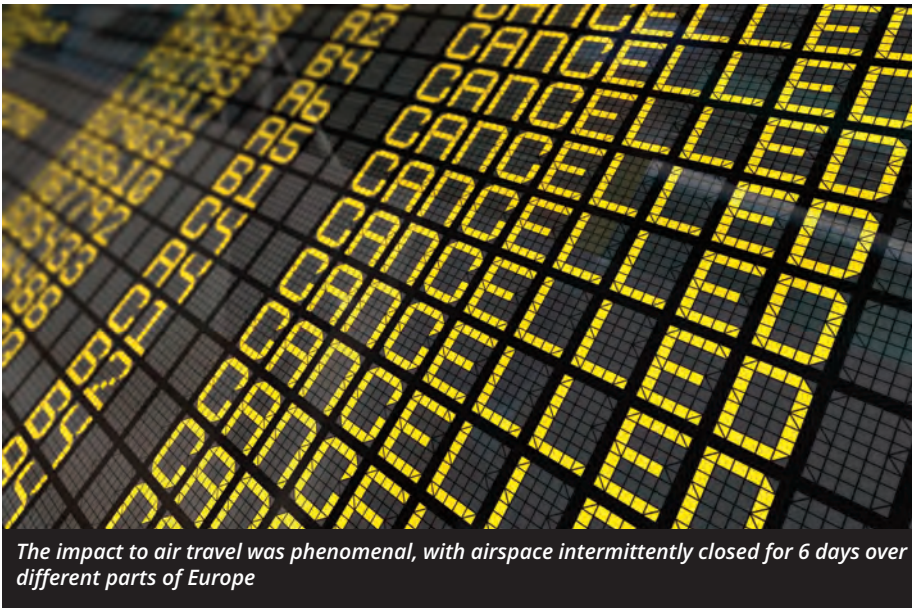
In 2010, the eruption of the Icelandic volcano Eyjafjallajökull, ejected a plume of fine glass-rich ash into the atmosphere to a height of over 8 kilometres (5 miles). Located directly under the jet stream this eruption went on to cause severe disruption, as the ash was carried over northern Europe and into its busy airspace. The volcanic ash was found to have silica concentrations of around 58%, a hard material which can cause severe



particulate erosion. The impact to air travel was phenomenal, with airspace intermittently closed for 6 days over different parts of Europe, affecting more than 10 million people and costing an estimated £1.1bn. The major concern for aviation was the ingestion of the volcanic dust into the engines, which would then become molten and, on passing through the engine solidify on cooler sections leading to engine failure. There was also the additional concern that the erosive nature of the ash would 'sandblast' windows and navigation lights reducing visibility for the pilots and damage the leading edges of blades and wings, as happened in 1992 to a British Airways flight to Auckland. The Civil Aviation Authority set new guidelines<sup>1</sup> allowing flights when the ash loading was between 200 and 2000 microgrammes per cubic metre of air, a figure which was subsequently revised up to 4 milligrams per cubic metre of air<sup>2</sup>, based on past experience, advice from academics and

experimental work. This is an extreme example of the impact of HTSPE which occurs routinely and impacts efficiency in turbomachinery and wind turbines for example.

Up until 2014 there were no recognised standard test methods for HTSPE testing. Testing up to that point was generally based around the ASTM G76 test method, which has some short comings (e.g. room temperature, limited velocities, and geometries) but was nonetheless used and is considered quite suitable for ranking material performance. Subsequent to 2010, ASTM International have published a standard test method for High Temperature Solid Particulate Erosion which addresses many of the measurement issues, and provides recommendations for apparatus design. Whilst this standard provides the framework and guideline for the test, it does not advance the robustness of the test through improved metrology.



*The impact to air travel was phenomenal, with airspace intermittently closed for 6 days over different parts of Europe*

The fundamental mechanism of particulate erosion can be considered as a simple transfer of kinetic energy from the particle to the surface of the material, and so is usually expressed as being proportional to the mass of the particle multiplied by the square of the velocity. The actual observed damage or rate of erosion is directly influenced therefore by the impact speed and mass of the particle, but will also be affected by the particle loading in the gas volume, shape and composition of the particles, temperature, impingement angle and surface properties of the stricken surface. With so many different parameters influencing the erosion rate it is important for materials development, mechanistic understanding and definitive measurements of erosion rates that we understand the influence these have and how reliable the test methods are that establish limits for safety critical applications.

It is clear from the literature and from our own experience that the test methods employed are reliable, and can reproduce material ranking from laboratory to laboratory. Whether

they provide a definitive value for the erosion rate is questionable, after all conditions vary and material performance will be heavily dependent on the application.

The National Physical Laboratory (NPL), the UK's National Measurement Institute, has taken the first steps in realising this through a collaborative EURAMET funded project "METROSION". Within this project, in conjunction with our partners, we have been able to realise definitive measurement of the erodent shape and size. An improved method for velocity measurement of the particles has also been developed and demonstrated in-situ for speeds up to  $300 \text{ ms}^{-1}$ , and will provide the velocity distribution of the particles and not just the maximum and minimum velocity which is the limitation of the double disk method conventionally used. As part of this project, a new HTSPE test facility was built at NPL incorporating in-situ measurements of mass and volume change to improve the real time monitoring during the test. Using this facility we have been able to demonstrate the effect different apparatus geome-

tries have on the measured erosion rates and identified important mechanistic effects relating to temperature, velocity and particle embedding.

These improvements in the measurement capability and control of HTSPE tests coupled with the new testing standard provides greater confidence in the comparability of results and characterisation of engineered surfaces subjected to HTSPE. The improved measurement capability incorporating real time monitoring of the tests is enabling a revolution in the understanding and modelling of erosion processes and will facilitate the development of new and improved materials in advanced manufacturing to meet the challenges for UK industry of operating under increasingly harsh operating conditions.

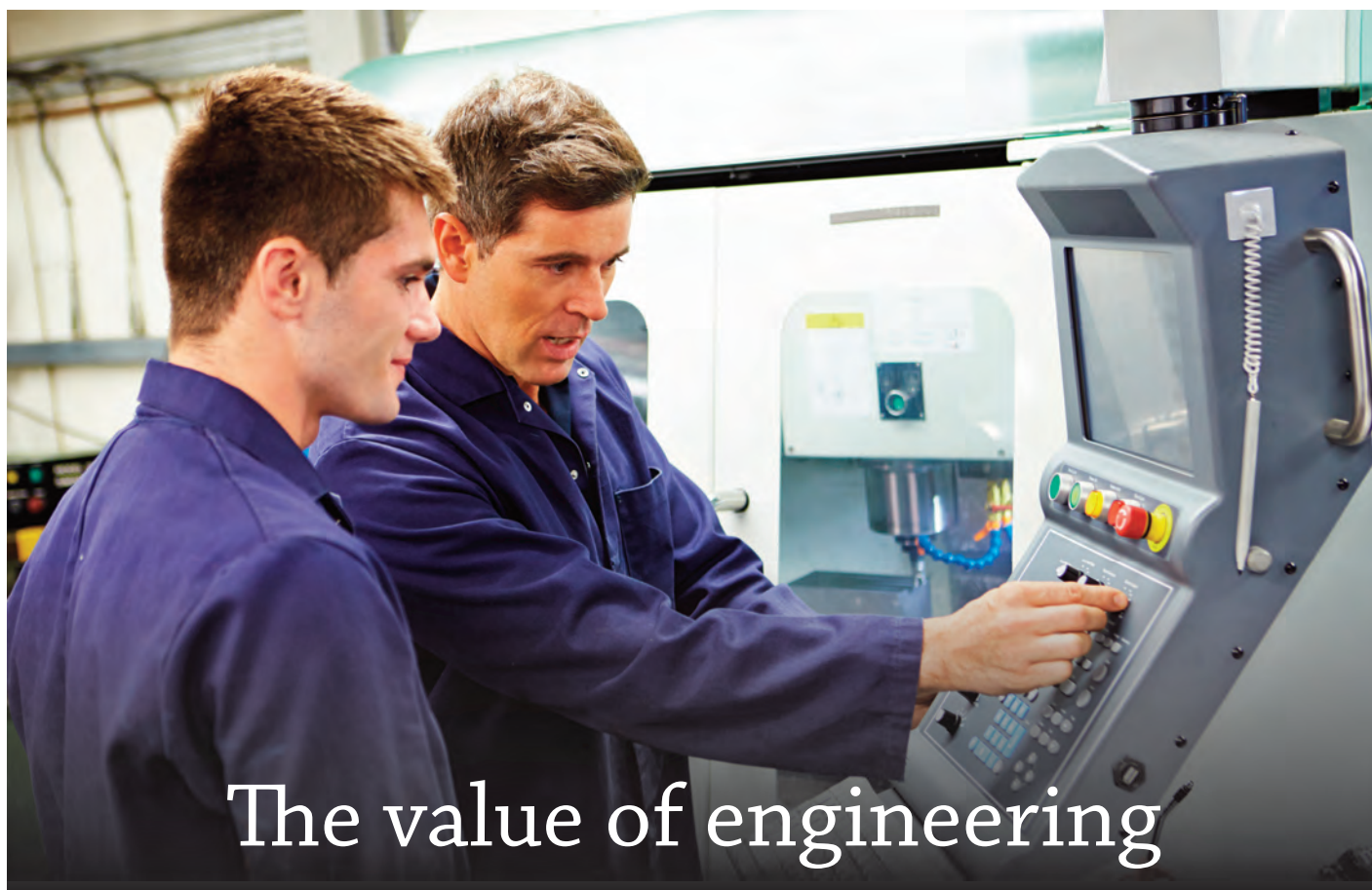
<sup>1</sup> P. Marks, "Engine strip-downs establish safe volcanic ash levels," 21 April 2010. [Online]. Available: <https://www.newscientist.com/article/dn18802-engine-strip-downs-establish-safe-volcanic-ash-levels/>. [Accessed 20 June 2016].

<sup>2</sup> C. A. Authority, "Guidance regarding flight operations in the vicinity of volcanic ash - CAP 1236," Civil Aviation Authority, Gatwick, 2014.



**Tony Fry**  
**Principal Research Scientist**  
National Physical Laboratory  
Tel: +44 (0)20 8943 6220  
[tony.fry@npl.co.uk](mailto:tony.fry@npl.co.uk)  
[npl.co.uk](http://npl.co.uk)





# The value of engineering

Tamzin Caffrey, Head of Communications at Engineering UK highlights how engineering is essential to sustaining the UK's long-term economic performance...

**E**ngineering sectors produce the majority of the nation's export and play an essential role in supporting the UK's international competitiveness by investing in research and development and innovation – a vital part of sustaining the UK's economic performance in the long term.

Productivity is enormously important. A country's capacity to produce goods and services is dependent on the size of its workforce, the size of its capital stock, and how effectively it uses labour and capital.

The Engineering UK 2016 – The State of Engineering report highlights the fact that the sector is driving productivity, the economy and employment. The gross value added of engineering businesses is larger than the retail and wholesale, and financial and insurance sectors combined, as well as being 68% more productive than the retail and wholesale sector.

Over 27% of total UK GDP is now generated by the engineering industry, amounting to £445.6bn and

turnover for engineering has grown by 3.4% to £1.21tn. It is perhaps unsurprising that alongside a growth in turnover engineering has seen a growth in employment. The industry directly employs over 5.5 million and supports 14.5 million jobs overall. A strong engineering industry creates a powerful ripple effect, not least because for every new job in engineering, 2 more are created outside of the sector and every £1 GVA generated in engineering generates £1.45 elsewhere.

The contribution of engineering to the UK economy should not be underestimated. Neither should the contribution of those who enter the industry as apprentices. Indeed, research shows that the productive contribution of engineering and manufacturing technologies (EMT) apprentices over past 10 years amounts to £12bn. That substantial contribution is equivalent to 8% of growth in GVA. This indicates that EMT apprenticeship programmes have a sizable impact in boosting the overall productive capacity of the UK economy and that we will see additional benefits with any increase in the number of apprenticeships.

In short, engineering and skilled engineers make a significant contribution to the UK economy and its productivity – as well as working towards mitigating the grand global challenges of climate change, ageing populations, food, clean water and energy. Yet, since there is still a considerable gap between the supply of and demand for people with engineering skills, there is widespread concern for the long term future of the industry.

In the UK there is no level of education with the current capacity or the required rate of growth to meet the forecast demand for skilled engineers and technicians by 2022. That demand runs to around 182,000 skilled workers a year, which given the current stock of engineers coming through the UK education system could mean an annual shortfall of 69,000 employees. This presents the industry with a significant challenge, where companies must work now collaboratively to boost the talent pipeline.

While there have been huge advances in engineering in the past 30 years, very little has changed in terms of diversity in the make-up of the sector. A different approach is needed. It is through concerted and co-ordinated action that the engineering community (particularly employers) can make a demonstrable difference by working with schools and colleges to inspiring future generations to pursue relevant qualifications and go on to careers in engineering. It is imperative that no talent is wasted.

The Tomorrow's Engineers programme is led by the engineering community and it is that collective ownership and collaborative spirit that makes it unique. Tomorrow's Engineers doesn't offer a single off-the-shelf package, it doesn't dictate how individual employers or schools should get young people engaged and it doesn't work on the premise that one size fits all. Tomorrow's Engineers provides a platform for employers to grow the talent pipeline as part of a coordinated drive.

This growing community of employers is working to realise the ambition of reaching 1 million young people a year with a memorable experience of engineering in action. Mapping that work highlights hot spots, areas and schools that are engaged and active in STEM (Science, technology, engineering and mathematics) promotion. Tomorrow's Engineers is able to identify and target schools in cold spots where engineering outreach can have the greatest impact.

Governments in each of the devolved nations need to ensure joined-up education policies that deliver easy-to-follow academic and vocational pathways for our young people within schools and colleges. We need joined-up education policies that deliver easy-to-follow academic and vocational pathways for those in education today and commitment across government, education and business to work hard and to work together to inspire those young people to become the industry's talent of the future.

We also need a coordinated approach led by government and supported by the engineering community, business and the education sector to make sure that the vital need for more trained specialist physics and mathematics teachers is met.

Skills strategies such as that announced by the Department for Transport are right to call for the community to focus on the programmes and interventions that are showing real results rather than looking to launch new initiatives. That strategy also includes specific targets and action for boosting apprenticeships, attracting more women into the industry and a year-long celebration of engineering in 2018.

A strong, consistent and positive message about working in engineering needs to reach young people whatever their background, wherever they live and whatever their gender. The engineering community needs to build on the strong foundations laid by the Tomorrow's Engineers programme to boost the volume, reach and quality of engineering employer engagements with young people. ■

Engineering UK 2016 The State of Engineering analyses the engineering industry's capacity for growth and details engineering in education, training and employment and is available at:

[www.engineeringuk.com/Research/Engineering-UK-Report-2016](http://www.engineeringuk.com/Research/Engineering-UK-Report-2016)

.....  
**Tamzin Caffrey**

**Head of Communications**

Engineering UK

[TCaffrey@engineeringuk.com](mailto:TCaffrey@engineeringuk.com)

[www.engineeringuk.com/](http://www.engineeringuk.com/)

[www.twitter.com/\\_EngineeringUK](https://www.twitter.com/_EngineeringUK)

# How can we tempt more women into engineering?

Clair Prosser, Press Officer at BSRIA, highlights why there has never been a more exciting time to be an engineer – especially for females in the industry...

**A**s BSRIA celebrated National Women in Engineering Day (NWED) on Thursday 23rd June, in an attempt to promote the subject to students in schools and universities and encourage more women into engineering, we asked: “How can we tempt more women into engineering?”

The day was dedicated to raising the profile and celebrating the achievements of female engineers. Engineering continues to be a male-dominated profession: currently, less than 10% of the engineering sector’s workforce is female and yet 64% of UK engineering companies report that a shortage of engineers is threatening their business.

“Industry experts” predict that we need to double the number of UK students studying engineering degrees. But with just 15% of our engineering and technology undergraduates female, “there’s work to be done”.

So why so few women? Marketing plays a huge part. In civil engineering – for example – we have a tendency to only show construction sites in marketing materials, even though many engineers spend most of their week in an office.

Julia Evans, Chief Executive, BSRIA, said: “Employers are realising that ‘female friendly’ policies, such as flexible working, go a long way to help attract women. But we also need to change young women’s (and their parents’) mind-sets to realise that engineering offers a wide range of exciting opportunities and career development. Engineers and technicians touch every part of life.

By encouraging girls into engineering careers we will not only be increasing diversity and inclusion – a business imperative – but enabling us to fill the substantial future job opportunities that have been predicted in this



sector. BSRIA is very supportive of women going into engineering and proud to be employing many female engineers itself who are flourishing.

History has shown that those who pursue science arguably make the biggest impact to the world; incredible minds provide us with incredible ideas we once might have thought of as unbelievable but are now ingrained in our society. Engineers help make the future a reality.

Women can bring a different approach to achieving solutions, bringing skills such as communication and analytical thinking to the table. And, of course, multi-tasking.”

## What can we do to redress the balance?

Industry and government-led initiatives are helping to encourage a rising number of female candidates at graduate level. But there is still a significant, and worsening, gap among engineering apprentices. To close the gender gap at apprenticeship level, the industry will need to be “lateral and creative” in its approach to recruitment.

BSRIA believes we need a “two-pronged attack” to ensure enough women are studying engineering



to begin with, and then stay on to reach the highest levels of the profession, should they aspire to do so. Early engagement is key.

The Institution of Engineering and Technology's new president Naomi Climer (a female) has called for quotas to redress the balance but educators and parents also have a role to play. Outreach work with schools and colleges spreads the word, with mentor schemes enabling young women to hear (and often see) first-hand how great a job in engineering can be.

Indeed, BSRIA's INSPIRE project running throughout 2016 includes a series of events to inspire and engage the workforce of tomorrow with what the engineering industry has to offer. INSPIRE is based around the STEM subjects.

The project raises the questions of why are STEM subjects important? What does engineering mean for you? Why does technology matter? There is one answer to those 3 questions which is quite simply 'everything'. BSRIA is working with local schools, national and local politicians and the media to promote STEM and change its perceptions.

It's clear to see the difference that women have made to engineering over the centuries: from Polish physicist and chemist Marie Curie (1867 – 1934): the first woman to win the Nobel prize and the only woman to win it twice; Edith Clarke (1883 – 1959): the first female electrical engineer; Katherine Blodgett (1898 – 1973): the first woman awarded a Ph.D. by the University of Cambridge; and Elise MacGill (1905 – 1980): a Canadian aeronautical engineer, the first female aircraft designer in the world, known as the "Queen of the Hurricanes". There was also Stephanie Louise Kwolek (1923 – 2014): an American chemical engineer and inventor and creator of Kevlar: now the main constituent of bulletproof vests.

More recent candidates include: British astrophysicist Jocelyn Bell Burnell who worked to create a radio telescope for planetary scintillation and British theoretical physicist and applied mathematician Helen Mason

who was involved in Skylab – the United States' first space station. Engineer Jo Da Silva OBE specialised in the delivery of humanitarian aid and helped build and repair refugee camps after the Rwandan genocide. Roma Agrawal is an Indian born structural engineer and was involved in the construction of the Shard on London's South Bank.

Wendy Sadler started Science Made Simple to inspire young engineers and won the Institute of Physics Young Professional Physicist of the Year award in 2005.

Increasing the visibility of women in senior positions helps demonstrate what women can achieve. After all, the more visible women are, the greater the likelihood of other women joining.

And, who knows – with a new female Prime Minister – by 2020 there may well be more women – not only wearing hard hats – but sitting in the boardrooms of engineering companies. Come on ladies – and smash that metaphorical glass engineering ceiling!

[www.nwed.org.uk](http://www.nwed.org.uk)

National Women in Engineering Day was set up on 23rd June 2014 by the Women's Engineering Society (WES) to celebrate its 95th anniversary. Since 2014 the day has focused attention on the great opportunities for women in engineering, at a time when it has never been more important to address the engineering skills shortage. ■

BSRIA is a non-profit distributing, member-based association, providing specialist services in construction and building services.

.....  
**Clair Prosser**  
**Press Officer**

BSRIA  
Tel: +44 (0)1344 465 600  
[bsria@bsria.co.uk](mailto:bsria@bsria.co.uk)  
[www.bsria.co.uk](http://www.bsria.co.uk)

# Gender equality: ambitious but attainable

Věra Jourová, European Commissioner for Justice, Consumers and Gender Equality takes stock of the progress and the remaining challenges in the way of gender equality...

I believe that Europe is a “good address” for women. Today, more women than ever graduate from university, have a job and participate in all areas of society.

Nevertheless, gender equality is not fully achieved yet. For instance, at the current pace, we could wait another 30 years for gender parity in national parliaments... This is clearly too slow.

Equal participation of women and men in society, in the labour market and in decision-making is not only a matter of justice and fundamental rights, it is also an economic investment in our modern society and economy.

As Commissioner for Justice, Consumers and Gender Equality, I have the ambition to end, or contribute to ending the unfinished business of gender equality. I see 4 main areas of action to achieve this goal:

## **First: increasing economic independence of women**

Ensuring economic independence of women is key to achieving gender equality. Despite their high qualifications and education levels (60% of university graduates in the EU are women), women are still today more likely to be paid less than men, to leave the labour market or to work part-time.

Work-life balance measures are very powerful in removing obstacles to female employment. However, they are still too limited. For instance, the availability, affordability and quality of childcare facilities are not yet satisfactory, despite EU targets, funding possibilities and recommendations. Moreover, it is primarily women who use parental leave for instance, while men continue to make very limited use of such measures.

To address these challenges and strengthen gender equality, the Commission aims to improve work-life balance of parents and others with caring responsibilities, and to promote a better share of paid and unpaid work between women and men.

## **Second: reducing the gender pay, earnings and pension gaps and thus fighting poverty among women**

In the EU, women are paid 16% less than men per hour of work. I am very committed to use all the existing instruments to tackle this gender pay gap. This includes monitoring enforcement of EU legislation on equal pay, promoting pay transparency, strengthening research and public awareness of the phenomenon, supporting employers and trade unions in combating it. Every organisation in every sector can and should contribute to closing the gender pay gap.

As a result of lower pay, longer career interruptions and more part-time work due to care responsibilities, women's pension benefits are 40% lower than men's. Older women are also at a higher risk of poverty. The EU has issued recommendations to several Member States to address the adequacy of their pension systems.

## **Third: promoting equality between women and men in decision-making**

Women still face barriers to take on decision-making positions in all sectors. They represent only 5% of CEO's and 23% of the board members of the largest publicly listed companies registered in EU Member States. Gender equality is also limited in politics at national or local level. For instance, women represent on average 29% of members of national parliaments in the EU, 32.5% of members of regional assemblies and only 15% of mayors.



*Věra Jourová, European Commissioner for Justice, Consumers and Gender Equality*

We need to break the class ceiling that stops women from reaching the highest positions. That's why the Commission proposed modern and flexible rules setting a target of a 40% presence of the under-represented sex on corporate boards by 2020. Our approach is merit-based, focusing on a fair and transparent selection process, which will bring about change. The Commission also promotes gender equality in economic decision-making by analysing data, raising awareness and promoting the exchange of good practice, and supporting stakeholders and various initiatives.

#### **Fourth: Tackling gender-based violence**

Finally, we need to tackle the serious issue of violence against women. One in 3 women in the EU experiences or will experience violence in her life.

Recent EU legislation secures victims' rights, addresses trafficking in human beings, and promotes equal treatment. I am determined to enforce it and to push for an end of violence against women. EU-funding,

supporting grass-roots activities aiming at preventing violence, supporting victims, encouraging cooperation between relevant professionals and tackling under reporting, should help in this endeavour. We will dedicate the year 2017 to the fight against violence against women, both in Europe and beyond.

Gender equality is attainable. It comes down to all of us, men and women, to stand together, today and every day and commit to creating a world where our daughters and sons have equal opportunities. ■

.....

**Věra Jourová**

**Commissioner for Justice,  
Consumers and Gender Equality**

European Commission

[http://ec.europa.eu/commission/2014-2019/jourova\\_en](http://ec.europa.eu/commission/2014-2019/jourova_en)



# Gender balance in scientific careers

Professor Rosalind L Smyth, Director at the UCL Great Ormond Street Institute of Child Health, outlines the importance of gender equality within the science sector

Many years ago, after I had been appointed as a research fellow in Cambridge, I bumped into a former senior colleague at a conference. She congratulated me on my new post, but proffered some advice, which was, “Now you can have a baby, because they don’t really mind if you do that when you are doing research.” I was flabbergasted on many counts, (what if I didn’t want to have a baby? who were “they” and why should I care whether they “minded” about my reproductive choices? Why was research training more expendable than clinical training?), but I certainly did not demure. Women were expected to either not have children (husbands were less controversial), take a less demanding career pathway or, if they wanted to ignore the first two options, they had to, “at risk”, navigate a career road map which had lots of escape lanes to shoot down when the gradient of a clinical academic career track became too steep and slippery. Given that the option to have children doesn’t offer an easy escape, these escape lanes could only lead back to a less demanding career pathway, which was arguably the route that should have been followed in the first place. Was it any surprise that most women, of my generation, didn’t bother?

So I ignored her advice, had a very successful research fellowship, decided that my passion, and future career

track, lay in clinical academia and had babies later on when I was doing clinical training. This is not to suggest that it was all plain sailing; I suffered considerable self-doubt, guilt about working full-time and raised my aspirations only in small increments; my road map was not at all clear and contained many blind corners.

During my early career, I considered the need for gender equality in science and medicine entirely from an individual perspective. Imbalances, be they due to gender, ethnicity, disability or social class, to mention just some, at an individual level, are profoundly unfair. Everyone should have the same entitlement to pursue a career according to their ambitions and ability. While that is undoubtedly the case, latterly, I’ve become more aware of the benefits of widening participation for the greater public good. While the battle of Waterloo may have been won on the playing fields of Eton, how much more effective might we now be, as a nation, if life opportunities were on an entirely level playing field? Science funding, career progression and publication are all competitive. By effectively doubling the pool of expertise, and making competition more rigorous, standards are raised and excellence in science and medical discovery is enhanced.

But it isn’t simply related to numbers; because their approach is qualitatively different, having a more equitable

balance of numbers of women in the workforce, at all levels, brings a different perspective, perhaps more methodical, collaborative and measured. This is not to suggest that archetypal male qualities (decisiveness, confidence, charisma) are in any way “wrong”, just that we need both and a balance. Nor is it true that all women lack confidence, are nuanced rather than polarised in their views, seek consensus rather than confrontation and so on, but it is probably true that all male groups show more “macho” characteristics than mixed, or female groups. As one very senior (male) academic, told me once, “When there are women in the room, the behaviour of the men changes, for the better.”

So what can we all do, to ensure that women reach the most senior roles in science and academia? Proponents of the principles embodied in the Athena SWAN charter<sup>1</sup> argue that policies to support women in STEM subjects are simply good working practice. For example, instituting “core hours” where all seminars, meetings and other key activities happen between 10.00 and 16.00, means that those who have to fit their work around child care arrangements are not penalised by being unable to attend such essential activities. The old style seminar programme, which begins during the afternoon and ends with discussion after work, in the pub, excludes those who have to pick up a child from nursery by 5.30 pm.

## PROFILE



Similarly, strategies to prevent unconscious bias, by ensuring a gender balance (and balance of ethnic and other minority groups) on appointments committees, review panels and promotion committees, mean that the bodies which make key decisions about career progression represent the diversity of the workforce.

Are there specific times, during the career course, when targeted support could make an important difference? I would suggest that, unusually, we don't need to start very early on in the career cycle. The evidence suggests that the "leaky pipeline" starts after undergraduate and PhD and early postdoctoral years. The problems start when women try to make the transition from postdoctoral posts to either intermediate research fellowships or a lectureship – the first step on the academic ladder. Over the last 2 to 3 decades, the competition for such posts has intensified hugely, requiring high impact publications, as

first or last author, external grant funding and measures of excellence, such as prizes and other accolades. The pressure to have a strong CV, with all of these elements, generally comes when individuals are aged between 30 and 40, the age when most professional women are having and raising their children. This is the real crunch point, when women will either make it or break it and should be a focus of specific support. Such measures can include ensuring grants properly support maternity leave, initiatives to support an individual to maintain research progress during maternity leave and part-time working, an environment which means that authorship is protected during periods of absence, among others.

Finally, I believe strongly in the personal encounter, as a powerful force for good. Positive role models, effective mentorship and quiet encouragement can instil confidence, resilience and motivation and in this, we all have a

responsibility. As Lesli Linka Glatter, the American TV and film director, said, "I have been helped over and over by wonderful men and women in my career. Men help each other all the time, and that kind of inclusion among women can create similar success".

<sup>1</sup> Athena SWAN is a national scheme which recognises a commitment to supporting and advancing women's careers in science, technology, engineering, maths and medicine (STEMM) in higher education and research.



**Professor Rosalind L Smyth**  
**Director**

UCL Great Ormond Street Institute of  
Child Health

Tel: 020 7905 2189

[ich.director@ucl.ac.uk](mailto:ich.director@ucl.ac.uk)

[www.ucl.ac.uk/ich](http://www.ucl.ac.uk/ich)

# The gender gap in academic leadership

Despite some progress women are still underrepresented in positions of academic leadership across the world. Why?

The situation has improved since the 1970s but across the world women still occupy only a minority of academic leadership positions. For example in 2015 just over one in five professors in the UK were women (22%), similar to the EU28 (21%) average and a little behind the USA (28%).

The representation is even lower in science, technology, engineering and mathematics (STEM) subjects, for example in the UK women account for 28% of professors in humanities subjects and only 19% in science subjects. The focus of many policy initiatives on inspiring and supporting girls and young women to study STEM subjects is an important but insufficient intervention. Cultural and organisational structural barriers must be removed as well.

To paraphrase Sheryl Sandberg – alongside her call for women to ‘lean in’ we contend that organisations must ‘lean out’. Change requires ongoing commitment from university leadership teams and ensuring that this stated commitment is translated into action to review and reform organisational procedures and processes, thus creating a level playing field for women to advance in their careers.

## What organisational policies help or hinder women’s progress to be a STEM professor?

The personal experiences of women

who have succeeded in becoming STEM professors, and the similarities and differences encountered in non-STEM subjects, has been given surprisingly little attention in research to date. But a deeper knowledge of the factors that have contributed to or impeded their success will create a better understanding of gender disparity in academic leadership.

## How have initiatives such as the Athena SWAN scheme made a difference to improving gender awareness in universities?

Athena SWAN was introduced in 2005 and is a practical scheme run by the Equality Challenge Unit (ECU) to improve women academics’ STEM careers. Additional impetus to the success of this initiative was given in 2011 when the UK’s Chief Medical Officer, Dame Sally Davies, announced that the National Institute for Health Research (NIHR) would only shortlist medical schools for funding if a silver Athena SWAN award was held by the school. This also included funding for patient safety research centres.

Athena SWAN has had a positive impact on progress to improve women’s presence in STEM positions. The Charter was expanded in 2015 to include arts, humanities, social science, business and law departments, and the ECU has also introduced a new race equality charter. Yet we still have a long way to go to ensure that such initiatives produce fundamental organisational

change and real diversity in the profile of the academic and research workforce in universities and in science and engineering industries.

## Our research: women in science – the gender gap in academic leadership

We interviewed 30 women in senior professorial positions. This stage of our research concentrated on our own academic backyard: the University of Manchester, where the gender profile of women in leadership positions compares favourably with the average for other research-intensive universities in the UK. The results of this qualitative study will serve a dual purpose, informing the next steps of the ATHENA action plan at the University of Manchester and forging new insights into gender segregation in employment more broadly.

## • Do women face particular challenges in securing senior leadership positions in STEM subjects?

Many spoke of the difficulties of being one of only a few women among the academics in their department. This manifested itself in being visible as both ‘different’ and invisible in that their contribution was sometimes undervalued or ignored. When attending meetings and events where they were one of very few women, many felt a pressure to be twice as good as their male counterparts in order to be noticed in a positive way and to be able to advance.



Some had grappled with being the first in their department to request maternity leave and to face the challenges of balancing their careers with caring responsibilities. Meanwhile, the men in their departments usually had fewer such responsibilities to manage.

While women were better represented in many of the humanities and social science disciplines, there were many points of similarity in their experiences and those of their scientific counterparts. Certainly economics and philosophy remain very male-dominated fields.

### • **Stereotypes and cultural assumptions still block women's progress**

Strong barriers to dismantle include gender stereotypes and assumptions of what it means to be a good academic leader.

Combining a demanding career with raising a family has always been easier for men – usually because they have a wife or partner who does the bulk of the childcare and housework. In our research we found that some professorial women had thought long and hard about whether to have children. Those who did and succeeded in making it up the academic career had only managed to do so because they had a husband who did more than other men at home, or they had arranged other additional support to enable them to work the long hours often required in their profession.

Academia is highly competitive and progression is ostensibly merit-based. However some promotion criteria may be biased against women. Research volume and income, more than contribution to teaching and mentoring, is often the dominant metric of pro-

motional criteria – and the way that professional networks and peer reputation impact on citation rates is another arena which may impact negatively on women's career progression. While academic promotion metrics are supposedly gender neutral, many perceived them to be skewed to reward a narrow and rigid career pathway which favours men on average.

### • **A shared experience**

The professors we spoke to have strikingly similar stories to tell about their climb up the career ladder. They considered long-term support networks, mentors and, at Manchester University at least, courses in leadership to be particularly key to their success. They reported how men in their departments seemed to consider the rules of the promotional game to be obvious, to have a wider pool of influential networks and mentors, to be less encumbered by childcare responsibilities and to obtain promotion more quickly.

Obstacles to their advancement included deeply rooted issues of unconscious bias and gendered expectations about men and women – and the way these issues fed into the organisational culture and promotional framework, and often favoured men.

These results bring to light the importance of long-term support networks for women, in the workplace as well as at home, in the shape of supportive and well-matched mentors and line managers who were committed to removing gender bias in the workplace.

### • **Concerted organisational efforts**

Gender parity in STEM is some way off yet, but the problem isn't restricted to

the sciences. Our research with women who have successfully become professors underscores that in order to make meaningful progress, fundamental changes must occur in the organisational procedures and culture of academia – and Athena SWAN must be seen as more than a box-ticking exercise.

Initiatives to promote gender equality must be monitored, evaluated and adjusted accordingly. Men as well as women should be involved in these endeavours since fair and open merit-based career opportunities, combined with better opportunities to combine professional life with caring for children and elder relatives, will benefit everyone who wants to pursue an academic career.

#### KEY COLLABORATORS

Dr Nina Teasdale; Professor Karen Hassell; Dr Jane Ferguson; Dr Lis Seston, The University of Manchester, UK



#### **Colette Fagan** **Professor, Deputy Dean and Vice Dean for Research**

School of Social Sciences  
Arthur Lewis Building 3.029  
The University of Manchester  
Manchester M13 9PL  
colette.fagan@manchester.ac.uk  
[www.socialsciences.manchester.ac.uk/research/impact/international-employment-policies/](http://www.socialsciences.manchester.ac.uk/research/impact/international-employment-policies/)

# Pioneering science the NSF way

Adjacent Government highlights the scope of the NSF in developing and promoting science across the US...

According to the Organization for Economic Cooperation and Development's (OECD) 2015 Science, Technology and Industry Scoreboard the US spent some \$433bn on research and development in 2013. This represented 2.7% of the nation's GDP for that year.

Research and development remains a vital part of society, and it is an area the US excels in significantly. Supporting research and development in the US is the National Science Foundation (NSF).

The NSF was created by Congress in 1950 as an independent federal agency "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defence..."

The NSF undoubtedly has a pivotal role to play in expanding research in the US, accounting for approximately 24% of all federally supported basic research carried out by colleges and universities. With an annual budget of \$7.5bn, the foundation certainly has the ability to foster change and pioneer new developments via the grants it supplies to fund specific research proposals.

While funding in the US certainly seems high, in an interview with Here & Now's Jeremy Hobson earlier this year, NSF's director France Cordova said more was needed to keep the US competitive.

"The basic research budget has been pretty stagnant since 2003, I'd say. But the world has changed a lot since then, and other [countries] are investing more proportionally speaking. So we do need to invest a lot more in basic research because it's the wellspring of new knowledge of how our world works."

However, Cordova said innovation in the US was

performing well, but that there needed to be greater diversity in the science sphere. She said: "The spirit of innovation is thriving. A lot of it is spurred by the internet and all the communication and network that's formed and the new wealth that's fostered."

"I think there's a real flowering of innovation, especially in the technology realm, in sectors like information technology. But we are missing a couple of very important things."

"One thing that we're missing is what I call inclusive innovation. There are many more people who could contribute to innovation but presently feel excluded."

"They're not part of the current wave of innovation, but they have a lot to offer. So among those would be women, underrepresented groups and youth in disadvantaged areas. And the National Science Foundation is trying to address that gap with a program it calls Includes."

"The second thing we're missing is that innovation is mostly happening in selected fields like information so, I think of innovations that are recent in data-science and machine learning."

"But there are many other areas that are not being fully explored, even though they're ripe for that innovation. An example of that gap would be health and medicine."

"There's a lot we could do, but not all the knowledge tools are being applied. And in my own fields of physics, the mysteries are really piling up."

"We need to go to the next step in investigating these mysteries. Then there's energy technology innovation. We need better battery designs for storage for example."



### **Computing and communication**

One area that is supported by the NSF is computer and information science. With a specialised division dedicated to furthering this field, the Directorate for Computer and Information Science and Engineering (CISE) has 4 goals.

This includes promoting the US to remain as a world leader in communications, computing, information science, and engineering; promoting the principles and uses of these sectors for society; supporting and advancing cyberinfrastructure to enable innovation across other fields; and ensuring transparency and participation in an information-based society.

CISE supports investigator initiated research, as well as fostering interdisciplinary collaborations that develop and maintain cutting-edge national computing and information infrastructure. As society moves into an

increasingly digital world, supporting innovation and development across these fields remains vital if the US is to remain at the forefront of discovery.

Innovation and research remains a vital part of all economies, but organisations like the NSF have a pivotal part to play in keeping the US a world leader in science. ■

.....  
Adjacent Government  
[editorial@adjacentgovernment.co.uk](mailto:editorial@adjacentgovernment.co.uk)  
[www.adjacentgovernment.co.uk](http://www.adjacentgovernment.co.uk)  
[www.twitter.com/Adjacent\\_Gov](https://twitter.com/Adjacent_Gov)



# Effectiveness and efficiency of computational scientific methods are not enough

Improving usability, reproducibility and sustainability of scientific methods via science gateways

Computational scientific methods tackle an increasing breadth and diversity of topics – analysing data on a large scale and accessing high-performance computing infrastructures, cutting-edge hardware and/or instruments. In the last decade novel technologies such as next-gen sequencing or the Square Kilometre Array telescope, the world largest radio telescope, have evolved, which allow creating data in exascale dimension. While the availability of this data salvage to find answers for research questions, which would not have been feasible before, maybe even not feasible to ask before, the amount of data creates new challenges, which obviously need novel computational solutions. Such new solutions have to consider integrative approaches, which are not only considering the effectiveness and efficiency of data processing but improve

usability, reproducibility and sustainability, especially tailored to the target user communities. The goal of science gateways, also called virtual research environments or virtual laboratories, are following exactly this goal to provide an easy-to-use end-to-end solution hiding the complex underlying infrastructure. They support researchers with intuitive user interfaces to focus on their research question instead of becoming acquainted with technological details.

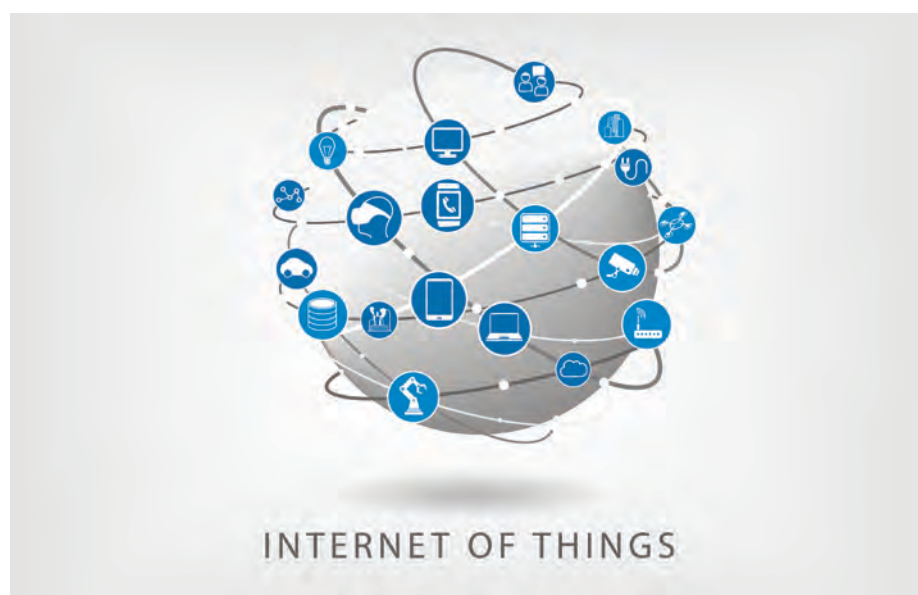
## Exciting fast evolving computational landscape

The computational landscape has never so fast evolved like in the last decade. On the hardware side from graphical processing units to sensors to smartphones, which possess computational capabilities, which are equivalent to capabilities of high-performance architectures only ten years

ago. The Internet has revolutionised our lives for the last 30 years and the Internet of Things (IoT) expand its vision to a network of physical devices, vehicles, buildings and other items embedded with electronics, software, sensors, and network connectivity that enable these objects to collect and exchange data. A further trend in the last 10 years include agile web frameworks allowing for much more user-friendly user interfaces in web browsers than ever before. Thus, users can apply rich-featured applications in browsers without the need to install or maintain desktop applications on their computers. Web-based libraries and application programming interfaces set the stage for modular, well-designed frameworks behind the scenes. The Cloud paradigm and containerisation approaches address the need for flexibility for accessing computational and data resources in the scale fitting to the users' and applications' needs.

## Multidisciplinary teams

Researchers are experts in their fields and to make their scientific discoveries faster and easier it is crucial to support them not only with effective and efficient computational methods but also with easy-to-use solutions, thus, science gateways. Science gateways lower the hurdle of employing the available complex architectures and infrastructures while simulating and model the often complex underlying theories. Multidisciplinary teams are necessary for creating a science



gateway for a specific research domain and the major challenge is the breadth of topics associated with science gateways. The challenges are manifold, from intuitive user interfaces and security features to efficient data and workflow management, and parallelisation of applications employing parallel and distributed computing architectures. Besides researchers from the target domain and computational scientists and/or developers, calling on experts for specific aspects, such as librarianship, statistics and machine learning, are essential, since it is not practicable for single persons to become an expert in every aspect of a science gateway.

### Research without geographical boundaries

Research communities collaborating on distinct topics are often geographically distributed and not located at one campus, in one country or on one continent. A key challenge is to integrate multiple disparate community clouds across the world into a single research infrastructure, where the user effectively does not have to worry about selecting the most appropriate service for them. Service selection should be transparent to the user – and they should be able to simply use the tools they need, share and access the data that they want, in as simple, rapid and limitation free way as possible. Users may want to share data not before they published or patented it. Hence, privacy and security needs have to be met in such an infrastructure but it should not hamper the sharing capabilities if they are desired. Thus, a science gateway for a research community is ideally a single point of entry irrespective of the location of a researcher. Science gateway frameworks are designed to exploit diverse underlying computing and data infra-

structures – campus-wide, national or international ones from clusters to Grid to Cloud. Such “pluggable” frameworks ease the development of a science gateway and the access to infrastructures and the main challenge does not lay on technical side, but on policy. The computing and data resources are mostly funded via local or national mechanisms and agencies and the exploitation of such resources is also often limited to such boundaries. Policies need to be aligned independent of geographical boundaries to allow for topic-related research within a community.

**“The Internet has revolutionised our lives for the last 30 years and the Internet of Things (IoT) expand its vision to a network of physical devices, vehicles, buildings and other items embedded with electronics, software, sensors, and network connectivity that enable these objects to collect and exchange data.”**

### Reproducibility of science

Researchers – independent to which community they belong – aim at sharing results and publishing them. Ideally, the results can be easily reproduced and science gateways provide a promising vehicle to allow for reproducibility of computational created data. Reproducibility is a cornerstone of science but computational methods used in science gateways are among others dependent on operating systems, tools in diverse versions and local or distributed data. Studies on shared computational methods present that only 20% are reproducible and reusable out of the box. For solving such problems in science gateways, the different sharing possibilities have to be analysed and – where necessary – tools, data and workflows have to be provided in diverse infra-

structures and via various job and data management systems to address such challenges.

### Sustainability of scientific methods

A further challenge for science gateways and computational scientific methods in general is their sustainability. Projects in academia depend on funding and often involve PhD students on the development side. More centralised research programmer teams, who can provide more experience and contribute to sustainability of solutions, are rather rare at universities and there is still a lack of incentives for interested developers to stay in academia. One of the future challenges for science gateways will be to increase the sustainability and getting less dependent on successful proposals. The US National Science Foundation has recognised the importance of this topic for research and has funded a Science Gateway Community Institute to support not only teams in developing science gateways but also to help communities to find a way to sustain their favourite science gateway for conducting their research.



**Sandra Gesing**  
**Research Assistant Professor**  
University of Notre Dame  
Tel: +1 574 298 0690  
[sandra.gesing@nd.edu](mailto:sandra.gesing@nd.edu)  
[www.sandra-gesing.com](http://www.sandra-gesing.com)  
[www.twitter.com/sandragesing](https://www.twitter.com/sandragesing)

# Digging into data for research

Canada is proud to co-lead efforts to internationalise social sciences and humanities research across the Atlantic – and back again. Here Ted Hewitt, President of the Social Sciences and Humanities Research Council of Canada explains why to [Adjacent Government](#)...

The social sciences and humanities research environment in Canada has always been a vibrant one. We are fortunate to have a large pool of talented researchers examining critical questions, and constantly exploring unseen avenues through which to innovate and, ultimately, improve the lives of Canadians.

But as the global landscape changes, and new digital research methodologies take hold, Canada is increasingly reaching beyond our borders to advance knowledge. Our interconnected world means that research that was once regionally focused may now be applicable an ocean away.

The [Social Sciences and Humanities Research Council](#) (SSHRC), as a research funding agency of the government of Canada, is in a good position to help mobilise our scientists and academics to make a big contribution to the world. An important foundation has been built through the establishment in 2013 of the [Trans-Atlantic Platform](#) (T-AP). A collaboration between key funders of social sciences and humanities research from the Americas and Europe, T-AP is meant to establish a sustained basis for cooperation and coordination between granting agencies in the social sciences and humanities. The goal is to open doors and remove barriers to international collaboration among researchers.

As co-chair of the EU-funded Trans-Atlantic Platform and president of SSHRC, I am proud of SSHRC's role as co-lead in this partnership. SSHRC is lead for the Americas, and the Netherlands Organisation for Scientific Research serves as the lead for Europe.

A concrete example of what T-AP can accomplish is the [Digging into Data Challenge](#). SSHRC is a key funder of this program. As information and research materials



*Ted Hewitt, SSHRC President*

increasingly become digitised, the fundamental information that social science and humanities researchers need can get lost in the sheer volume of materials now available.

The question of how best to tap “big data” in search of key insights, and how to develop and apply computer-based tools to help social sciences and humanities researchers access it, has been explored since the competition's inception in 2009. The relationships built through T-AP – now embracing 16 agencies representing 11 countries – have allowed this initiative to be expanded to an impressive array of funders and researchers.

Specifically, the T-AP Digging into Data Challenge offers funding to international teams of researchers to explore new methodologies and techniques for harnessing “big data” to address their research questions. The latest competition closed in June with an unprecedented 109 applications received. Each of these proposals has at least 3 T-AP countries participating. Winners are expected to be announced early in 2017.





Past funding award winners have delved into, and shared knowledge about, accessing and compiling data on a variety of topics. Some examples of winning projects are:

- A study of the 1918 Spanish flu outbreak in the United States and how media shaped public opinion around it;
- An examination of Twitter data to see how words are used by men and women in different regions of the United Kingdom and the United States;
- A project that brought together political scientists from Canada, the Netherlands and the United Kingdom to conduct a large-scale analysis of the proceedings of their countries' respective parliaments from the 1800s to present day to create a dataset to facilitate the study of them.

Building on the success of the Digging into Data project, T-AP aims to develop other international funding opportunities to further the ability of social sciences

and humanities researchers around the world to work together to advance scholarship in key areas of pressing global concern.

Closer to home, our goals at SSHRC are increasingly complementary to those of T-AP. We will continue to invest in developing next-generation researchers throughout Canada's postsecondary institutions who are equipped with the latest research tools. And we will continue to connect decision-makers in all sectors – public, private and not-for-profit – with the evidence-based knowledge that builds strong communities and innovative societies. ■

.....

**Ted Hewitt**  
**President**

Social Sciences and Humanities Research Council of Canada.

[www.sshrc-crsh.gc.ca](http://www.sshrc-crsh.gc.ca)

[www.twitter.com/SSHRC\\_CRSH](https://www.twitter.com/SSHRC_CRSH)

# Finding your motivation for exercise

Paule Miquelon, professor at Université du Québec à Trois-Rivières, is studying the self-regulation of physical activity behaviour – specifically, how the quality of motivation influences the adoption and maintenance of such activity

Engagement in regular physical activity is an important part of a healthy lifestyle. Research shows regular exercise to be linked to the prevention of cardio-vascular disease, type 2 diabetes, obesity, and hypertension. Public health guidelines for adults recommends the accumulation of at least 150 minutes per week of moderate-to-vigorous intensity physical activity in bouts of 10 minutes or more (World Health Organization, 2010). Unfortunately, in North America at least, available figures suggest that less than 15% of adults currently comply with these public health guidelines. Given these participation trends, it has become essential to understand why so few adults regularly practice physical activity, despite the documentation of beneficial effects on their health.

Concerning this issue, studying the quality of motivation associated with physical activity behaviour or the reasons why individuals choose to practice physical activity seems highly relevant, given that among the barriers identified by individuals, lack of motivation and enjoyment are determining factors (Sallis & Hovell, 1990). A promising theoretical approach to understand how the quality of motivation influences the adoption and maintenance of physical activity is Self-determination theory. According to this theory, the quality of individuals' motivation affects the extent to which they will engage in, and persist with, behaviors.



Central to the theory is the distinction between autonomous and controlled forms of motivation. Autonomous motivation is characterised by engaging in a behavior with a sense of choice, personal endorsement, interest, and satisfaction. By contrast, controlled motivation is characterised by engaging in a behavior with a sense of obligation and pressure (e.g., to satisfy external demands, such as a doctor's advice, or to avoid feeling guilty). Consequently, individuals who decide to exercise or to engage in a new physical activity (e.g., running) for autonomous motives are more likely to show commitment and sustained efforts to attain their goals (e.g., running 10 km/week for the next 6 months) than those who engage in this same activity for controlled motives.

## Research agenda and objectives

Professor Miquelon's research agenda focuses on the self-regulation of physical activity behavior among adults from the general population, as well as adults with type 2 diabetes. The aims of her research are twofold. A first objective is to examine to what extent adults who are autonomously motivated to practice physical activity (i.e., who engage in physical activity for the inherent fun associated to it or for personally relevant outcomes such as being healthy) are able to initiate this behavior and also, to maintain it within time. In the same vein, she also studies and compares the motivational profiles of adults who are a regular exerciser, non-regular exerciser, and inactive. In addition, as the adop-



## PROFILE



Paule Miquelon

tion and maintenance of physical activity can be challenging, despite the quality of one's motivation, another aim of her research is to examine how planning, a promising strategy for bridging the gap between intention and behavior, helps adults initiating and pursuing the practice of physical activity. Specifically, she examines how 2 conceptually distinct forms of plans, action and coping plans, contribute to physical activity initiation and maintenance. Action planning involves specifying the details of when, where, and how to act in the service of one's intentions (e.g., "At the end of the work day, I will go to my aerobic session by bringing my training clothes with me to work") while coping plans involves identifying how one will cope with potential barriers or obstacles that could get in the way of the goal striving process (e.g., "If I am tired after work, then I will take a short walk after dinner instead of doing aerobics").

### Recent results

Professor Miquelon and her colleagues have used longitudinal designs, as well as web-based surveys to verify the effect of one's initial motivation towards physical activity on his or her behaviour maintenance, or relapse within different periods of time (3, 6,

and 12 months later). Unsurprisingly, they found that people who showed greater autonomy in their decisions to undertake exercise showed more positive overall physical activity outcomes. This was true for a number of different measures of exercise success. Particularly, in one recent study, professor Miquelon and her colleagues were able to demonstrate that adults with type 2 diabetes who engage in physical activity for autonomous motives also reported a greater observance of physical activity guidelines. For more controlled motives, the research team found either no or negative associations with the outcomes of physical activity. This latter result supports the view that when physical activity practice is externally prescribed and associated with a sense of obligation (e.g., medical pressures toward weight-loss, especially among adults with type 2 diabetes), the chances of relapse and drop out are higher. Furthermore, professor Miquelon and her colleagues also found that individuals who are autonomously motivated towards physical activity tend to spontaneously form more action and coping plans related to physical activity. This is most likely due to greater levels of interest and autonomy that characterises autonomous, compared with controlled, forms of motivation. With fitness, or lack of it, playing such a major role in public health, it is important that both medical practitioners and members of the public can analyse their own motivations, and hopefully use this analysis to create better outcomes.

### Future Research

As recent studies have shown that individuals tend to indicate that they have engaged in more physical activity when asked to self-report this behavior

than when their behavior is evaluated with an objective measure, Professor Miquelon's future research plans are to supply self-reported measures of physical activity practice or relapses with objective tools, such as accelerometers. The objective will be to see if the relationship found between motivation's forms and the various indicators of physical activity behavior holds when the measures of behavior are physiological.

### KEY COLLABORATORS

Alexandre Castonguay, PhD candidate, Department of Psychology, Université du Québec à Trois-Rivières, Canada

Robert J. Vallerand, PhD, Department of Psychology, Université du Québec à Montréal, Canada

François Boudreau, PhD, Nursing Sciences Department, Université du Québec à Trois-Rivières, Canada

### PARTNERS



**Groupe Interdisciplinaire  
de Recherche Appliquée  
en Santé**

Research Group on Applied Health Issues (GIRAS), Université du Québec à Trois-Rivières, Canada – [https://oraprdnt.uqtr.quebec.ca/pls/public/gscw030?owa\\_no\\_site=3744](https://oraprdnt.uqtr.quebec.ca/pls/public/gscw030?owa_no_site=3744)



Research Laboratory on Motivational Processes (LIPROM), Université du Québec à Trois-Rivières, Canada

### FUNDING

Social Sciences and Humanities Research Council of Canada (SSHRC)

Fonds de Recherche du Québec – Santé (FRQS)

Fonds de Recherche du Québec – Société et culture (FRQSC)



**Université du Québec  
à Trois-Rivières**

**Paule Miquelon**

**Professor of Social Psychology**

Université du Québec à Trois-Rivières

Department of Psychology

Tel: +1 819 376 5011

[paule.miquelon@uqtr.ca](mailto:paule.miquelon@uqtr.ca)

[http://bit.ly/Paule\\_Miquelon](http://bit.ly/Paule_Miquelon)



# Language acquisition and bilingualism

Lydia White, James McGill Professor of Linguistics at McGill University, discusses research conducted by the Language Acquisition Research Group, based in Montreal, Quebec, Canada...

Language acquisition is a unique accomplishment, realised under many different circumstances. In an increasingly multilingual world, it is essential to understand the nature of second language (L2) acquisition and factors influencing it. Our team focuses on language acquisition by bilingual children, early or late L2 learners, and learners with language impairment.

We are a multidisciplinary team, with backgrounds in linguistics, psychology, and speech-language pathology. Our research is funded by the Fonds de recherche du Québec – Société et culture. The team includes the following professors at McGill University: Lydia White, Fred Genesee, Heather Goad, Yuriko Oshima-Takane, Karsten Steinhauer, Elin Thordardottir, as well as Phaedra Royle from l'Université de Montréal. Collaborators from McGill include: Meghan Clayards, Denise Klein, Kristine Onishi, Michael Wagner.

Our current focus is on neurocognitive underpinnings of language acquisition and use. Bringing together a variety of theoretical perspectives and adopting neurocognitive, psycholinguistic and behavioural methodologies, we address 3 themes: language acquisition – investigating effects of prior linguistic knowledge, proficiency, age, memory, etc.; language attrition – including loss of the birth language, influence of the L2 on the first lan-

guage (L1); processes and mechanisms underlying language processing.

Examples of ongoing work by team members are presented below.

## Language Acquisition

Our team explores a number of issues, identifying and explaining linguistic properties that cause problems for learners and for children with language impairment.

Language acquirers, be they children, adults, impaired or unimpaired, have problems in consistently producing appropriate inflections (tense, agreement, etc.) and function words (determiners, auxiliaries, etc.), sometimes omitting them (e.g., *she jump* instead of *she jumps*), sometimes substituting inappropriate forms. Heather Goad and Lydia White propose a phonological account, arguing that L2 learners' difficulties are attributable to differences in how inflection is prosodified in the L1 and L2. Results on English from speakers of Mandarin, Korean and Turkish, as well as French from English speakers, and Spanish from French-speakers show that omission and substitution are phonologically-determined.

Phaedra Royle and colleagues compare children and adults learning L2 French with children with language impairment on sensitivity to verb conjugation patterns. Results show no differences

between L2 adults and children – performance is better on regular and high-frequency verbs. Language impaired children, in contrast, behave differently, with regular and irregular verbs proving equally problematic.

If children are under-performing, is this because they are bilingual, or language impaired, or both? There is a need for diagnostic tests which distinguish between the productions of children with impairment and child L2 learners. Pursuing the question of differences between bilingual acquisition and language impairment, Elin Thordardottir addresses ways to diagnose impairment in young children and distinguish it from effects of bilingualism.

## Language attrition

When people are exposed to an L2 and use it more than – or in place of – the mother tongue, there can be loss of the L1 or effects of the L2 on the L1.

Fred Genesee, Denise Klein and colleagues look at international adoptees exposed to Chinese at birth, who are adopted into French-speaking families at ages 1-2, with no further contact with Chinese. These children do not differ from monolingual acquirers of French on behavioural tasks, showing no effects of the birth language. Nevertheless, they retain neurological traces of the birth language, suggesting that very early language experience

may have permanent consequences. The neuro-cognitive systems underlying their use of French are characteristic of child L2 learners.

Karsten Steinhauer and colleagues have observed somewhat similar effects in adults, in that differences at the brain level are not necessarily revealed in behavioural tasks. The population in question consists of adult migrants whose L1 is Italian, living in an L2 environment, English, with relatively little contact with Italian as adults, tested on a number of different linguistic properties, including verbal and nominal inflection, word-order, and word meanings. Event-related potentials show evidence of L1 attrition at the brain level; when processing their L1, they resemble adult L2 learners of Italian in some areas.

### **Language processing**

It is frequently assumed that non-native performance reflects processing difficulties, which may be permanent. Our research suggests that differences in L2 proficiency, rather than more fundamental cognitive differences, may explain discrepancies between L2 and native speaker processing. In other words, native-like implicit processing is attainable by highly proficient L2 speakers.

Steinhauer and colleagues compare Chinese- and German-speaking learners of English in processing sentences like: *While the bear is approaching the people come running*, which can be misinterpreted unless there is a pause after *approaching*. Results show that, even when the L1 is very different

from the L2, with continued L2 exposure, it is possible to achieve brain signatures like native speakers.

**“Our team explores a number of issues, identifying and explaining linguistic properties that cause problems for learners and for children with language impairment.”**

Goad, White and colleagues investigate how learners interpret ambiguous sentences such as: *Someone spoke to the servant of the actress who was on the balcony*, using listening tasks to determine the influences of overt prosody on L2 processing decisions, when the L1 and L2 differ in the preferred interpretations of such sentences. Results from Spanish-speaking learners of English suggest that advanced learners – but not intermediates – are able to take full account of prosodic boundary information (including pauses), supporting the proposal that proficiency is largely what determines eventual L2 processing outcomes.

Yuriko Oshima-Takane and colleagues examine performance of Japanese-English bilinguals in judging the acceptability of sentences with omitted objects (grammatical in Japanese, ungrammatical in English). EEG patterns of bilinguals listening to ungrammatical English sentences differ from English monolinguals (and resemble Japanese monolinguals). However, bilinguals with native-like English proficiency living in English-speaking countries show EEG patterns similar to English monolinguals. Once again, these results suggest that processing differences between L2

learners and native speakers are overcome with sufficient exposure and advanced proficiency.

In conclusion, the relationship between changes in the brain and environmental and linguistic factors in explaining how language is acquired, maintained and processed will be of considerable interest to linguists, psychologists, and neuroscientists, with practical applications for clinical practice, language teaching, and language planning. Our research has the potential to contribute to informed public debate on the advantages of bilingualism, a central concern in the Canadian context, as well as more broadly.

For more information on the Language Acquisition Research Group, [click here](#).



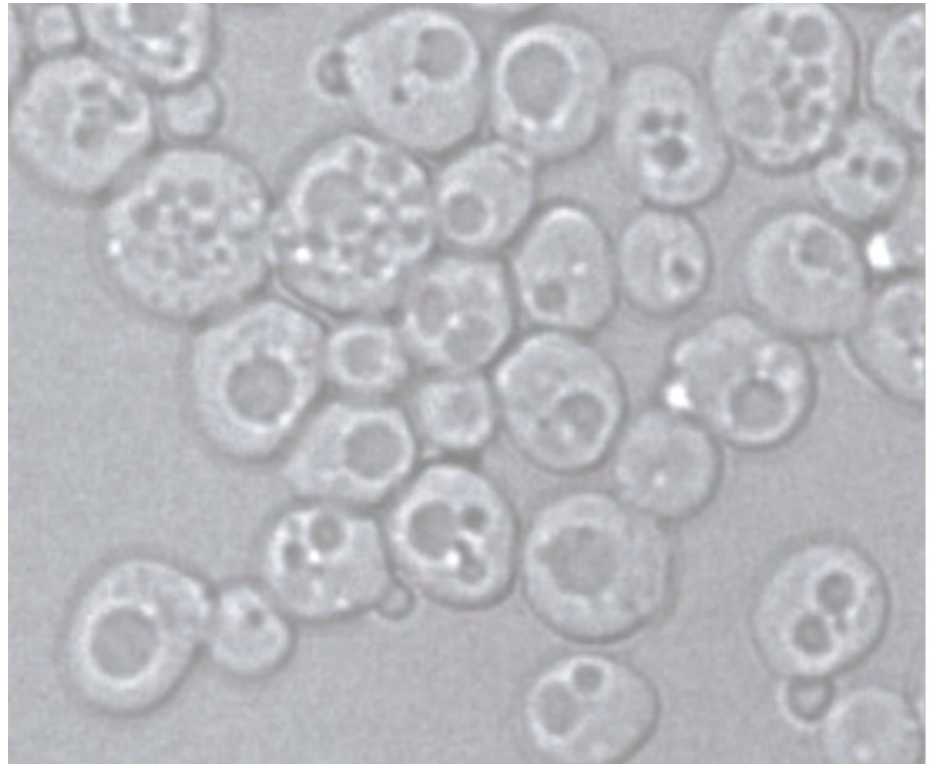
**Lydia White**  
**James McGill Professor**  
McGill University  
Tel: +1 514 398 4143  
[lydia.white@mcgill.ca](mailto:lydia.white@mcgill.ca)  
<http://www.crblm.ca/>

# Anatomy and cell biology

Dr. Troy Harkness' lab at the University of Saskatchewan, in the Department of Anatomy and Cell Biology, has used funds provided by the CIHR Institute of Aging to advance our knowledge of how cells age using budding yeast as a model

The Canadian Institute for Health Research (CIHR) provides funding for a broad array of research across Canada, ranging from patient oriented research to curiosity driven science using a diverse variety of model systems including bacteria, yeast, worms and flies. With the idea in mind that DNA maintenance is the most critical event in a cell's life, it becomes apparent that knowledge gained from simple model systems, such as yeast, can be directly applied to human health. This idea is forged by the fact that cancer arises when DNA stability goes awry and that basic heredity is grounded in the passage of perfect copies of the genome from mother to daughter. At the molecular level, yeast and humans are very similar, with upwards of 50% of human genes conserved with their yeast counterpart. The conserved molecular and genetic nature of yeast and human cells has allowed yeast to be used extensively to study the molecular genetics of cancer and aging. Strikingly, the first genes isolated that influenced yeast aging are functionally conserved all the way to mice, and in some cases, predicted to apply to humans as well<sup>1</sup>.

Dr. Troy Harkness' lab at the University of Saskatchewan, in the Department of Anatomy and Cell Biology, has used funds provided by the CIHR Institute of Aging to advance our knowledge of how cells age using budding yeast as



a model. Over the past 2 decades it has been clear that sugar metabolism and the stress response play opposed roles in controlling cell proliferation and protecting the cell from damage. The insulin-signalling pathway in multicellular organisms is at the nexus of growth and repair. When the equilibrium of the pathway is altered, uncontrolled proliferation (cancer), or increased stress response (increased cell health), will result. However, studying signalling pathways at the molecular and genetic level in animal systems is very difficult, limiting what we can learn about how to control ageing and cancer. The effects on cell health and

stress response are what tweaked researchers to the fact that yeast ageing can be genetically controlled; increased cell health directly leads to increased lifespan. The budding, or more commonly, baking or brewing yeast, does not respond to insulin, but nonetheless encodes intracellular components of the insulin-signalling pathway. This is because yeast cells respond directly to sugars in the environment and do not need insulin to tell them food is available. The Harkness' lab first foray into ageing studies was the result of identifying a critical modulator of cell cycle progression that could directly control yeast lifespan;



## PROFILE



Dr. Troy Harkness and Dr. Terra Arnason

the Anaphase Promoting Complex (APC), a large multi-subunit conserved protein complex, targets proteins that inhibit mitotic progression for ubiquitin-dependent protein degradation, and when defective, yeast lifespan is decreased, but lifespan is increased when the APC subunits are overexpressed<sup>2</sup>. Studies have shown that conserved factors in cells, from yeast to humans that inhibit the insulin-signalling pathway, particularly the AMP-dependent kinase (AMPK in humans, SNF1 in yeast), halt cell growth in the presence of stress, leading to increased yeast lifespan<sup>2-4</sup>.

With this knowledge, Harkness then turned to his colleague, Dr. Terra Arnason, a Clinician Scientist in the Division of Endocrinology at the University of Saskatchewan, who uses yeast to study metabolic disorders such as diabetes. The Arnason lab has shown that the yeast AMP-dependent kinase, SNF1, is regulated through its Ubiquitin-Associated (UBA) domain<sup>3</sup>. This novel observation was coupled with their discovery that SNF1 activity was driven by the stress response Forkhead Box (FOX) transcription

factors Fkh1 and Fkh2 and together impacted stress resistance and ageing control. The FOX family members, which are highly conserved from yeast to humans, play an important role in extending lifespan in a variety of organisms<sup>5</sup>. The Harkness lab was the first to show that Fkh1 and Fkh2 control yeast aging and that this occurs in collaboration with the APC<sup>6-8</sup>. In human cells, it is known that AMPK and FOXO proteins respond to stress, as in yeast, but how they interact remains elusive. Also, AMPK and the FOXOs play a negative role in insulin-signalling, the basics of which are clear, but fine detail is still lacking. The collaborative work proposed by the Arnason and Harkness labs using yeast provides the opportunity to extend what we know about how cancer and ageing pathways in humans can be fine-tuned, with the potential of identifying novel druggable targets. With the generous assistance of CIHR, this research will lead the way to understanding the fine details governing how stress response pathways can increase the health of a cell, ultimately lead to better health and longevity of the organism.

### References

- Pitt JN, Kaerberlein M. (2015). Why is aging conserved and what can we do about it? *PLoS Biol.* 13:e1002131.
- Harkness TA, Shea KA, Legrand C, Brahmanian M, Davies GF. 2004. A functional analysis reveals dependence on the anaphase-promoting complex for prolonged life span in yeast. *Genetics* 168:759-74.
- Jiao R, Postnikoff S, Harkness TA, Arnason TG. 2015. The SNF1 Kinase Ubiquitin-associated Domain Restrains Its Activation, Activity, and the Yeast Life Span. *J Biol Chem.* 290:15393-404.
- Yao Y, Tsuchiyama S, Yang C, Bulteau AL, He C, et al. 2015. Proteasomes, Sir2, and Hxk2 form an interconnected aging network that impinges on the AMPK/Snf1-regulated transcriptional repressor Mig1. *PLoS Genet.* 11:e1004968.
- Martins R, Lithgow GJ, Link W. 2016. Long live FOXO: unraveling the role of FOXO proteins in aging and longevity. *Aging Cell* 15:196-207.
- Malo ME, Postnikoff SD, Arnason TG, Harkness TA. 2016. Mitotic degradation of yeast Fkh1 by the Anaphase Promoting Complex is required for normal longevity, genomic stability and stress resistance. *Aging* 8:810-30.
- Postnikoff SD, Harkness TA. 2012. Mechanistic insights into aging, cell-cycle progression, and stress response. *Front Physiol.* 3:183.
- Postnikoff SD, Malo ME, Wong B, Harkness TA. 2012. The yeast forkhead transcription factors fkh1 and fkh2 regulate lifespan and stress response together with the anaphase-promoting complex. *PLoS Genet.* 8:e1002583.



**Dr. Troy Harkness**  
[troy.harkness@usask.ca](mailto:troy.harkness@usask.ca)

**Dr. Terra Arnason**  
[terra.arnason@usask.ca](mailto:terra.arnason@usask.ca)

University of Saskatchewan  
Saskatoon  
Saskatchewan  
Canada  
<http://medicine.usask.ca/departments/schools-divisions/biomed/acb.php>

# Protecting victims of crime in Canada

Adjacent Government highlights how the Ministry of Justice in Canada is helping to minimise trauma to children involved in criminal cases...

The law affects many aspects of our everyday lives, no matter what country you live in. Wherever in the world we are, there are laws in place to keep us safe and ensure we follow the right paths. The justice systems are there to ensure our safety and protection from criminal activity.

In Canada the Ministry of Justice is responsible for ensuring the justice system throughout the country is fair, accessible and efficient. The Department represents the government in legal matters, with the current Minister of Justice being Jody Wilson-Raybould.

In Canada, the Department of Justice and the government know the importance of support for victims. As well as making sure that laws are followed and justice is fair, the Department has a role to play in support and protection to victims of crime.

In order to further boost this support to victims, the Honourable Jody Wilson-Raybould [recently announced funding](#) of €3,411,450 over 5 years to enhance and support services to victims and survivors of crime in British Columbia.

The funding is expected to be used for projects to help advance services and access for justice for victims and their families. These projects will improve services to family members of homicide victims, child victims, victims of domestic violence, victims in remote communities and Aboriginal communities.

Commenting on the funding the Honourable Jody Wilson-Raybould said: "Responding to the needs of victims and their families helps to reduce devastating consequences of crime, not only for victims but for society at large.

"It is important that all levels of government work together to ensure that victims of crime have the services they need and can access the justice system."

The justice system can be challenging, and when children are involved, either as victims or criminals, it can be even trickier. Protecting children that are involved in criminal cases is paramount in order to prevent any kind of long term impact.

The Ministry of Justice in Canada reports that "over the last decade, an increasing number of studies have examined the extent which children's memories are susceptible to suggestion, as a result of post event information.

The [Ministry of Justice states](#): "There have been a proliferation of studies on the suggestibility of children's memories. The findings are at times contradictory and confusing, but several consistent results are appearing. Children are more suggestible than adults and younger children are more suggestible than older children.

"There are interview characteristics such as number of interviews, style of questioning employed in interviews (open, repeated, exploratory, direct, probing, misleading, forced choice and yes-no), emotional tone of interviewer, and social pressure that appear to affect the accuracy of the response's given by children about events they have experienced. Post event information prior to the investigative interview is another factor, which can affect children's reports."

[Child Advocacy Centres](#) (CACs) in Canada are a way to help minimise induced trauma to children involved in criminal cases. Their aim is to provide a single, child-friendly setting for young victims or witnesses



and their families to seek services. Funded by the Victim's Fund, CACs are said to greatly reduce the emotional and mental harm to child and youth victims involved in the criminal justice system.

**“The Ministry of Justice in Canada reports that “over the last decade, an increasing number of studies have examined the extent which children’s memories are susceptible to suggestion, as a result of post event information.”**

In 2015, the Canadian government, as part of their Economic Action Plan 2015, provided additional funding to CACs and child and youth advocacy centres (CYACs). From 2016 to 2017, the government aims to provide \$5.25m over 4 years, and \$2.1m on an annual basis thereafter. This funding is expected to help make support services that are provided by these centres more accessible to communities across the country.

Speaking in 2015 about the funding, Robert Goguen, Parliamentary Secretary to the Minister of Justice and Attorney General, said: “Our government is committed to standing up for victims of crime and giving them a more effective voice in the criminal justice and corrections systems.” ■

.....  
Adjacent Government  
[editorial@adjacentgovernment.co.uk](mailto:editorial@adjacentgovernment.co.uk)  
[www.adjacentgovernment.co.uk](http://www.adjacentgovernment.co.uk)  
[www.twitter.com/Adjacent\\_Gov](https://twitter.com/Adjacent_Gov)



# Children's allegations of sexual abuse

One thing I have learned after conducting over 2 decades of research, is that one can never assume anything about children's memory. In fact, I began work in this field precisely because I was hearing lots of opinions in the legal system about children's memory that did not fit with what I learned during lectures on child development. In these lectures, the common theme was "Isn't it incredible what children can do?" whereas commentators in the legal system focused on what children cannot do. Yet, decisions in child sexual abuse criminal cases often hinge on people's assumptions about children's memory. Jurors, judges, prosecutors, police officers, social workers, parents and so on, can influence the case based on their opinion of what children should and should not remember. Some common myths are sexual abuse is so traumatic children would remember it if it happened, interviews need to be done in 10 minutes as children have short attention spans, and children routinely confuse fantasy and reality. Through funding from national research councils, I and students in the Child Memory Lab have tested this last assumption to determine whether it is true or a myth.

This assumption has been cited in legal cases for a long time. I conducted a simple experiment with Dr Mark Blades (University of Sheffield) in 1995. We asked children to hide some buttons in a room and just pretend to hide other buttons. We later asked them where they had hidden the buttons

and found that 3- and 4-year-olds were quite confused about buttons they had actually hid and those that they had merely imagined hiding. However, when I put them back in the room and asked them to go only to where they had actually hidden the buttons, their accuracy shot up, and 6-year-olds were even as accurate as adults. This study taught us that children may appear deficient on the surface but when we modify tests to be more developmentally-appropriate (letting children search for the buttons), we allow children to use their skills appropriately.

Over the next decade, researchers began to realise that there are many sources of information (in addition to children's own imagination), that can contaminate children's testimony. Police investigators are often concerned about informal interviews by parents and concerned adults, whether children have seen similar events on television, talked to other alleged victims, and so on. We have shown, in the Child Memory Lab, that anyone (child or adult) can be confused about the sources of information they recall ('Did I send the email or just imagine sending it?'; 'Did Jan or David tell me about the new job?'). Source confusion is most likely when the sources are similar, when memories of the events have faded, and when information comes from a credible or knowledgeable source. Unfortunately, these are often the conditions children have experienced before they disclose that they have been abused. Consider,



*Kim P Roberts PhD, Professor*

for example, a child who has been abused for many years (similar, repeated events), takes a long time to disclose the abuse (memories have faded), and a well-meaning parent has unknowingly suggested that the abuse was 5 years ago, when it was actually 2 years ago (credible source).

I have spent the last decade with my students and collaborators developing techniques to reduce contamination from outside sources. It has not been an easy road. Very young children (aged 3 and 4 years old), often do not even understand that someone can believe something happened but be mistaken in that belief. Children aged 6 to 10 have trouble inhibiting (purposefully not thinking about) information from another source. Pre-teens (aged 10 to 12) are able to monitor multiple sources of information but do not necessarily do so.

## PROFILE



My strategy has been to a) highlight that there are other sources of information, b) teach children to compare different sources, and c) give practice in monitoring sources and their corresponding information. In some recent studies conducted with Dr Martine Powell and Dr Sonja Brubacher (Deakin University, Australia), we have found we can 'warm up' children by asking them to describe 2 instances of a repeated event (e.g., swimming lessons, weekly visits to grandparents), before discussing the abuse allegations. The warm up provides an opportunity for interviewers and children to develop rapport and, importantly, allows the child to realise that their memories contain information from different sources (in this case, other instances of an event). When the actual topic of the interview is then discussed, children inform interviewers early on if

there has been more than one event, and report more information than children who practised describing just one instance.

It is essential that researchers have appropriate funds to carry out this research. It takes several years and multiple studies to develop a training technique like the repeated-event training just described. It is necessary to test the technique with children from age 3 to teenagers, to carefully observe whether children report more information, to check that the technique does not harm the accuracy of children's memory, and conduct feasibility studies so that the technique can easily be used in the field by investigative interviewers. It is only through meticulous research like this that we can gather objective evidence of children's skills and when they develop, rather than

simply relying on inaccurate assumptions about children's memory. Arguably, this will reduce false convictions and increase true convictions providing better justice and protection to child victims of abuse. Through this research, everyone wins.



**Kim P Roberts PhD**

**Professor**

Wilfrid Laurier University

Tel: +1 519 884 0710 ext. 3225

[kroberts@wlu.ca](mailto:kroberts@wlu.ca)

[www.childmemorylab.com](http://www.childmemorylab.com)

[www.wlu.ca](http://www.wlu.ca)

[www.twitter.com/childmemorylab](https://twitter.com/childmemorylab)





# SUBSCRIBE FOR FREE

Adjacent Government is pleased to offer a FREE subscription service to all our products including our regular newsletters.

We can offer you news and features focusing on a specific topic plus a monthly round-up.



**Click here to go to our subscription page**  
You can choose from a variety of newsletters from our selection of subject areas

[www.adjacentgovernment.co.uk/subscribe](http://www.adjacentgovernment.co.uk/subscribe)



# An education for every child

The Ministry for Education in Ontario answers Adjacent Government's questions on the importance of every child in Canada benefiting from world class education...

**E**ducation in any country is important and it's key that every child has the chance to achieve their full potential. In Canada, it is no different and the Ministry of Education in the province of Ontario strives to provide education and support to pupils of all communities. Here they outline to Adjacent Government their commitment to every child in the province and steps that have been taken to reach these goals.

## How important is it for each child in Ontario to benefit from education?

Vibrant communities and a prosperous society are built on the foundation of a strong education system, and the task of the government is to help the province of Ontario's 2 million students reach their full potential.

In 2014, the Ontario government launched [Achieving Excellence: A Renewed Vision for Education in Ontario](#). Its 4 goals are: Ensuring Equity, Promoting Well-being, Enhancing Public Confidence and Achieving Excellence. The vision reaffirms the province's commitment to helping all learners in the province's education system develop the knowledge, skills and characteristics that will lead them to become personally successful, economically productive and actively engaged citizens.

Ontario's publicly funded education system partners with parents, guardians and communities to help develop successful graduates. With a provincial five-year graduation rate of 85.5% – we now have 190,000 additional students who have graduated since 2004 – students who would not have done so had the rate remained at the 2004 level.

## How does Ontario's Ministry of Education support schools and pupils in First Nations?

In keeping with our Aboriginal Education Strategy, the ministry continues to focus on reaching 2 primary

objectives: improving student achievement and well-being among First Nation, Métis and Inuit students, and closing the achievement gap between Indigenous students and all other students in Ontario.

**“Ontario's investments in its publicly funded education system are paying dividends. The province's strong graduation rate and international test scores confirm our success. But we are not complacent; we know that more work needs to be done to continue improving Ontario's system and help every student reach their full potential.”**

The government is also committed to continuing to build positive relationships with Ontario First Nations and working in a spirit of mutual respect through all interactions. Although the Ministry of Education does not provide direct funding for the operation of First Nation schools, the ministry works in partnership with First Nations and the federal government to achieve the goal of the Aboriginal Education Strategy.

We know that strong partnerships between the ministry, school boards, schools, educators, families, students and community organisations are essential in our work. To reach our goals, we have taken important steps in making system-wide changes including targeted funding, professional development and the integration of First Nation, Métis and Inuit perspectives into the curriculum.

## How important is it for all young Canadians to understand Indigenous histories and culture?

All students, both Indigenous and non-Indigenous, are enriched by learning about the histories, cultures and perspectives of First Nation, Métis and Inuit peoples in Canada. Also, students are more engaged in their



learning when they see their own communities and cultures reflected in the curriculum.

Since 2003, the Ontario Ministry of Education has engaged a broad range of Indigenous stakeholders and academic experts during the curriculum review process to ensure that the curriculum is more inclusive of First Nation, Métis and Inuit histories, cultures, contributions and perspectives.

Thanks to the contributions of our First Nation, Métis and Inuit partners, every Ontario student is building a greater awareness and understanding of Indigenous histories, cultures and perspectives. The teaching of the histories, culture and perspectives of Indigenous people – including residential schools – is now a mandatory part of the teacher training curriculum.

In 2014, Ontario sent First Nations and Treaties maps

to every elementary and secondary school in the province to help raise awareness about treaties. These maps and the accompanying teaching resources are helping students to learn about the significance of the treaties and the shared history of First Nations and non-Indigenous Ontarians. Our province has designated the first week of November as [Treaties Recognition Week](#) to promote public education and awareness about treaties and treaty relationships.

### **How can this help to develop greater community throughout the country?**

Ontario's diversity is one of the province's greatest assets. Embracing this diversity and moving towards inclusivity and respect will help us reach our goal of making Ontario's education system the most equitable in the world. Everyone in our publicly funded education system – regardless of background or personal circumstances – must feel engaged and included.

### How important is integration in schools in order to bring together different communities?

Ontario schools need to be places where everyone can succeed in a culture of learning and high expectations. The government's work over the past decade has been focused on helping all children and youth reach their full potential by giving them the tools to help overcome obstacles. We are seeing the results, which includes a culture shift in schools that recognises diversity as a contributor to success, and not a barrier. The fundamental principle driving this work is that every student has the opportunity to succeed, regardless of ancestry, culture, ethnicity, gender, gender identity, language, physical and intellectual ability, race, religion, sex, sexual orientation, socio-economic status or other factors.

**“We know that strong partnerships between the ministry, school boards, schools, educators, families, students and community organisations are essential in our work. To reach our goals, we have taken important steps in making system-wide changes including targeted funding, professional development and the integration of First Nation, Métis and Inuit perspectives into the curriculum.”**

### How does the ministry support Achieving Excellence throughout Ontario with investments such as the recent \$7M for First Nations Métis and Inuit students?

Ontario's Aboriginal Education Strategy sets the foundation for improving achievement among Aboriginal students in provincially funded schools and supports life-long learning beginning in the early years and continuing through postsecondary, training or workplace opportunities. In 2016-17, Ontario's targeted investments for Indigenous education will be more than \$71mn.

Some of the more recent investments will help provide all school boards with a new senior-level position dedicated to supporting First Nation, Métis, and Inuit

education initiatives. This initiative clearly demonstrates Ontario's support for the education recommendations of the Truth and Reconciliation Commission. In addition, this new position will promote a greater awareness of Indigenous histories, cultures, perspectives and contributions among all students, while developing greater community and family engagement.

Ontario's support for Indigenous students is part of the province's overall annual education budget, which is estimated to be \$22.9bn for 2016-17.

### How can investments such as this help to deliver world class education for all?

Ontario's investments in its publicly funded education system are paying dividends. The province's strong graduation rate and international test scores confirm our success. But we are not complacent; we know that more work needs to be done to continue improving Ontario's system and help every student reach their full potential. Equity remains a key goal of our education system, and through our many investments in education, we are committed to helping all of our students achieve success in school and beyond. ■



Ministry of Education  
Government of Ontario  
[www.edu.gov.on.ca/eng](http://www.edu.gov.on.ca/eng)



# Residential Schools: Truth and Reconciliation Commission Report and Implications for Education

**“Reconciliation is not an Aboriginal problem, it’s a Canadian problem. It involves all of us.”**

**(Justice Murray Sinclair, TRC Chair)**

On Wednesday 11 June 2008, the then Prime Minister Stephen Harper made a Statement of Apology to former students of Indian residential schools on behalf of the Government of Canada, for their role in the operation of those schools. The apology was intended as a recognition that the residential school policy of assimilation was wrong, had caused irreparable long-term harm, and had no place in the ideology of the country. Canada fell into an identity crisis when the myth of Canada the Good was challenged by the acknowledgement of this shameful and ugly part of Canada’s history. After all, what does this mean for our past, our future, our identity and our reputation as a nation? What does it mean for us individually as citizens of a nation that could actively participate in and condone such acts of abuse and genocide?

Residential schools were government-sponsored church-run schools. The schools in Canada were predominately funded and operated by the Government of Canada together with Roman Catholic, Anglican, Methodist, Presbyterian and United churches. The residential school era dates from the 1870s through to the 1990s. Indian residential school administrators and clergy, with the help of the Royal Canadian Mounted Police and Indian Agents, forcibly and violently removed over 150,000 First Nations, Métis, and



Inuit (FNMI) children ages 4-16 from their families and communities.

Nicholas Flood Davin in his 1879 Report on Industrial Schools for Indians and Half-Breeds [http://www.canadianshakespeare.ca/multimedia/pdf/davin\\_report.pdf](http://www.canadianshakespeare.ca/multimedia/pdf/davin_report.pdf) states “[I]f anything is to be done with the Indian, we must catch him very young. The children must be kept constantly within the circle of civilized conditions” (p. 12). These schools were established to “kill the Indian in the child” by: isolating FNMI children from the influence of their homes, families, traditions and cultures; severing connections to family and eliminating parental involvement in the intellectual, cultural and spiritual development of their children; stripping Indigenous children of their language; disrupting intergenerational transmission of vital traditional knowledge thereby destroying links to ancestral culture and traditions; and institutionalised assimilation into the dominant “Canadian” culture. These

children would often be placed in schools hundreds of miles away from their home communities in an effort to keep them from running away as well as to minimise parental visitation and the likelihood that the children would be able to tell family or community members about the realities of the schools.

In 1920, amendments to the 1876 Indian Act made it legally mandatory for every FNMI child to attend residential school. The Indian Act was developed over time through two separate pieces of legislation regarding First Nations peoples across Canada: The 1857 Gradual Civilization Act and the 1869 Gradual Enfranchisement Act. Under the Indian Act an Indian<sup>1</sup> was defined as: “First, any male person of Indian blood reputed to belong to a particular band; Secondly, any child of such person; Thirdly, any woman who is or was lawfully married to such person.” (Indian and Northern Affairs Canada, 2002, p. 1).

While the 1876 Indian Act does not include the Métis and Inuit people, under this definition Métis and Inuit children were also forced into residential schools and have been and continue to be equally impacted by these experiences. Church officials consistently put pressure on Indian Affairs to ensure that Métis and Inuit children attended residential schools. In 1911 Indian Affairs school inspector, J. A. K. McKenna made the argument that it was in the best interests of the country to admit Métis children to Indian residential schools and sent a letter to the secretary of the Department of Indian Affairs stating:

Our Indian residential schools are the only agencies for the proper upbringing of these unfortunate class of children. What is to keep them from becoming outcasts and menaces to society if they be not taken into Indian schools — schools established and maintained, be it remembered, not for the mere purpose of fulfilling the conditions of Indian treaties, but in the interest of the commonwealth. (as cited in Truth and Reconciliation Commission of Canada, 2015b, p. 23-24).

Similarly in the North, in 1927 A. L. Fleming, conducted an experiment requesting that two boys be sent from the Northwest Territories to a school in the south stating that “[t]he idea is not to educate these boys and send them back to the simple primitive Eskimo life, but to send them back for all practical purposes as white men” (as cited in Truth and Reconciliation Commission of Canada, 2015a, p. 26).

The experience proved disastrous for the two boys and they returned to the North after a year during which they suffered horrendous chronic illnesses such as influenza, pneumonia, measles, and tonsillitis. The department of Indian Affairs, while initially focusing most of its financial resources and political energies in educating First Nations children also, upon pressure from church officials, extended that treatment to Métis and Inuit children in the best interest of the commonwealth.

The 1876 Indian Act (and amendments) is administered by the Minister of Indigenous and Northern Affairs Canada and is still in full force and effect. It is the legislation that governs First Nations people and their communities. It is very wide-ranging in scope, covering governance, land use, healthcare, and education. Duncan Campbell Scott, then Deputy Superintendent General of Indian Affairs, in his 1920 speech to parliament regarding Bill 14, an amendment to the Indian Act stated: “I want to get rid of the Indian problem. Our objective is to continue until there is not a single Indian in Canada that has not been absorbed into the body politic, and there is no Indian question, and no Indian Department and that is the whole object of this Bill.” (Titley, 1998, p. 50)

Following the passing and ascension of the 1920 Bill 14, parents were forced to surrender legal custody of their children to the school principals – who were church employees – or face imprisonment. The principals became the legal guardians of the FNMI children in their

schools. By assuming legal guardianship of the children the schools were no longer under any obligation to advise the parents of the status and well-being of their children, even in the event of illness or death. In some cases parents never heard from their children again – they are often referred to as the lost generation. Far too many of the children in those schools suffered various forms of horrendous atrocities and abuse. Some died as a result of neglect, illness, and abuse or from exposure when they attempted to run away and tried to go home.

At the peak of the Residential School era there were over 130 residential schools located across the country. The last Canadian residential school, the Gordon Residential School in Saskatchewan, closed in 1996. The objectives of residential school policies were based on the assumption that FNMI cultures, languages and spiritual beliefs were inferior and savage and that institutionalised assimilation was the only way to “save souls” and “civilise” the Indians. While there are an estimated 80,000 former students living today, the ongoing impact of residential schools has been felt through the generations and has contributed to social problems and mental health issues that continue to exist. As Johanne Coutu-Autut, spouse of a former Turquetil Hall resident, so eloquently states: “I want Canadians to understand that the [legacy of the residential schools] does not just affect the lives of the person who actually attended the school but family members, such as spouses and

## PROFILE

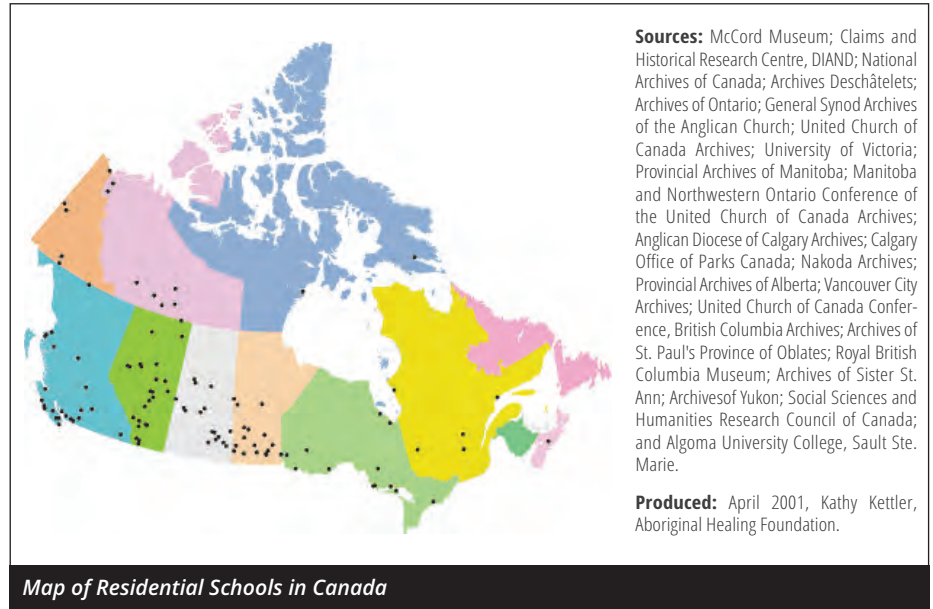
children, are also very deeply affected about this sad legacy in history.” (cited in TRC, 2015, p. 183)

The Canadian government implemented this policy of assimilation and genocide for economic and political reasons. The government wished to get out of its legal, financial, and ethical responsibilities to FNMI people under the Treaties in order to gain access and control of land and resources: “If every Aboriginal person is absorbed into the body politic, there would be no reserves, no Treaties and no Aboriginal Rights” (TRC, 2015, p. 3).

One of the outcomes of the 2008 Canadian Government Apology was the mandate to establish a Truth and Reconciliation Commission (TRC). The TRC was established June 1, 2008 as an independent body whose mandate was to:

- (a) Acknowledge residential school experiences, impacts and consequences;
- (b) Provide a holistic, culturally appropriate and safe setting for former students, their families and communities as they come forward to the Commission;
- (c) Witness, support, promote and facilitate truth and reconciliation events at both the national and community levels; and
- (d) Promote awareness and public education of Canadians about the Indian Residential School system and its impacts.

The TRC completed its work in 5 years and presented its final report in June



2015. In order to remedy the legacy of residential schools and move toward reconciliation the final report contains 94 Calls to Action covering five broad areas relating to child welfare, education, language and culture, health, and justice. We have pulled out the most salient points from each of the broad areas. Each of these points have direct relevance and particular implications for education across diverse contexts. The TRC calls upon the government, in genuine consultation and with the full participation and informed consent of FNMI peoples:

**Child Welfare:** To reduce the number of FNMI children in care by ensuring that social workers and others who conduct child-welfare investigations are properly educated and trained about: the history and impacts of residential schools; and the potential for FNMI communities and families to provide more appropriate solutions to family healing. Also, to develop cultur-

ally appropriate parenting programs for FNMI families.

**Education:** To develop strategies to close funding, educational attainment, and employment gaps; to draft new FNMI education legislation that includes a commitment to sufficient funding and would incorporate the values and principles of FNMI peoples; to provide adequate funding to end the backlog of FNMI students seeking to enter post-secondary education; and to develop culturally appropriate early childhood education programmes for FNMI families.

**Language and Culture:** Acknowledge and recognise that FNMI rights include FNMI language rights; enact an FNMI Languages Act that incorporates the values and principles of FNMI peoples; appoint an FNMI Languages Commissioner who will have oversight of FNMI language initiatives across Canada; post-secondary institutions to create



## PROFILE



Social Sciences and Humanities  
Research Council of Canada

Conseil de recherches en  
sciences humaines du Canada



university and college degree and diploma programmes in FNMI languages; enable residential school survivors and their families to reclaim names changed by the residential school system by waiving administrative costs for a period of five years for the name-change process and the revision of official identity documents.

**Health:** Acknowledge that the current state of FNMI health in Canada is a direct result of previous Canadian government policies, including residential schools; recognise and implement the healthcare rights of FNMI people as identified in international law, constitutional law, and under the Treaties; provide sustainable funding for existing and new FNMI healing centres to address the physical, mental, emotional, and spiritual harms caused by residential schools, and to ensure the funding of healing centres, medical and nursing schools in Canada; to require all students to take a course dealing with FNMI health issues, including the history and legacy of residential schools, the United Nations Declaration on the Rights of Indigenous Peoples, Treaties and FNMI rights, and Indigenous teachings and practices.

**Justice:** Ensure that lawyers receive appropriate cultural competency training, which includes the history and legacy of residential schools, the United Nations Declaration on the Rights of Indigenous Peoples, Treaties and FNMI rights, Indigenous law, and FNMI-Crown relations; law schools in Canada to require all law students to take a course in FNMI people and the law,

which includes the history and legacy of residential schools, the United Nations Declaration on the Rights of Indigenous Peoples, Treaties and FNMI rights, Indigenous law, and FNMI-Crown relations; provide more supports for FNMI programming in halfway houses and parole services; create adequately funded and accessible FNMI-specific victim programmes and services with appropriate evaluation mechanisms.

Child welfare, education, language and culture, health, and justice are socio-political constructions that also have direct implications for educational contexts. Justice Sinclair, TRC Chair, challenges each of us to pick just one of the Calls to Action to implement in our daily personal and professional practices. With each of us working to fulfill the Calls to Action we can pave the road to reconciling colonial relationships – this in turn leads to greater economic, social and political wellbeing both for FNMI people and for Canada as a whole, nationally and within the global arena.

#### Notes:

1. Indian is a government legislated designation that collectively describes all the First Nations people in North America who are not Inuit or Métis. Indian peoples are one of three peoples recognized as Aboriginal in the Constitution Act, 1982 along with Inuit and Métis. This term continues to be primarily used in the USA and by previous generations of First Nations people in Canada. Its use is now considered offensive in Canada.

#### References:

Indian and Northern Affairs Canada (January 2002). Indian Act R. S., 1985, c. I-5 (Office Consolidation). Ottawa, ON: Author.

Titley, E. B. (1986). *A Narrow Vision: Duncan Campbell Scott and the Administration of Indian Affairs*. Vancouver, BC: UBC Press.

Truth and Reconciliation Commission of Canada (2015a). *Canada's Residential Schools: The Inuit and Northern Experience: The Final Report of the Truth and Reconciliation Commission of Canada*, Volume 2. Montreal, QC: McGill-Queens University Press.

Truth and Reconciliation Commission of Canada (2015b). *Canada's*

*Residential Schools: The Métis Experience. The Final Report of the Truth and Reconciliation Commission of Canada*, Volume 3. Montreal, QC: McGill-Queens University Press.

Truth and Reconciliation Commission of Canada (2015c). *Honouring the Truth, Reconciling for the Future: Summary of the Final Report of the Truth and Reconciliation Commission of Canada*. Ottawa, ON: Author.



**Sandra Styres**

**Adjunct Professor**

Department of Child and Youth Studies  
Brock University

**Assistant Professor of Language,  
Literacy and Curriculum in Aboriginal  
Education**

Department of Curriculum,  
Teaching & Learning  
OISE/University of Toronto  
[sandra.styres@utoronto.ca](mailto:sandra.styres@utoronto.ca)

**Dawn Zinga**

**Associate Professor and Chair**

Department of Child and Youth Studies  
Brock University

Tel: +1 905 688 5550, ext. 3152

[dzinga@brocku.ca](mailto:dzinga@brocku.ca)

<https://brocku.ca/social-sciences/departments-and-centres/child-and-youth-studies>

# Embracing cultural values in Canada

The Department of Education, Culture and Employment, Government of the Northwest Territories details the importance of cultural and heritage values across the different regions of the country...

Culture and heritage are powerful components of any society. Culture is the living expression of our values, and heritage encompasses the tangible and intangible things we wish to bring to the future. Together, culture and heritage help us adapt to changing times. Culture keeps our past alive and fosters pride in where we have come from and where we now live. Culture and heritage define us, tell others who we are, and provide a solid foundation for understanding our place in the world.

In Canada, our cultural values include equality, religious freedom and inclusiveness. These values are rooted in our diversity, beginning with the Indigenous peoples of Canada, and then with people from across the globe who have come to live here. While our diversity makes Canadian identity difficult to define, it is what instills in us a sense of pride and helps us promote tolerance. Recently, we have paid particular attention to the need for reconciliation between Indigenous and non-Indigenous Canadians.

Canada's northern territories (Yukon, Nunavut, and the Northwest Territories), are marked by large geographic size, unique and sometimes harsh climate, and a high proportion of Indigenous peoples compared to the rest of Canada. The Northwest Territories (NWT) for example, covers 1.35 million square kilometres with a total population of just over 41,000. There is no single Indigenous "culture" in the NWT; the Dene, Cree, Métis, and Inuvialuit people, which comprise approximately 50% of the population, are characterised by their linguistic and cultural diversity. Indigenous knowledge about how to survive and, indeed, to thrive and live harmoniously in our northern landscape has been passed on for generations, and helps us navigate the challenges of present day. The other 50% of the territory is comprised of people from a wide variety of cultural

and ethnic backgrounds, creating a vibrant multicultural community.

Raising the importance of the culture and heritage of Canada and the NWT is critical. When people are connected to culture and heritage, we use our knowledge of the past, in the context of the present, to make wise choices for the future.

The primary role of culture and heritage resides with families and individuals. Yet, through its strategies and resources, the Government of the Northwest Territories (GNWT) is a steward, collaborator, and contributor to culture and heritage.

Since 1997, the GNWT has had a policy that acknowledges the important and essential role that Indigenous traditional knowledge plays in helping to make present-day decisions about the land and natural resources. More recently, the GNWT created a Culture and Heritage Strategic Framework, whose purpose aligns the work of all government departments around a shared set of cultural principles until 2025. The principles are based on a blend of Indigenous and non-Indigenous cultural values. The Framework explicitly recognises that culture and heritage both influence, and are influenced by, the work of public government.

Education in the NWT has a strong cultural component, with a specific commitment to having curriculum and programming reflect the perspectives and values of the Indigenous people of the territory. Two foundational frameworks, *Dene Kede* and *Inuuqatigiit*, are used to guide all curriculum development.

All NWT educators receive 2 days of cultural orientation each year as part of the Department of Education, Culture and Employment's ongoing commitment to



supporting the professional learning of teachers, providing cultural context for all learning in the classroom.

Cultural perspectives are built into a wide range of curricula, including science and, particularly, language arts, social studies and northern studies. The latter course is a mandatory high school course for all students, where they explore their own Northern identity, the history, land claims, economy and major issues facing our territory.

**“Raising the importance of the culture and heritage of Canada and the NWT is critical. When people are connected to culture and heritage, we use our knowledge of the past, in the context of the present, to make wise choices for the future.”**

A major directive funds cultural and language programming in all schools in the NWT, and supports on-the-land learning activities.

Operated by the GNWT, the Prince of Wales Northern Heritage Centre acts as the territorial museum and archives, as well as housing the offices of the Culture and Heritage Division including the archaeology program, geographic names, and arts and culture funding. Through exhibits, public programs (guest lectures,

presentations, theatrical performances), and school programs, the Centre plays a central role in presenting, preserving, and promoting the cultures and heritage of the NWT.

We take an inclusive view of culture – encompassing how culture interplays with wellness, education, the economy, the natural environment, the arts, and traditional practices; and inclusive of the many cultures that have contributed to the fabric of NWT society. We see our primary role as cultivating strong relationships with NWT residents, portraying culture and heritage from the point of view of the people who are the subjects of our programs. ■

With information provided by staff from the Department of Education, Culture and Employment, Government of the Northwest Territories:

Lynn White, Strategic Planner, Culture and Heritage

Sarah Carr-Locke, Director, Culture and Heritage

Tom Andrews, Territorial Archaeologist

John Stewart, Director, Instructional and School Services

.....  
Department of Education, Culture and Employment,  
Government of the Northwest Territories  
[www.ece.gov.nt.ca](http://www.ece.gov.nt.ca)



# Exploring pathways for wellbeing among Inuit in Nunatsiavut, Canada

Alexandra Sawatzky, Ashlee Cunsolo, and Sherilee Harper highlight the need for regional perspectives on Inuit-specific pathways for wellbeing...

Understanding the context-specific nature of Inuit relationships with the land is essential when developing and implementing public health policy and programs that aim to enhance Inuit wellbeing in culturally-appropriate ways. Collaborative efforts to continue strengthening the formation, implementation, and evaluation of public health strategies are needed, and must be firmly rooted in Indigenous knowledge, ways of life, and connection to the land.

Drawing from a multi-year, multi-community, community-led and community-based participatory case study based in the Inuit region of Nunatsiavut, Labrador, Canada, and this project had 3 main objectives:

- Characterise conceptualisations of wellbeing and its underlying components from the perspectives of Inuit living in Nunatsiavut;
- Describe pathways through which Inuit in this region achieve and maintain good wellbeing; and
- Compare protective factors for wellbeing at both individual and community levels.

## Nunatsiavut, Labrador, Canada

The Inuit Settlement Region of Nunatsiavut is located on the North coast of Labrador, Canada. Formed in 2005 as a result of the Labrador Inuit Land Claims Agreement, it is the first of the Inuit land regions in Canada to achieve full self-governance. Nunatsi-



Figure 1: Map and demographic composition of Nunatsiavut communities and participating community members (2012-2013)

avut is comprised of five small, remote, fly-in only communities (from North to South): Nain, Hopedale, Postville, Makkovik, and Rigolet (Fig. 1).

Led by the Rigolet Inuit Community Government, and working in partnership with the Inuit Community Governments of Nain, Hopedale, Postville, and Makkovik, and the Nunatsiavut Government Department of Health and Social Development, this project responded to Inuit-identified needs and priorities for locally-specific environment and health research.

*The Land is Essential to Wellness: 'it helps people's hearts feel better'*

Across all interviews, it was clear that understanding Inuit relationships with the land was essential to discovering pathways to locally-connected health and wellness. While relationships with the land were highly personal –

dependent on each individual's unique history and experiences – almost every interviewee felt that the land was foundational to all aspects of Inuit life, culture, livelihoods, and overall wellbeing.

"Going out on the land is everything to us – it's our heart and our soul. That's real. A lot of people think of spirituality as just a church thing and it's not, that's just one portion of spirituality. For us, going out on the land is a form of spirituality and if you can't get there, then you almost feel like your spirit is dying and then when you get out again, then you feel so much better when you come back. I think it energises you more and just frees your spirit more by being out on the land."

*Culture as the Cornerstone of Inuit-Identified Pathways for Wellbeing: 'culture isn't just a people; it's a way'*

"Going off" on the land to learn and share traditional skills not only helped people to connect to their cultural roots, but also helped them to connect to each other and to their communities. Going off on the land was also commonly mentioned as one of the best ways to develop and use traditional knowledge, while simultaneously fostering health and wellbeing. It was expressed that passing on knowledge surrounding land-based traditions and cultural skills to the younger generations was especially important.

## PROFILE



**Figure 2: Pathways to wellbeing, as identified by Inuit in Nunatsiavut, Labrador**

*Building Relationships Supports Wellbeing: '...Inuit needs more support peoples... more connectedness to other people'*

Relationships with family and friends provided individuals with a network of support that was important for good wellbeing, and people need to foster this network through family time and land time. The majority of participants identified that going off on the land with friends and family was essential for strengthening relationships. Friends and families who went off on the land together said they were able to connect on a deeper level, and develop healthy, strong relationships while also creating memories.

*A Sense of Community Strengthens Collective Wellness: 'there's a lot of good, strong community support here'*

Many individuals felt that community programmes, gatherings, and events could positively impact on health and wellbeing by enhancing their sense of belonging, whether in the community or on the land. These programmes were viewed as opportunities to share day-to-day experiences, stories, and struggles with fellow community

members. Emphasis was placed on the benefits of using the land as a space to provide both formal and informal programming to build supportive connections within and between various groups. People from all age groups said they valued land-based programming, but it was said to be particularly beneficial for youth.

*Inuit-Identified Pathways for Wellbeing Lead to Self-Determination: '... just do what you want to do and be happy doing it'*

The independent creation and pursuit of pathways for good wellbeing that were Inuit-specific and land-based helped people realise that they “can choose the way that they live,” and that life was “all about making their own choices.” This sense of self-determination based on cultural sovereignty was strengthened by “doing things that you want to do instead of doing things that other people want you to do,” and being “able to exercise [their] Aboriginal rights.” Not only did the land encompass community-wide conceptions of wellbeing that were tied to culture and supportive relationships, it also provided the space for individuals to create and pursue pathways to wellbeing that led to meaningful outcomes that were locally- and culturally- appropriate and relevant (Fig. 2).

### *Moving Forward*

This research demonstrates how Inuit in Nunatsiavut are actively creating and pursuing pathways for wellbeing, which will help to guide future research and policies in this region that aim to enhance wellbeing in relevant and meaningful ways. Further, it places Inuit voices, culture, ways of knowing, and conceptualisations of health and wellbeing at the centre of decision-making and action.

Re-shaping and re-defining frameworks for research and policy so that they authentically represent Inuit-identified health and wellbeing definitions and priorities presents many benefits and opportunities for preserving and promoting Inuit culture, identity, and wellbeing within the context of strengthening healthcare provision, programming, and policies across the North.

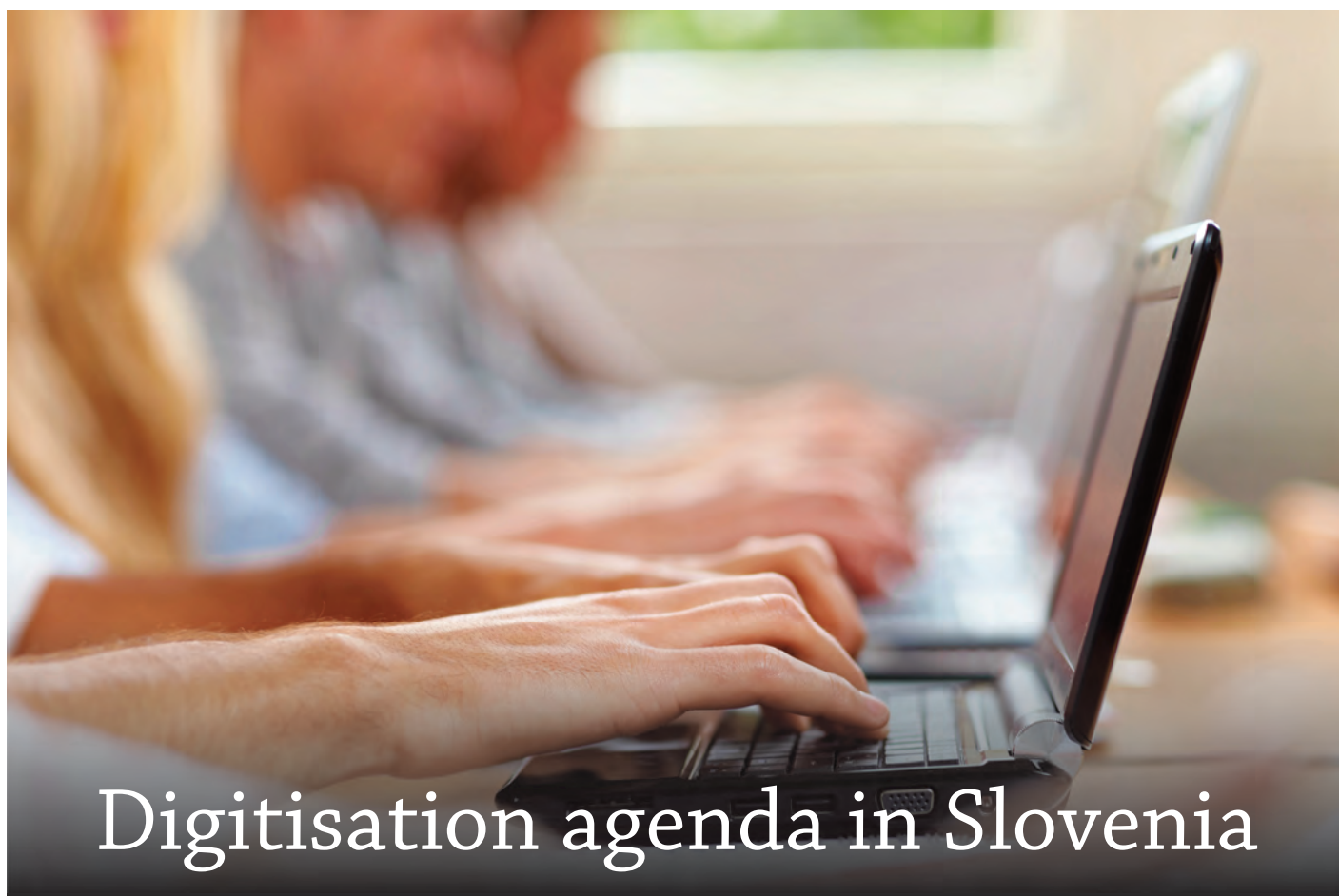
Key Partners & Collaborators: Jack Shiwak & Charlotte Wolfrey, Rigolet Inuit Community Government | Inez Shiwak & Marilyn Baikie, 'My Word': Storytelling & Digital Media Lab | Herb Jacque & Myrtle Groves, Makkovik Inuit Community Government | Diane Gear & Greg Jacque, Postville Inuit Community Government | Wayne Piercy & Juliana Flowers, Hopedale Inuit Community Government | Anthony Andersen & Noah Nochacak, Nain Inuit Community Government | Michele Wood, Nunatsiavut Department of Health & Social Development. Graphic Design: André Mersereau, Chapter 1 Studios

Funding: Health Canada's First Nations and Inuit Health Branch  
Nasiwuk Centre for Inuit Health and Changing Environments  
Nunatsiavut Government's Department of Health and Social Development Canada Research Chairs program.

**Ashlee Cunsolo PhD**  
**Canada Research Chair in Determinants of Healthy Communities**  
**Associate Professor of Community Health**  
Departments of Nursing and Indigenous Studies  
Cape Breton University  
Tel: +1 902 563 1949  
ashlee\_cunsolowilox@cbu.ca  
<https://ashleecunsolowilox.ca/>

**Alexandra Sawatzky**  
**PhD Student, Population Medicine**  
University of Guelph

**Sherilee Harper, PhD**  
**Assistant Professor of EcoHealth**  
Department of Population Medicine  
University of Guelph



The Ministry of Culture of the Republic of Slovenia outlines how they are digitising their culture and heritage in line with the European Digital Agenda...

In December 2013, the Ministry of Culture of the Republic of Slovenia issued a lengthy report on Guidelines for Collection, Long Term Preservation and Accessibility of Cultural Heritage in Digital Form. The document listed objects and suggested technical standards and procedures for this project, based on the European Digital Agenda.

The report summed up findings of 3 groups, working respectively on ideas for speeding up the cultural heritage digitisation agenda, for efficient use of digitised and originally digital cultural objects, and for creating a stimulating environment for entrepreneurial, creative, educational and academic use of this material.

### **Cultural heritage typology**

The first step was definition of objects that are to be included in the process. The typology of relevant objects follows the methodological approach of the EU financed project ENUMERATE and covers all existing fields of cultural heritage:

- archival records, ancient texts and old books and manuscripts;
- newspapers and other periodicals, microfilms, musical prints, maps, posters, postcards;
- engravings, drawings, pictures and photographs;
- other 2- and 3D objects;
- other 3D hand-made objects;
- 3D works of art;
- monuments and archeological sites;
- films, video and audio recordings;
- other objects that cannot be listed as any of the above.

An interesting addendum to this list is the final computer file from which a physical object was printed or otherwise produced. This is especially relevant for long term storage and these files may be granted the same status as archival records.

### **Legal and educational challenges**

An important issue is accessibility of public databases containing cultural heritage, produced (partly or



entirely) with public funds. The Ministry believes that such objects should be freely accessible when public investment exceeds a certain threshold (proposals range from 30 to 75 %) defined by law. In case it requires changes to the copyright regulation, these would be proposed, as well as enhancements of the digital material for the visually impaired. This is of vital importance for this group as digitisation vastly improves their ability to access countless objects.

These requirements demand certain regulatory steps that simplify such procedures in the future: all copyrighted works, (entirely or partly) produced with public funds, should be commissioned by contracts specifically acquiring material copyright for (free) online distribution. This should include scientific papers on publicly funded research which should be accessible in an open repository. This all would be facilitated by relying on open-source software wherever possible.

All of the above obviously requires new skills for professionals handling cultural heritage, including employees of Archive of the Republic of Slovenia, the National and University Library and other key national institutions. Professional courses and exams should be updated to include specialist digital education and skills.

### What to digitise and why?

For maximising outcomes, and indeed to properly execute it in the first place, authors of cultural heritage mining protocols need to resolve some important questions. Above all it is imminent to define criteria and procedures for selection of objects to digitise. This is obviously related to objectives of the project and to disposable funds – nevertheless, prior to the process all stakeholders need to be clear about what to digitise and why.

The criteria is fairly obvious, and really inspires enthusiasm about the future accessibility of vast troves of cultural heritage. The aim of digitisation is:

- wider and better accessibility of cultural heritage;
- better preservation of originals;
- cultural heritage dissemination to a wider public;

- simplified handling of objects;
- restoration of objects;
- production of objects' copies for public use.

Of vast and somewhat yet unknown importance is metadata. Two issues are of particular interest, one of an unimaginable opportunity for data mining from crossing countless sources, and another of the right to be forgotten. Both open previously little known aspects of public exposure and will need to be regulated as the situation develops according to individual wishes and the legitimate public interest.

There are many technical and security issues to consider, too. The latter concerns proper security (against malware software, security packages protocols, etc.), screening of materials before they are included in permanent collections in order to prevent their contamination. We have briefly mentioned open-source software, but what may present an even bigger challenge is the rapid pace of rising software and hardware requirements which need to be followed in order to guarantee access to digitised cultural heritage.

A whole new set of stakeholders need to get involved in cultural heritage preservation – and re-creation. We can look forward to numerous new ways in which the immense legacy of our ancestors and ourselves will be available to future generations. The past is often just as exciting as the future. ■



### REPUBLIC OF SLOVENIA MINISTRY OF CULTURE

Ministry of Culture – Republic of Slovenia  
Tel: +386 1 369 59 00  
gp.mk@gov.si  
www.mk.gov.si/en/

# Digitising cultural heritage for future generations

The Ministry of Culture in Lithuania highlights to Adjacent Government how they are supporting digitisation of cultural heritage in libraries, museums and archives...

Supporting digitisation in cultural heritage in Lithuania is integral, in order to encourage memory institutions to carry out the active dissemination and popularisation of the cultural values kept by them, and to use digitised contents in educational processes for the development of national identity and cultural characteristics along with the enrichment of public leisure. As well as, to raise the competency of the digitisation experts working on them, the Ministry of Culture has been organising a tender for the co-financing of projects for the dissemination of digitised cultural heritage since 2010. One of the project financing priorities is cooperation with institutions operating in various sectors, including the private sector. In 2013, 6 projects were implemented, in 2014 – 18 projects, and in 2015 – 15 projects. Funds of €86,880 have been assigned to their implementation every year. Since 2014, project administration has been assigned to the Lithuanian Council for Culture. The priority of cooperation between budgetary and private sectors was implemented by carrying out projects such as: Interactive Teaching Class – Cultural Heritage for the Digitisers project of the Lithuanian Art Museum, which was also co-financed by Education technologies, UAB; Creation of the Audio guide of the Anykščiai Arts Centre and its Adaptation for Visitors' Personal Mobile Electronic Devices project of the Anykščiai Arts Centre, to which a contribution was made by Pronovus, UAB; other projects.

Lithuania is effectively using financing from EU structural funds for the implementation of the cultural heritage digitisation initiatives. During the EU structural funds investment period of 2014–2020, investments were made in the field of E-Services and Solutions of Culture of the 2nd priority Promotion of Information Society of the Action Programme of the Investments of the European Union funds, development of e-services on the

basis of digitised Lithuanian language, cultural heritage objects, scientific research, education and art resources were planned in order to make valuable digital contents available for the broadest and most diverse applications by society, etc. New electronic services based on digital content will be introduced for users and memory institutions, digitised contents will be adapted for education, tourism, genealogy research purposes, and access opportunities for people with disabilities will be increased. During the period of investment of 2014–2020, funds of over €35m are planned to be used from the European Regional Development Fund.

It is important to digitise cultural heritage in order to standardise the processes and develop Lithuanian cultural heritage digitisation policy and create a single digital space for Lithuanian cultural heritage, providing up-to-date, thorough and reliable information about Lithuanian cultural heritage to national, European and global societies. Also, it is important to preserve cultural heritage to our future generations and, digitisation is one of the possible ways of doing this.

The Programme of Digital Cultural Heritage Actualisation and Preservation 2015–2020 stipulates strengthening of the network of digitisation centres to embrace all types of cultural heritage objects and the development of their activities by creating conditions for a consolidation of the processes of cultural heritage digitisation, quality, compatibility and the interoperability of digital contents, and by establishing an effective mechanism of cooperation between the centres and the provision of services to all memory institutions. ■

.....  
Ministry of Culture of Lithuania  
<http://lrkm.lrv.lt/>

# Elements of success in the Swiss education systems

In a speech at an International Congress, President Johann N. Schneider-Ammann, Head of the Department of Economic Affairs, Education and Research, outlines the importance of vocational and professional education and training...

**V**ocational and Professional Education and Training – or VPET – is a matter of considerable importance to the Swiss government and to me, in particular, as President of the Confederation and Education Minister.

There are 3 main reasons for this: VPET ensures an income, it imparts knowledge and, it creates jobs.

“From skills to prosperity – sharing elements of success” – The motto of this year’s congress puts it in a nutshell. It also raises 2 important questions:

Firstly, what skills are needed if we are to be successful and create prosperity? Secondly, how can we use the skills acquired to best effect?

The motto also suggests how to address these questions. Not by retreating to an ivory tower and trying to solve problems all by ourselves, but by going out and exchanging ideas in the workplace, between the workplace and school, within our own country and with our neighbours beyond our borders.

Allow me to say a few words about my country, Switzerland.

As you know, we now have one of the highest per capita GDPs in the world, one of the highest labour force participation rates (at 84%, 13 percentage points above the OECD average) and one of the lowest unemployment rates in Europe, and, indeed, the world.

That was not always the case. Switzerland used to be a poor country. 200 years ago, at the beginning of the 19th century, the people here in the canton of Zurich did not have enough to eat. As a small, landlocked country at the centre of Europe, with no raw materials

worth mentioning, Switzerland had no choice but to develop into an innovative knowledge society, and to constantly invest, expand and diversify in it. One of our country’s greatest strengths is our mixed education system, which allows us to recognise both practical and academic talent and to invest in each accordingly.

**“In times of great change, no-one can afford to stand still. Let’s take a look into the future. There are two major forces of change in the world today.”**

This is a major contributor to our innovativeness and competitive strength. It also means that we can continue to develop our education system, making it fit to respond to the needs of the future, both of the country’s economy and of the individual. Please don’t misunderstand me: the last thing I want to do is suggest that other countries should adopt our education system. Each country has its own historical, economic and socio-economic context. A country’s education policy should take account of this background and reconcile what is desirable with what is feasible.

But I would like to reveal to you briefly what I believe are the Elements of Success in the Swiss education system:

**1. Duality and work based learning** – The dual vocational education and training system, in which apprentices spend time in both a host company and in vocational school, is a key element of success and the main VET model in Switzerland.

About two thirds of all young people in Switzerland take up an apprenticeship when they are about 15. There are about 230 nationally recognised and regulated apprenticeships to choose from.





This dual system is based on a very simple idea: learning by doing. Young people are able to learn the skills that businesses require. Their job prospects are therefore excellent.

**2. Permeability** – The next Element of Success is permeability, which occurs in 2 directions: laterally, between the academic and vocational education paths, and bottom-up, with opportunities for life-long learning and promotion.

Whichever path a person takes, it offers the potential for a successful career.

I can give you a good example of this. A colleague of mine recently spoke to a woman who had done an apprenticeship as a hairdresser. Having obtained advanced qualifications in her trade, she successfully ran her own business for 20 years. She then obtained the baccalaureate qualification and went on to university to study social sciences. Today she runs her own consulting company. The point I'd like to make is: no

qualification leads to a dead-end. As we say in German: kein Abschluss ohne Anschluss! With a qualification under your belt, doors will open to you.

**3. Private-sector involvement** – Another success factor in Swiss VPET I would like to highlight is the role and involvement of businesses, which makes for a system attuned to the needs of the labour market.

Small to medium-sized businesses make up over 99% of the Swiss economy. So it is especially important for these small companies to be involved in training young people. Indeed, about 40% of companies in a position to offer apprenticeships do so. They do this on a voluntary basis – there is no obligation. This private-sector involvement and cooperation with trade associations is hugely important in Switzerland. It is the trade associations that define the apprenticeship curricula. This means that young people acquire the skills that are required in the labour market. At the first VPET congress in 2014, we looked at why companies take the trouble to train apprentices.

Studies show that businesses benefit from offering training. I used to be the CEO of a construction machine manufacturing company that trained apprentices. And I can assure you that the benefits of employing apprentices can usually be felt even before they complete their training: after a time, their productive work more than compensates for their employment and training costs.

Furthermore, to train apprentices is an investment in the future skills available to the company: the company can then save indirectly on the costs of recruiting and training new employees.

**“This dual system is based on a very simple idea: learning by doing. Young people are able to learn the skills that businesses require. Their job prospects are therefore excellent.”**

In times of great change, no-one can afford to stand still. Let's take a look into the future. There are 2 major forces of change in the world today.

Firstly, the effects of global competition are being felt in many countries. Traditional economies are affected by a gradual process of deindustrialisation.

This threatens the jobs of many. In Switzerland, where about a fifth of economic output is still generated by the industrial sector, there are 2 principal factors ensuring that industrial production remains efficient – a liberal labour market and a skilled workforce.

The second big change in society is digitalisation. This offers huge opportunities both in our private lives and at work. Take today's congress. As I stand here before you, you may well be tweeting to each other about our congress – under “#VPET16”.

So I have to compete with Twitter and your mobile phones for your attention. Of course, I am not really being serious – but the digitalisation of our society does become a serious threat when employees are in fear of losing their jobs. Certain occupations will no doubt disappear.

But here again, our flexible and permeable labour market opens up new opportunities. New jobs will be created and new training programmes developed. Life long learning applies not only to individuals, but to our education and training system too. A system that is to be successful long term must continue to develop and adapt to external circumstances.

To quote the physicist and Nobel Prize winner Stephen Hawking: “Intelligence is the ability to adapt to change.” I am convinced that the dual education and training system can adapt quickly to technological change.

When the public and private sectors work closely together, young people can acquire exactly the skills they need for the labour market of tomorrow.

In order to be able to cope with challenges and change, we need to think and to act collectively. Truly viable solutions don't come from isolated thinkers, locked in isolated rooms, but develop from networks and discussions.

The time has come to learn from one another and to share our countries' experiences. All of us are attending this congress because we believe in the importance of vocational and professional education and training, we are convinced of its place in the future of our countries and so we wish to see it promoted.

My country, Switzerland, is honoured to be acting as a platform for the exchange of ideas, experiences and good practices. ■

This is an edited version of a speech which appeared here – <https://www.sbf.admin.ch/sbf/en/home/news/medienmitteilungen.msg-id-62302.html>

.....  
**President Johann N. Schneider-Ammann**  
**Head of the Department of Economic Affairs,**  
**Education and Research WBF**

<https://www.wbf.admin.ch/wbf/en/home.html>  
[www.twitter.com/\\_BR\\_JSA](https://www.twitter.com/_BR_JSA)

# Self-regulated learning: What is all the fuss about?

Dr. Yves Karlen, M. Sc. Miriam Compagnoni and Prof. Dr. Katharina Maag Merki at the Institute of Education, University of Zurich highlight self-regulated learning and its benefits

From a lifespan perspective, the constant improvement of knowledge, skills, and competencies through education has become unavoidable. To meet this challenge and to become a successful lifelong learner, competence in self-regulation is crucial. Hence, knowing how to regulate one's own learning activities has become an important survival tool. It plays a central role in positively influencing learning in and outside the educational context.

## 1. What is self-regulated learning?

Kindergarteners who persist when they encounter challenging tasks, school kids who review their homework before submitting it, or university students who adapt different learning strategies to prepare adequately for a test. All have one thing in common: They successfully self-regulate their learning and use different strategies to master challenges. From an educational psychological perspective, self-regulated learning refers to the active role of the learners in autonomously guiding their learning. It includes control, monitoring, and evaluation of thoughts, feeling, and actions. Thus, the competence of self-regulated learning is multi-layered and involves the use of metacognitive, cognitive, motivational, and behavioural competencies in constantly recurring phases. Learners, motivate themselves, set goals, and plan their learning in the pre-action phase; monitor their learning, use strategies to process information, and stay motivated in the

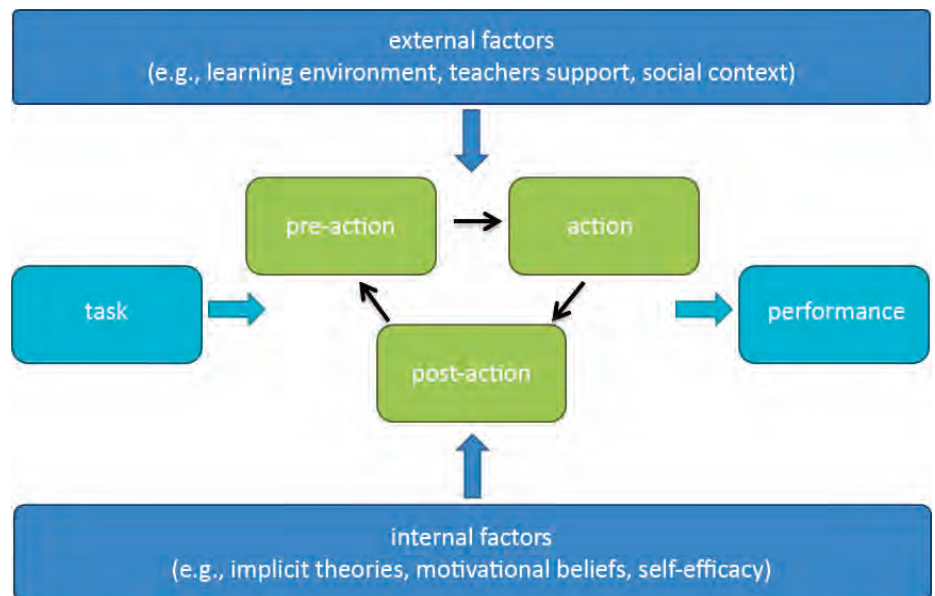


Figure 1: Process model of self-regulated learning

action phase; and evaluate their progress in the post-action phase. Self-regulated learners take responsibility for their performance and have control over their learning. They know that successful learning is not something that happens to them; it is something that they make happen.

Self-regulated learning is a highly task-specific process, influenced by internal factors such as learner's beliefs, values, goals, motivation, and particularly the outcomes they expect in a given task. Based on their motivation, learners – even kindergarteners – select which goals to pursue, which strategies to use and how long to persist in their pursuit of goals. For example, learners with high self-efficacy beliefs may judge the probability of

succeeding in a particular task as higher and consequently may be more willing to self-regulate their learning. Not all beliefs are adaptive for self-regulated learning. For instance, some students come to believe that human attributes are more innate and fixed (fixed mind-set) and cannot be substantially improved or developed by learning. This fixed mind-set hinders self-regulated learning behaviour and leads to a constant need to prove one's abilities, rather than put the effort into improving the ability. Further, self-regulated learning is influenced by external factors such as task demands and characteristics, support by teacher, learning environment, and social context. For example, if the task is too simple, learners do not need to use their self-regulated learning



competence as the task can be easily solved without extra effort.

### 2. How important is self-regulated learning for higher performance?

Most adults think school education should focus only on improving academic skills, such as math or language. However, it is just as important to teach students how to regulate their motivation, thoughts and behaviour. Several studies have shown that the competence of successfully self-regulating one's own learning is an important predictor for higher performance from childhood to adulthood. Longitudinal studies from different fields of research have shown that learners who better regulate their learning, earn higher grades in different school domains, get higher diplomas, are less likely to drop out of university, and perform better in standardised achievement tests. Recently, studies have even shown that self-regulated learning is a stronger predictor of school performance than intelligence. Even beyond the academic context, higher self-regulated learning competence is related to a broad range of mental and physical aspects, such as less drinking, less obesity and better physical health. It also is an important success factor in the work environment. Overall, self-regulated learning can be identified as the key competence for performance in and outside of school. To prepare our students for the challenges of tomorrow, the promotion of self-regulated learning should become a central part of everyday schooling. However, as has been shown in several studies for different school levels and confirmed in our own studies for the upper secondary school level, teachers only marginally foster self-regulated learning.

### 3. What can teachers do to help learners to self-regulate their learning?

Evidence from different studies suggests that self-regulate learning can be fostered successfully. Unfortunately, teachers are led by several misconceptions about the nature of self-regulated learning. Based on theoretical and empirical work, we suggest four important points to take into consideration to successfully foster self-regulated learning in today's classrooms:

The often isolated and sporadic teaching of general learning strategies is only slightly effective. Different strategies, such as motivational, cognitive, and metacognitive strategies, should be instructed continuously on a daily basis and should be tied to actual school topics. Teachers should also emphasize the benefit of strategies and explain when, why, and how specific strategies are effective.

Fostering a growth mind-set (abilities are not fixed but malleable) in a classroom helps students to regulate their learning and persist in the face of difficulties. In general, students must be encouraged to become strategic learners.

Self-regulated learning cannot be fostered by just applying student-focused teaching methods such as free choice of work, weekly schedule or project weeks. Learners need to be taught how to self-regulate their own learning and need teacher's support.

Kindergarteners are not too young to learn self-regulation strategies. Already kindergarteners can improve their self-regulated learning compe-

tence through instructions. On the other end of the timeline, it is not evident that adults are experts in self-regulating their learning. Even adults can improve their competence of self-regulated learning.

In summary, the competence of self-regulated learning is crucial for success in school and beyond, and needs to be a key component of today's school curricula. Our research on self-regulated learning spans from kindergarten to university students and focuses on gaining further understanding of student's self-regulated learning processes in different contexts and situations.



**University of  
Zurich** <sup>UZH</sup>

**Prof. Dr. Katharina Maag Merki**  
**Chair**

Tel: +41 44 634 27 80  
kmaag@ife.uzh.ch

**Dr. Yves Karlen**  
**Senior researcher**

Tel: +41 044 634 27 43  
ykarlen@ife.uzh.ch

**M. Sc. Miriam Compagnoni**  
**PhD candidate**

Tel: +41 44 634 45 70  
mcompagnoni@ife.uzh.ch

Institute of Education  
University of Zurich  
<http://www.ife.uzh.ch/de/research/teb/mitarbeitende3.html>

# Towards a deconstructive approach to style and the production of space from the generation of knowledge

Dr Kevin J. Flint and Associate Professor Dr Andrew Lowley ask, what has this all got to do with the very practice of review?

Over the last 18 months we have been working with a group of researchers from across Europe on Erasmus funded research entitled the 'SuperprofDoc Project', led by Dr Annette Fillery-Travis [Middlesex]. We are concerned to understand more about the experiences gained through the process of doctoral supervision involving students from a variety of professions, whose research is primarily directed towards gaining more knowledge and understandings of aspects of their various practices.

Andrew Loxley [Dublin] and I have been tasked with producing a review of the available literature. In attempting to be innovative we adopted an approach which foregrounds *style*, so taking further an earlier paper published by Adjacent Government that I wrote on this subject. At this stage we will be deliberately adopting a naive perspective on style, which we anticipate will change during the course of our research.

This profile paper not only generates a space from the rationale for centring upon style, together with the economic, ethical and aesthetic issues that lay behind the approach we are adopting. As a matter of working towards justice



in practice – with a deconstructive approach always being mad about justice – as a deliberately naïve starting point, in opening this space and exposing it to a public audience we are also introducing a temporal dimension, as vital to the process of review that is itself continually exposed to an on-going deconstructive approach.

In adopting such an approach it becomes obvious that the traditional method used in reviewing literature serves only to generate metaphysical bridges over the flux of time, so generating associated social spaces

containing supposedly unmoving truth claims to knowledge located in the present. In any critical review, of course, these social spaces generated from knowledge production themselves remain permeable, vulnerable and open to negotiation. Truth claims to knowledge, therefore, invariably remain subject to revision, refinement, re-emphasis and so on.

Traditionally, then, reviews of the literature have always sought to make visible any such transformations within specific fields of practice. But, in being concerned, almost exclusively with

## PROFILE



epistemology and knowledge production, the effects of any such transformation upon the very practices of human beings themselves is always in danger of being elided as Heidegger showed.

Not surprisingly given the Western desire to create what it has considered to be the 'good life', other ways of building metaphysical bridges over the flux have emerged. The desire to take control of the world remains, seemingly, insatiable. In epistemological terms this alternative approach to reviewing the literature presupposes that at least some practitioners are in possession of the wisdom to be able to understand all of the myriad possibilities at play in anyone form of practice, and so make the wisest possible choices about the course of action required in any multi-faceted form of practice. We question the scope of such wisdom [Flint, in preparation].

We could start, then, as Charles Spinoza and his colleagues [1997] suggest,

with the organisation of practices involving the interplay of any equipment used in reviewing literature, the express purpose of our review, and the identities generated from it. For Spinoza et al., *style* is the name for the way in this case the practice of review fits with other practices – supervision, research... – so constituting them as what they are. For them *style* is a matter for pragmatic practice of 'coordinating actions', 'determining how people and things matter', and that which is 'transferred from situation to situation'.

But, this approach, too, only creates metaphysical bridges over the flux of time.

In being critical each of these approaches to reviewing the literature on any form of practice, all presuppose a *homogeneous* economy, ethic and aesthetic of practice, in any one instance, whose very *possibilities* are *conditional, calculable*.

But, as human beings we all live in *heterogeneous* economies, ethics, aesthetics of practice that are *unconditionally impossible* to gather together in any one instance of a review, and so remain *incalculable*.

The deconstructive approach we are beginning to explore in our review, therefore, seeks to open space for both heterogeneous and homogeneous dimensions of any practice.

### Bibliography

Flint, K.J. [in preparation] 'Rebirth, renewal, rediscovery in moves towards justice' in, Fulton, J. and Costley, C. [eds.] *Methodologies for Practice Development*, London: Sage

Spinoza, C., Flores, F. and Dreyfus, H.L. [1997] *Disclosing New Worlds*, Cambridge, MA: The MIT Press

Erasmus + programme RA2: 2014-1-UK01-KA203-001629

**IAPD** International Association for Practice Doctorates

**Dr Kevin J. Flint**  
Reader in Education  
International Association for Practice Doctorates  
Tel: 07531754709  
kevin.flint@ntu.ac.uk  
www.professionaldocorates.org

**Dr Andrew Loxley**  
Association Professor  
CAVE Research Centre  
Trinity College  
Dublin



# First Nations Students' Lived Experiences

## in Ontario Secondary Schools

The transition to high school can be a challenging time for students as it marks a shift in what is required of students as well as a change in their social groups as more students come together in a single school. While all students will experience challenges during this transition, First Nations students face additional challenges not experienced by many of their peers. Furthermore, the experiences of First Nations youth in Ontario schools are not universal experiences. There are a number of factors such as where the students live and the school they are attending that influence the kinds of challenges they may experience while attending high school.

This special e-book offers insights into the complexity of these challenges and how educators and schools might better address the needs of First Nations students in ways that improve the educational experiences of all students.



To read the  
digital ebook





[www.brocku.ca](http://www.brocku.ca)



# Europe – invest and connect

Adjacent Government Editor, Laura Evans, and Adjacent Oil and Gas Editor, Katy Edgington attended the 7th European Regions and Cities Summit in Bratislava last month. Here they report on the 2 day event and how investment and collaboration is key for Europe to move forward...

A week after Slovakia took over the Presidency of the Council of Europe, around 700 politicians, including local and regional leaders, met in the capital city of Bratislava to discuss investment in the regions. The event, which was organised by the European Committee of the Regions (CoR), the Bratislava Self-Governing Region, and the City of Bratislava, aimed to tackle the investment gap experienced by some regions in the EU.

One of the key outcomes of the summit was the adoption of the Bratislava Declaration. The summit, where the slogan of 'Invest and Connect' echoed throughout the 2 days, was the perfect place to launch the declaration.

Throughout the meeting, members of the CoR gathered to join in debates and round table events on the topic of the persistent investment gap which represents a threat to future growth and job creation across EU cities and regions. The need to consider how to improve the

effectiveness of the €351.8bn of EU funding (almost a third of the total EU budget) set aside for Cohesion Policy, was also highlighted.

One of the key speakers in attendance was Markku Markkula, President of the European Committee of the Regions. During a number of keynotes he stressed the role of cities and regions for creating sustainable growth and the importance of creating an investment plan for Europe.

"Growth and investment gaps in the EU's regions are still widening 8 years after the financial crisis, severely hindering long-term growth," he said. "We must encourage all levels of actors and mobilise private and public resources to reverse this trend and achieve tangible results on the ground."

Brexit was also still fresh in everyone's mind at the conference, and at the opening press conference, President Markkula described the result as "especially





unfortunate, given that it comes at a time when, in Europe and across the globe, we should be focussing our resources on tackling burning social, economic and environmental challenges”.

Jennette Arnold, Deputy Chair of the London Assembly, spoke at the summit about the disappointing result and how the City of London may be able to benefit from it.

“As you know, London is a global city. It has an excellent international reputation, as a tolerant and respectful city, two key markers of its success and its attractiveness,” she said.

“The next Prime Minister must work with the Mayor of London to build on this reputation so that the capital can maintain its position as a leading World and European City.

“Over 800,000 EU citizens live in London, contributing to our communities, they underpin the social fabric and economy. It is therefore vital that EU nationals working and living in London feel fully reassured that they are welcomed, and that they will continue to be appreciated, in London and the rest of the UK, now and in the future.”

As the investment gap for regions and cities gets bigger – local and regional governments account for 60% of public investment, with their money going notably into education, health, social spending, transport and general

Image: © Wim Dancels



public services. This gap makes it all the more important to ensure fuller and more effective use is made of EU funds, and guarantee there are greater synergies between the funds and other financial instruments.

Throughout the event, Politicians highlighted the need to tackle growing regional disparity. Pavol Frešo, Governor of the Bratislava Self-Governing Region also spoke, saying: “EU funding accounts for around 80% of investment by public authorities in Slovakia, so EU money is crucial to Slovakia’s development. But we need to do more with that money especially following the uncertainty following the UK’s EU Referendum result.





*Jyrki Katainen – Vice-President of the European Commission*

“Maximising investment requires work not only by the EU, but also by national, regional and local authorities in every country. EU funds must also be extended to cover education, social affairs, health and transport so I am glad to see this reflected in the Bratislava Declaration.”

A recent report by the OECD revealed that many of Europe’s regions and cities have seen public investment drop substantially since 2008. The Bratislava Declaration praises a special investment fund created by the European Commission in 2015, the European Fund for Strategic Investments (EFSI), saying that it is “showing great potential”. The Declaration calls for it to be combined with the EU’s Cohesion Policy to ensure other regions also benefit from the fund, which uses public investment to leverage private investment.

The EFSI is an initiative which was launched jointly by the EIB Group – European Investment Bank (EIB) and European Investment Fund – and the European Commission to help overcome the current investment gap in the EU. As one of the 3 pillars of the Investment Plan

for Europe, the EFSI aims to mobilise private financing for strategic investments.

Vice-President of the European Commission [Jyrki Katainen](#) echoed the comments made by Markku Markkula and highlighted his commitment to encouraging local and regional local authorities to take full advantage of investment opportunities provided by the EU.

“I also want to stress that the combination of Structural Funds with the European Fund for Strategic Investments is possible, both at project and at investment platform level. We rely on the help of our local and regional partners to spread the message about the opportunities that exist under the Investment Plan.”

Speaking to members at the event, Vice-President Katainen started that people should “be active and look at what other countries have done. Investment opens your eyes to fascinating opportunities that are at your disposal.”





*Professor Jeremy Rifkin highlights the role of smart cities and regions to members*

Supporting the transition of cities to smart and sustainable cities was another topic on the agenda. Highlighting the role of smart cities and regions was one of the keynote speakers, Professor Jeremy Rifkin. An adviser to the EU and to national leaders for more than 10 years, Rifkin argued that the advance of the digital economy, which is one of the priorities of the European Commission, signifies a third industrial revolution. The convergence of the familiar 'communications internet', the developing 'energy internet', and an 'automated transport internet', he says "... will allow small businesses, large companies, whole regions to use this new digital technology for communication, energy and transport to dramatically increase their aggregate efficiencies across the value chains".

The majority of speakers agreed that investment and collaboration are key in order to create cities for citizens of the future. The overall message received from the event was that we need to unlock the investment potential of EU regions and allow them to be Europe's pioneers. As President of the European Committee of

the Regions, Markku Markkula said: "It's time to act and think outside the box – we must invest and collaborate together to connect Europe." ■

.....  
**Laura Evans**

**Editor**

Adjacent Government

**Katy Edgington**

**Editor**

Adjacent Oil and Gas

[editorial@adjacentgovernment.co.uk](mailto:editorial@adjacentgovernment.co.uk)

[www.adjacentgovernment.co.uk](http://www.adjacentgovernment.co.uk)

[www.twitter.com/Adjacent\\_Gov](https://www.twitter.com/Adjacent_Gov)



# High resolution 3d mapping

From smart city model to self-driving vehicle...

The past few years have seen remarkable development in mobile laser scanning (MLS) to accommodate the need for large area and high-resolution 3d data acquisition involved in building smart city model (cf. <http://www.adjacentgovernment.co.uk/research-science-innovation-news/situated-augmented-3d-cities/25452/>). Such data collection systems provide the required level of detail and precision to build large scale 3d city models and run simulation applications, such as building shadowing or traffic sound pollution studies. These 3d urban maps enable a high degree of understanding of the complete environment and facilitate an enhanced ability to plan and manage events while providing solid decision making.

Beyond the framework of smart cities, there is a growing interest for high resolution 3d urban maps. Indeed, the emerging world of self-driving vehicles need high resolution maps to show autonomous vehicles the way. Self-driving vehicles work by relying on a combination of detailed pre-made maps, as well as sensors that see obstacles in real time. The vehicles have to process inputs from multiple sensors to precisely understand their environments. Relying on detailed maps simplifies this task. Self-driving vehicles concern not only the car industry market (ex. Tesla, Volvo, Google). Various prototypes have been designed and tested for public



transportation as well like the self-driving, fully electric shuttle (ex. European project CityMobil 2). Also, it is anticipated self-driving trucks could rewrite the rules for transporting freight.

There are still many challenges to overcome from the standpoint of high resolution 3d mapping based on MLS data before self-driving vehicles become a reality. First, self-driving vehicles rely on a combination of sensors to understand their environment (ex. LiDAR, fisheye cameras). The data from these sensors have to be brought together in order to combine their individual perception of their surrounding. Mapping of heterogeneous data is an active research area. This is a complex task since the data sources have not the same structure (ex. continuous image versus discrete

point clouds), the same representation of the physical world (ex. radiometry versus geometry), the same viewpoint (ex. short range image viewpoint versus mid to long-range LiDAR viewpoint) and are not collected at the same frequency.

Also, creating and maintaining such maps is difficult work. Advancements in processing LiDAR point clouds are required to improve the automation of objects classification and identification. So far, people pore over the data in order to categorise different features such as intersection, light poles etc. It is still very difficult for a computer to recognise an object as that object, especially if it has to rely on a series of points with no connection among them. To be able to do so, the computer needs to be trained with

examples of features it has to identify. A vast amount of examples, covering a breadth of contexts and situations, has to be provided. Much like a human learns through experiences, the computer need to be exposed to vast quantities of information. The more data we collect, the smarter the system becomes.

**“These 3d urban maps enable a high degree of understanding of the complete environment and facilitate an enhanced ability to plan and manage events while providing solid decision making.”**

Thus there is a need for large databases allowing training of algorithms on board the self-driving vehicles. Availability of public and documented databases will also enable comparison among various approaches and determination of the best classification methods. This is the rationale behind the French National Mapping Agency (IGN) contest ( <http://data.ign.fr/benchmarks/UrbanAnalysis/> ). The database contains 3d MLS data from a dense urban environment in Paris (France). Each individual object has been manually annotated in the 3d dataset. All the 3d points belonging to the same object have the same object identifier (id). From the classification standpoint, a category is assigned to each segmented object. Each class represents an urban semantic entity.

Availability of rich and public database of 3d MLS data can also be a catalyst of new applications or usages of this technology. It may favor collaboration among various communities (ex. cre-

ators, developers and users) and stimulate researchers from different fields (ex. computer graphics, robotics, geomatics) to propose innovative solutions to 3d MLS data processing issues.

Another issue related to high resolution 3d mapping for self-driving vehicles is the need to collect beforehand MLS data in new cities or territories. So far, this task is completed manually by driving vehicles in the targeted locations. Eventually, autonomous vehicles will be used to collect the data to build high resolution 3d maps. However, in such a context, smarter data acquisition approaches will be required. Indeed, currently, all the environment is digitised even if most of the collected points do not correspond to valuable information for building the 3d maps. Thus there is a vast amount of data collected. This is an issue not only from the storage standpoint but also from the processing standpoint. Indeed, some of the 3d point cloud processing has to be carried out in real time onboard the vehicle. Relying on machine intelligence, new acquisition strategies need to be devised in order to tune the data collection according to the vehicle context (ex. narrow streets versus avenues: close range versus mid-range acquisition settings) and information need (ex. more details about a potential obstacle).

As a conclusion, MLS offer great advantages not only for building smart 3d city models, but also for guiding the future generation of vehicles. As dense and documented

3d MLS databases are becoming more and more available publicly, a diversity of applications and usages (ex. digital arts, engineering, immersive intelligence,) can be anticipated. This context induces 2 major stakes that would need to be addressed: 1) documentation of 3d MLS data fitness for use: users will need guidelines to better understand the application accuracy and precision achievable with the databases; 2) crowdsourcing feature extraction and classification: if millions of kilometers of streets are to be digitised, mapping teams won't be sufficient to process them. Similarly as OpenStreetmap initiative ( <https://www.openstreetmap.org> ), volunteers could contribute to the 3d high resolution map construction. Automatic quality assurance and quality control tools would have to be developed accordingly.



**Dr Sylvie Daniel**  
**Full Professor**  
Université Laval  
Tel: +14186567182  
[Sylvie.daniel@scg.ulaval.ca](mailto:Sylvie.daniel@scg.ulaval.ca)  
[www.sylldan.wordpress.com](http://www.sylldan.wordpress.com)  
[www.crg.ulaval.ca](http://www.crg.ulaval.ca)  
[www.scg.ulaval.ca/sylvie-daniel](http://www.scg.ulaval.ca/sylvie-daniel)

# Regenerating local communities

David Pipe, Practice and Policy Officer at the Chartered Institute of Housing outlines the importance of regeneration schemes for local communities...

Following the economic downturn and the 2010 general election, many tried and tested approaches to regenerate our most disadvantaged neighbourhoods became financially unviable. The incoming coalition government was sceptical about nationally backed, capital intensive regeneration schemes and ended a number of programmes. As a result much regeneration activity simply ceased.

However, in January the Prime Minister announced that he would make £140m of loan funding available to kick-start the transformation of 100 estates in England. Due to this funding, regeneration is now firmly back on the political agenda. This is welcome as the housing professionals we speak to were always clear that well-delivered, housing-led regeneration can lead to real improvements for communities.

With government now backing more regeneration activity, our focus is shifting to how we ensure this is carried out in the right way. It is a contentious issue, in London in particular, there is understandably much concern about 'gentrification' and the danger that projects could see existing communities priced out of their area. The relatively small amount of funding committed and the government's wider support for home ownership (sometimes directly at the expense of social housing) has left many concerned that a renewed focus on regeneration might see social housing demolished and replaced with expensive homes for the better off.

So how do we ensure that we get it right? And what can be achieved if we do? Our research, carried out with Poplar HARCA and the Centre for Regional Economic and Social Research (CRESR) at Sheffield Hallam University looked at a number of examples of successful regeneration. It concluded that:

Investing in housing-led regeneration provides a good return and a mix of public and private investment could help to get more schemes off the ground. However, the £140m of loan funding currently committed by the government is not sufficient. Loan funding can play a useful role but in many areas some grant funding will also be required. If that is not available, it may be hard to make schemes in parts of the country where housing and land costs are lower stack up.

Kick-starting an increase in regeneration could deliver more of the homes we badly need. Most experts agree that we need to build somewhere in the region of 250,000 new homes per year in England to keep up with demand. However, in 2015 we managed a little over 140,000, so projects that deliver a net increase in homes overall can go some way towards helping government increase overall housing supply. Among the case studies we spoke to, some were bringing brownfield sites not previously used for housing into use while others were increasing the density of existing residential areas.

For example, in the North Prospect area of Plymouth, Plymouth Community Homes are delivering a 10 year plan which will see 800 homes demolished and replaced with 1,100 new homes - while in Poplar in East London a total of 300 homes will be demolished and nearly 1,200 built. This needs to be designed carefully and may not be possible, or desirable, in every area, but where appropriate it is a good way of delivering mixed communities - with more homes being built for purchase, without any corresponding loss of homes to rent.

Understanding the local context and the needs and aspirations of the existing community is vital in order to get regeneration right. Gaining local support for





change is often a significant challenge and while attracting new people into the area may be a legitimate objective, it is vital that regeneration activity brings benefits for existing residents. Engaging with the local community and enabling them to take some ownership of plans is challenging and labour intensive, but it is also a hallmark of successful schemes.

In particular the mix of different housing options which are ultimately provided needs to be determined by local requirements. This means that there will usually still be a need to retain social housing alongside homes for shared and outright home ownership, and that priority may need to be offered to local people.

We heard from people who had been living in poor quality accommodation and who had benefited hugely from improvement works. For example, in Plymouth, 60% of homes in North Prospect did not meet the government's Decent Homes standard prior to the project commencing. Many residents reported knock-

on improvements to their health or to their children's education, as a result of improvements to their housing.

So it is positive that the government is now looking to kick-start more regeneration activity. When done well, this can improve conditions for existing residents and deliver more of the homes that we need. But we are also clear that existing residents need to be engaged in, and to benefit from, these schemes and that government will need to look again at the funding arrangements if they want to transform estates in all parts of the country. ■

.....  
**David Pipe**  
**Practice and Policy Officer**

Chartered Institute of Housing  
[www.cih.org](http://www.cih.org)  
[www.twitter.com/CIHhousing](https://twitter.com/CIHhousing)

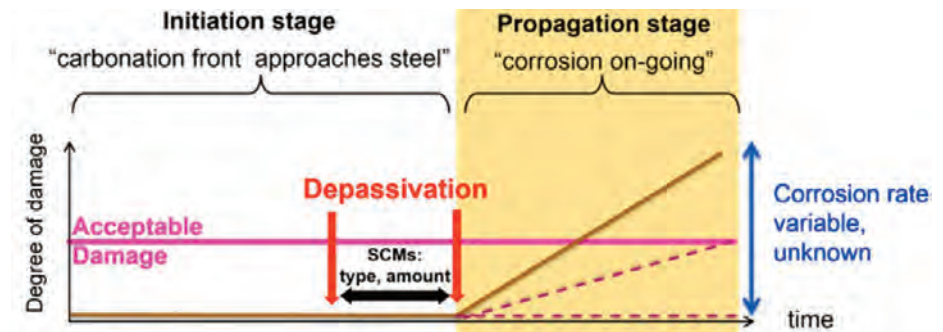
# On the way to more sustainable concrete structures

Prof. Dr. Bernhard Elsener, Head Durability Research Group at The Institute for Building Materials ETH Zurich outlines the durability screening of new blended cements

Portland cement has for decades been the most used type of cement to build reinforced concrete infrastructure. Experience and research on the corrosion of reinforcement in concrete made from Portland cement, have shown that the very high alkalinity of the pore solution ideally protects the steel [1]. The disadvantage is that about 8% of the man-made CO<sub>2</sub> is due to the production of Portland cement (CEM I).

In order to reduce this CO<sub>2</sub> emission and to obtain materials that have a reduced environmental footprint, the cement industry have already made great efforts, e.g. in changing from fuel to waste incineration. However, to obtain a substantial CO<sub>2</sub> reduction, the clinker content in the cements must be reduced and substituted with supplementary cementitious materials (SCM), such as limestone, fly-ash, and geopolymers etc. This substitution is ongoing and reflected in the decreasing amount of Portland cement and the increase of blended cements used for concrete construction. In the future blended cements with increasingly lower clinker content and a huge variety of SCM will be used.

However, achieving sustainability not only requires decreasing the environmental footprint of the materials at the time of their production, (reducing the clinker content) but to also combine this with high durability, thus achieving long and maintenance free

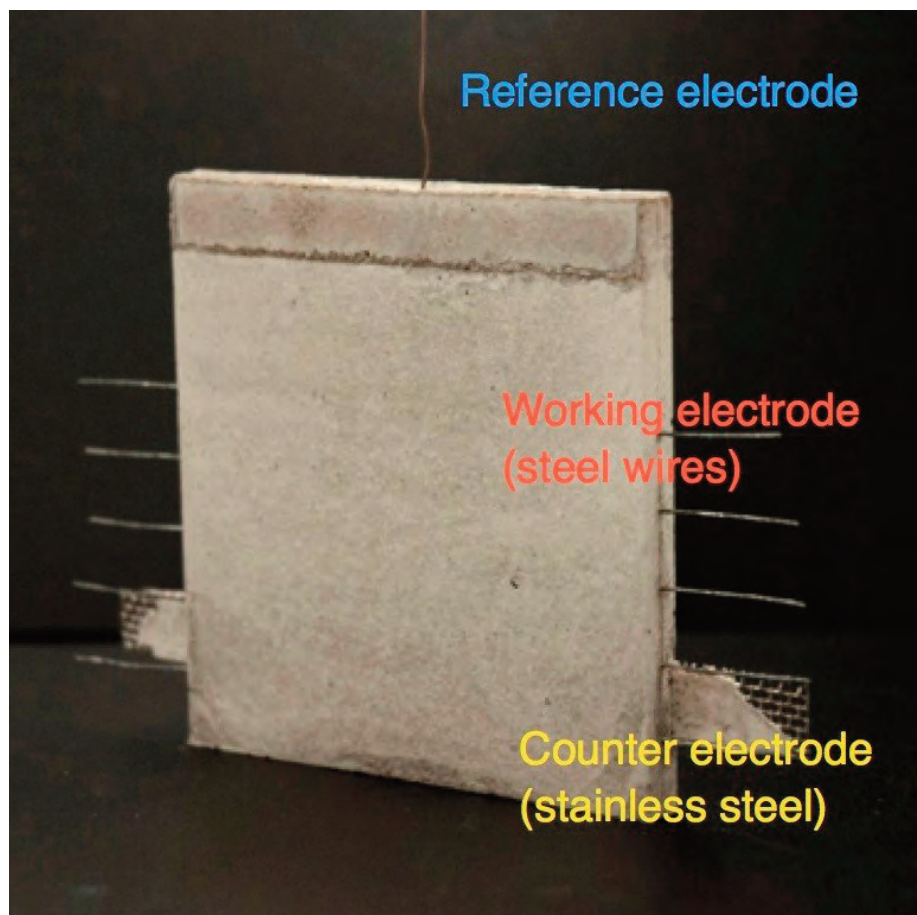


service lives of the structures in their actual exposure environments. The introduction of non-Portlandite binders has strongly increased the diversity of the pore solution chemistry in concrete: the hydroxide (OH<sup>-</sup>) concentration in the pore solution of systems with SCMs is typically about a factor of 10 lower than in Portland cement systems; additionally, the pH buffer capacity is generally depressed as a result of the reduction, (or elimination) of the calcium hydroxide reserve considered one of the main reasons for the corrosion inhibiting nature of Portland cement systems. Whereas it is clear that the different pore solution chemistry of concrete made with blended cements will affect the corrosion protection of the reinforcing steel, precise information on how this will influence the service life of structures (Figure 1), are not yet available.

For a sustainable use of the different blended cements, convincing answers for the long-term durability of these new structures, both regarding the resistance against carbonation and

against chloride-induced corrosion, are urgently needed. As no long-term experience is available, the input parameters for service life calculations have to be determined in laboratory experiments. Such performance tests include transport properties, permeability of oxygen, carbonation process and the corrosion rate of steel in carbonated concrete. Today, these tests based on large samples are very time consuming and give only limited results. Therefore, a new test setup for durability screening of new blended cements has been developed at our institute (Figure 2) [2]. It consists of small (8 x 10cm) and thin (6mm) cement paste or mortar samples instrumented with a reference electrode, 4 steel wire electrodes and a stainless steel grid counter electrode. The thin sample allows rapid full carbonation (max 3 weeks in 4% CO<sub>2</sub>) and rapid equilibration of environmental humidity. Parameters that can be measured are electrical resistivity of the sample (w/c ratio, humidity, and pore solution), corrosion potential and corrosion rate of the steel (durability,





initiation and propagation of corrosion), oxygen diffusion and oxygen consumption rate. The sample can in principle be instrumented with additional sensors such as chloride or pH sensors.

The new setup for durability screening of new blended cements can be used for any cement blend, w/c ratio and admixture content. Durability testing can be performed both for chloride or carbonation induced corrosion. Specific applications that are envisaged are:

- Durability screening of completely new, unknown blended cements in standard conditions (w/c ratio, environment);
- Durability testing of already established blended cements in a variety of environmental conditions of testing of specific mixes for specific special environments (e.g. marine structures);
- Research on the mechanisms and controlling factors of corrosion in carbonated concrete.

The potential users are cement producers, test laboratories, research institutions, standardisation bodies, owners that build a large numbers of new structures etc. The potential market worldwide is huge, especially because cement producers and users

are still local and many different new blends have to be tested.

The setup for rapid durability screening of new blended cements presented contributes decisively to testing, standardisation and increased future use of new blended cements. It contributes to tackle the future challenge of cement and building industry, to guarantee long-term durability of reinforced concrete infrastructure with the minimum amount of clinker in the cement, thus minimum CO<sub>2</sub> emission possible.

### **Authors:**

M. Stefanoni, U. Angst, B. Elsener

1 L. Bertolini, B. Elsener, E. Redaelli, P. Pedersen, R. Polder, Corrosion of Steel in Concrete, WILEY VCH 2013 (second edition)

2 M. Stefanoni, U. Angst, B. Elsener, Innovative sample design for corrosion rate measurement in carbonated concrete, presented at 11th annual International Concrete Sustainability Conference (2016 ICSC) May 15 – 18, 2016, Washington DC (USA)

**ETH** zürich

**Prof Dr Bernhard Elsener**  
**Head Durability Research Group**  
Institute for Building Materials ETH Zurich  
Tel: +41 44 633 2791  
elsener@ethz.ch  
[www.ifb.ethz.ch/corrosion](http://www.ifb.ethz.ch/corrosion)



# Without the zero carbon homes standard can we achieve carbon reduction?

The vision of zero carbon homes is not all lost according to Mike Foster, CE at the Energy and Utilities Alliance (EUA)...

In December 2006, the UK government announced that all new homes would be 'zero carbon' from 2016. This was a ground breaking commitment that has had an incredibly important influence on the house building industry, and the supply chain.

In July 2015, Chancellor George Osborne announced that he is dropping the zero carbon homes target. Some political toing and froing later and it seems like the government have turned their backs on building better, more efficient homes for the future.

House building remains a top priority with government plans to fast track the building of new homes, but at what cost? We need more housing but there is no justification for building homes with a permanent legacy of energy bills being higher than they need to be.

The UK has some very old inefficient housing stock and is subsequently faced with the challenge of retrofitting our existing homes and buildings to enable us to live and work more sustainably. We know that this retrofit programme is key to achieving our ambitious carbon reduction targets, and so it seems illogical to add to the numbers of homes that require retrofitting.

The government know that they should be putting long-term plans in place to improve our homes now and in the future, so why aren't they?

In April 2016 the UK signed the Paris Climate Deal, making a global commitment to reduce our carbon emissions. Achieving these targets involves our homes and buildings becoming more energy efficient. Without the zero carbon homes target to drive this forward I fear that other policies will be needed, which will cost the consumer more. However all is not lost as government policy is not the only means to drive through changes for the greater good.

Research based consultancy BRE have recently unveiled a voluntary sustainability standard for new homes that allows developers to differentiate their product in the marketplace by recognising performance beyond minimum regulation, and provide increased choice for the consumer.

Local decisions by council leaders and Mayors to demand higher energy efficiency specification for the homes and buildings being built in their area could also offset the lack of national targets.

Improving the energy efficiency of UK homes is vital if we are to reduce carbon emissions and keep bills down. But on its own that won't be enough.

Energy supply is also crucial, which is why we must continue to investigate the role that 'green gas' has to play. Decarbonising the gas flowing through the grid- which currently delivers gas into the homes of 85% of the UK population- is central to carbon reduction.

Industry is already working on a range of 'green gas' solutions, including biomethane, BioSNG and hydrogen. All of these offer the potential to decarbonise heat affordably and without the need for homeowners to change their heating systems. The existing gas grid is a major but hidden asset that we need to exploit to help achieve our climate change obligations. ■

.....  
**Mike Foster**

**Chief Executive**

Energy and Utilities Alliance (EUA)

Tel: +44 (0)1926 513777

mail@eua.org.uk

www.eua.org.uk

www.twitter.com/energyutilities

# DON'T GAMBLE WITH YOUR FIRE PROTECTION



If you are the appointed 'Responsible Person' for your company's fire policy you need to be sure that the contractors you use are competent. To find these competent providers, you need BAFE.

By using third party certified BAFE approved companies, you can be confident you are using independently assessed skilled professionals for your requirements, which will help meet your obligations with UK fire legislation.

FIRE EXTINGUISHER MAINTENANCE // FIRE RISK ASSESSMENTS  
EMERGENCY LIGHTING // FIRE DETECTION AND ALARM SYSTEMS  
FIXED GASEOUS FIRE SUPPRESSION SYSTEMS



Search FREE to find certified competent companies at

**WWW.BAFE.ORG.UK**

® Promoting Quality in Fire Safety



*Fig 1. A newly developed “Complete Cover” roof from Komproment in Denmark. It includes a build-in possibility for placing exhaust air armatures, avoiding shadow problems from normal types of exhaust air armatures, and this is with a proven operation quality according to tests at Aalborg University in Denmark*

## Active Roofs and Facades of the future

Building integrated PV (BIPV) has now been developed into useful substitutes for normal roof and facade materials. Due to continuous reductions of PV costs on a global scale, extra costs for electricity producing roofs and facades is becoming more and more marginal.

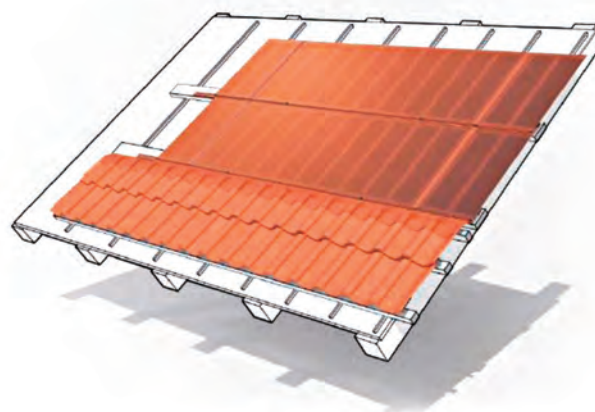
In some cases, it is therefore possible to have almost similar m<sup>2</sup> costs of PV or BIPV to natural slate roof costs or costs of Steni facade or roof plates with an added up to 60 years' durability.

The costs of PV panels have as a mean been reduced by 36% every year since 1991, and

during the last 7-8 years it was reduced by a factor of 10, and a further 50% reduction can be expected before 2020.

This illustrates the importance of ensuring an aggressive development and practical use of BIPV solutions in Europe so a basis for a future supply of Active Roofs and Facades can be secured.

In fig 1-3 examples of recently developed BIPV solutions are illustrated and fig 4 shows how it is possible for builders to support such a development with the help of the international Active House standard.



*Fig 2. An example of Gaia Solar PV panels which can be incorporated into red tile roofs, here illustrated by Henning Larsen Architects, this solution won an architectural competition in Copenhagen.*



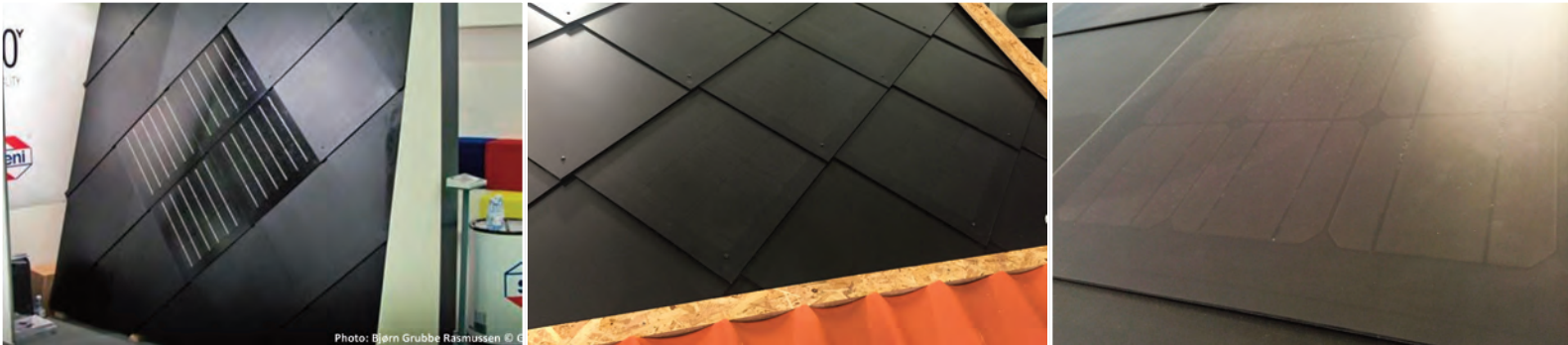


Fig.3 Here is illustrated the impressive development of PV panels from Gaia Solar in Denmark together with Norwegian Steni roof plates. Compared to the 1st generation solution the 2nd generation PV panels have exactly the same appearance as the Steni plates



Fig 4. The Active House specifications and labelling system is very useful to communicate the Active House quality of a building project, with respect to energy, comfort and sustainability, and it can, at the same, time be used as a dialogue and performance verification tool. (see also [www.activehouse.info](http://www.activehouse.info))

Building integrated PV both improves the assessment of CO<sub>2</sub> level, primary energy use and energy supply.

# Shining a light in a dark corner: district heating systems

Bill Watts, Senior Partner at Max Fordham discusses district heating systems  
in new-build developments...

I've been on record for some time questioning the wisdom of the almost-mandated installation of district heating systems in new-build housing developments in London.

Primary amongst my concerns is the lack of data to support claims of their benefit, and hence a lack of evidence to justify their mandated installation.

Last month, smart-payment and energy-efficiency technology company Guru Systems launched their 'Pinpoint' heating data analytics package at the Royal Institution of Chartered Surveyors (RICS). The data it measures and collects will help us shine a light into this murky, complex and expensive technology and enrich our understanding of district heating efficiency.

I'm not writing as a shill for Guru Systems, but the accurate, real-time collection of meaningful data of functioning domestic district heating is a welcome development.

They have already captured data from scores of legacy systems currently operating. That data has revealed unprecedented information on these complex systems. Although the presenters from Guru Systems would not be drawn on exactly how inefficient the systems were, it's clear that as a rule they are operating very poorly.

Tim Rotheray from the Association of Decentralised Energy [ADE] spoke to the RICS audience towards the end of the afternoon, pleading for the government to trust them and not regulate. Self-regulation of any industry doesn't have a famous history. It relies heavily on a good deal of trust. The district heating industry has presided over, and promoted, the installation of a range of poorly performing systems for a long time. Investing further trust at this point makes me very nervous.

Is the ADE to blame for this? Perhaps not. Businesses will not do something that is expensive – such as a good job – unless there is some compunction or some market force at work. When it comes to district heating there is no market force at work. One can charge whatever one likes for heat in this anti-competitive environment. What's more there is no accountability on carbon standards in use. As we have seen with construction standards in buildings, it was only the threat of a simple airtightness test that brought the industry to take this seriously. To its credit, it did. Standards improved, even if the performance gap remains embarrassingly high.

**“The government's chosen tool to direct energy-efficient design is the SAP calculation, which sets ambitiously low limits for the energy related CO<sub>2</sub> emissions from a new building. The tool currently directs designers to more or less ignore the losses from district heating systems when calculating their building's performance.”**

Does anyone actually want district heating? The government mandates developers to put it in with a view to providing inexpensive and low-carbon heat to meet the nation's CO<sub>2</sub> emission standards. Without reasonable system efficiency, this will not be achieved. To date, there has been scant concern about the performance of any of the systems. Guru Pinpoint, and technology like it, provides a platform to improve performance of these systems to a reasonable standard. However, without some compunction to achieve these standards, I don't see the industry rushing to adopt them. Presenting alongside Tim Rotheray was Phil Jones, the Chair of the CIBSE Energy Performance group and a professional champion of these systems. He stated that achieving improvements in the industry





was a 10 year project. This is an extraordinarily relaxed rate of progress. Given that district heat has been all but mandated for a decade, this would be 20 years too late. Much damage has already been done and much money has been wasted. If the government is forcing us to spend billions on installing these systems, they should at least attempt to control the quality.

**“Does anyone actually want district heating? The government mandates developers to put it in with a view to providing inexpensive and low-carbon heat to meet the nation’s CO<sub>2</sub> emission standards.”**

My understanding is that members of our government know the current district heating model is terrible, but that it is worth it in the “long run”. When is that, exactly? It would be interesting to see the model to identify how long it will take to pay off the additional CO<sub>2</sub> we are releasing now with the notional savings from the technologies in the future. Any future scenarios need to take into account the likely losses of these systems.

The government’s chosen tool to direct energy-efficient design is the SAP calculation, which sets ambitiously low limits for the energy related CO<sub>2</sub> emissions from a new building. The tool currently directs designers to more or

less ignore the losses from district heating systems when calculating their building’s performance. This is a gift to the industry, whose installations could double the heating energy consumption and CO<sub>2</sub> emissions. If the SAP calculations were amended to require designers to be as careful with these systems as they might be with, say, making sure it’s warm enough in winter, that would be a great advance in getting a true picture of installation performance. I understand that the SAP calculation is up for review. However, even if the SAP calculations were 100% accurate – even if they do generate better designs – it will not build or run the building. That will be done by humans with many different motivations and pressures. Without adequate enforcement or market pressure, the performance of the systems installed will remain expensive and wasteful. ■

.....  
**Bill Watts**

**Senior Partner**

Max Fordham

[www.maxfordham.com](http://www.maxfordham.com)

[www.twitter.com/MaxFordhamLLP](https://www.twitter.com/MaxFordhamLLP)



# Accessible housing standards: confusion could lead to a lack of delivery

Jean Hewitt, Director of the Centre for Accessible Environments returns to the subject of accessible housing standards and how easy it is to confuse the categories...

**T**he technical detail of building standards and regulations rarely makes the headlines. Yet the impact that inaccessible environments have on people's daily lives, health, employment prospects, independence, and life chances is vast. This is particularly true of dwellings, where there is currently a lot of confusion around standards over what should be applied and what they really mean.

No-one is in any doubt that this country needs to build more homes and the new national technical access standards in England, incorporated into the building regulations for the first time last October was widely applauded. It is hoped that developers, planners and local authorities will take the option to increase the supply of accessible homes. This is vital if we are to meet housing needs both now and in the future.

**“This ‘visitable’ label is causing confusion and, worryingly, it is being interpreted by some built environment professionals as a higher accessibility standard than it actually is.”**

While it's too early to fully assess the impact in practice, the feedback we're receiving from a range of professionals reveals inconsistent interpretation, which is a major concern.

How do we know this? Our accessible housing training courses attract delegates from a variety of fields and differing experience levels trying to get to grips with the new Building Regulation Approved Document M4 Categories 1, 2 and 3. From architects to planners, building control officers to surveyors and occupational therapists to product manufacturers, there is a fundamental misunderstanding about what the standards mean. When even experienced players in



*Jean Hewitt, Director of the Centre for Accessible Environments*

core sectors are interpreting the standards differently to one another, you realise there is a problem. We have been able to help delegates on our courses, but our concern is that this appears to be representative of widespread uncertainty, with the potential to exacerbate the significant shortage of accessible housing being built across the country.

So what do the categories mean, and why is it confusing?



### Category 1

The default M4 Category 1 is described as ‘visitable dwellings’. To the uninitiated this is a rather vague label for a specific technical housing standard and ‘visitable’ is open to interpretation.

In reality, Category 1 is the standard contained within the earlier Building Regulations, and it provides a very minimal level of access without future-proofing for future adaptations. If no category is included in the Local Plan AND specified within the planning permission by the planning authority, then Category 1 is the default standard which will apply.

Category 1 is not sufficiently accessible for most older and disabled people, and it is only ‘visitable’ in the loosest sense. Yes, a wheelchair user may be able to get through the front door but could struggle to access internal rooms or use a toilet or washing facilities for example. It would have to be a short and potentially uncomfortable visit and certainly not an overnight stay. This ‘visitable’ label is causing confusion and, worry-

ingly, it is being interpreted by some built environment professionals as a higher accessibility standard than it actually is. Homes built to this basic standard have no flexibility for change.

**“Better quality homes can make a difference to the lives of so many and with so many homes needed, surely it matters that these are fit for purpose over the course of our lives.”**

Add to this the pressing need for local authorities to have a local plan in place by 2017 for their housing development, and there is a risk that inconsistencies could soon be enshrined by councils across England to the detriment of local people. While Greater London has applied a common approach through the London Plan, local plans elsewhere could potentially be very different regarding which access categories apply. This could create a postcode lottery on the supply of accessible housing in different areas, compounded by the confusion over labelling of the level of accessibility.



### Category 2

M4 Category 2 is broadly equivalent to the Lifetime Homes standard – the accessible default in London since 2004 under successive mayoral administrations and committed to by the new Mayor of London too. Lifetime Homes are regulated for in Wales, Scotland and Northern Ireland to varying degrees (which adds another layer of complexity for UK wide professionals). Many people are consequently already referring to the Category 2 standard as Lifetime Homes since this term is more readily understood, although there are differences.

We hope everyone understands why the Category 2 default in London would be the best option throughout England. It gives true 'visitability', as well as the potential to adapt and change over the course of a lifetime – from people with young children to older and disabled people and even someone trying to get a decent size sofa into their home. Better quality homes can make a difference to the lives of so many and with so many homes needed, surely it matters that these are fit for purpose over the course of our lives. In March 2016, the House of Lord's Select Committee on the Equality Act and Disability made such a recommendation.

### Category 3

There's further confusion between Category 2: Accessible and adaptable dwellings and Category 3: Wheelchair user dwellings, with its two sub-categories of 'wheelchair adaptable' and 'wheelchair accessible'. The use of the same terms for both categories is adding to challenges with the interpretation and application of the standards. This is very worrying, as it could potentially result in the loss of wheelchair accessible units, not through intent, but through confusion over language.

Finally, people reading the regulations often miss the fact that there is no difference in the overall property

footprint required for an 'adaptable' and an 'accessible' wheelchair user-dwelling, even though designers seem to expect differing spatial requirements. Designs also need to show how the accessible standard is met and which select features can be adjusted for the adaptable version.

Oh, and that's just in England. Scotland, Wales and Northern Ireland have different standards! ■

For more information on CAE training courses see <http://www.cae.org.uk/training/>

For a concise comparison between Lifetime Homes standard and Part M(4) Category 2 see <http://www.habinteg.org.uk/accessible-housing-standards>



.....  
**Jean Hewitt**  
**Director**

Centre for Accessible Environments  
Tel: 020 7822 8232  
[info@cae.org.uk](mailto:info@cae.org.uk)  
[cae.org.uk](http://cae.org.uk)  
[www.twitter.com/CAE\\_info](https://www.twitter.com/CAE_info)



# HEADLINES LIKE THESE...

A London hotel has had to pay more than £260,000 in fines and costs in what is believed to be the first jury trial of a case under the Regulatory Reform (Fire Safety) Order 2005

The former owners of a Wolverhampton Hotel have been fined almost £44,000 following 11 breaches of fire safety

A landlord has been jailed for four months and ordered to pay £10,000 costs after pleading guilty to three offences under the Regulatory Reform (Fire Safety) Order 2005

...ARE BECOMING  
ALL TOO FAMILIAR

DON'T GAMBLE  
WITH YOUR FIRE  
RISK ASSESSMENT!

USE BAFE TO FIND  
QUALITY FIRE PROTECTION  
COMPANIES NEAR YOU

**FIRE SAFETY LEGISLATION IS NOW BEING SERIOUSLY  
ENFORCED TO ENSURE THAT PROPERTY OWNERS MEET THEIR  
OBLIGATIONS TO PROTECT STAFF, CUSTOMERS AND PREMISES**

Adequate Fire Protection starts with a comprehensive and competent fire risk assessment.

That's why BAFE developed a scheme for the certification of companies who provide fire risk assessment services.

BAFE scheme 'Life Safety Fire Risk Assessment' (SP205) ensures that UKAS accredited certification bodies can assess staff and procedures, so that property owners

can be sure that the provider that they use meets appropriate standards.

BAFE is the independent third party approvals organisation, which ensures quality for the fire protection industry and provides the vital reassurance that the services being bought or specified are effective and reliable.

Don't leave everything to chance.  
Make sure that your suppliers are certified and registered with BAFE at [WWW.BAFE.ORG.UK](http://WWW.BAFE.ORG.UK)



PROMOTING QUALITY IN FIRE SAFETY

[WWW.BAFE.ORG.UK](http://WWW.BAFE.ORG.UK)

# Varberg takes responsibility – again

For the coastal city of Varberg, Sweden, 2015 was the year when the community united in a joint effort to take responsibility for peace and human rights – just as they did at an international peace summit held there one hundred years before. The municipality has an active role to play and views the project as an extension of the work towards its vision of developing the city of Varberg as the Swedish West Coast's creative hotspot, with the help of local residents.

As the 100th anniversary of a significant peace summit approached, here in Varberg we chose a different way to celebrate. The result was the VARBERG CALLING for Peace project, with the aim of engaging and involving residents in actively working for peace and a sustainable society. The basic idea is to draw attention to the local and international history of peace, and in doing so combine the forces of Varberg's administrative bodies, organisations, civil society and local residents to increase awareness of the important perspectives that are vital for peace and a sustainable future. It is also important to encourage participation in order to highlight issues of democracy, human rights, cultural understanding and sustainable environment, and to examine them in greater detail. Also for there to be a legacy once the project has ended, which can be built on and will provide support for future development.

Photo: Mimmi Persson



Greater awareness of the age in which we are living and a common educational perspective on our history provide the conditions for future creativity, innovation and action. We believe that the big, universal human issues can unite many, both organisations and individuals.

Thinking globally and taking into consideration situation analysis and environmental and resource perspectives cannot be restricted to municipal or national borders. VARBERG CALLING for Peace is an opportunity, therefore, for Varberg municipality to take a forward-looking, general approach to sustainable development in a project that involves local residents. Engagement on humanitarian issues and the all-pervading problems we now face in the world around us may also increase interest in important issues at local level. The project therefore represents a step towards the realisation of Varberg's plan: Vision 2025 "Swedish West Coast's creative hotspot" and a sustainable future.

**Christina Josefsson**

**Head of the Culture and Leisure department**  
The City of Varberg

**Come to Varberg. Share our vision.**

# Inspiring people to create everyday peace



**VARBERG  
CALLING  
for Peace**

The city's local education centre, Campus Varberg, is today the largest vocational college in the Halland region and is one of Sweden's leading providers of vocational education. The core values at Campus Varberg include knowledge, innovation and creativity, and it was not long before it became involved in the VARBERG CALLING for Peace project.

At the college's events and management course a number of students are running their own projects as part of VARBERG CALLING for Peace. Here they tell us about the solid peace work they have done, which has given them valuable experiences.

"We are studying on a three-year events and management course and during February and March we studied a course in 'project-based development work'," explains Lina Rundbom, one of the students.

"During the course, we had the opportunity to choose from a number of assignments to work on and we five chose 'VARBERG CALLING'. We had to examine and communicate the questions 'What do you stand for?' and 'How can you get strangers to talk to one another?' to the general public."

The assignment came from the two process managers for VARBERG CALLING for Peace, Malin Bellman and Jon Liinason.

"They gave us some good advice before we started. 'Don't think – just do it and see what happens!' they said. So we did. We tried out our ideas on people using quick and easy prototype tests, with the results leading to new ideas."

One of the prototype tests involved leaving a bicycle in the entrance to the city's galleria. The girls left the bicycle "right in the way" and stood a few metres away to see how people reacted. Contrary to what you might expect, most people did not seem particularly irritated. It gave some people something to talk about as they wondered why the bicycle was there. Another was the mobile "everyday peace cycle café". Loaded up with coffee and pastries, the bicycle was pushed around to various parts of the city, offering coffee and cakes for free.

They asked the people they met how we can create everyday peace. Smile at someone you don't know, pick up litter, and hold open the door for someone were some of the suggestions.

"It really doesn't need to be any more difficult than that," says Lina. "Everyone can do something. The cool thing was seeing how our own positive energy clearly spread to those people we were talking to."

**Annette Wenklo**

**varberg**

varberg.se



# Verification of BIM Level 2 capability for design and construction from BSI

BSI's verification and training solutions help underpin the BIM curve as explained here by Charlotte Broady, UK Propositions Manager, Construction and Personal Safety at BSI Group...

In today's construction industry, the drive for faster, more efficient delivery of infrastructure or building projects has never been more challenging. Efforts to improve efficiency are difficult in a market that is too often defined by low margins, aggressive procurement, skills shortages, uncertain work pipelines and complex supply chains. The use of BIM (Building Information Modelling) is becoming more and more commonplace as a route which addresses the issue of collaboration and increased efficiency.

The adoption of BIM requires organisations and individuals to change the way they work. They must accept that traditional roles within the supply chain and client organisations may need to be redefined to successfully implement the new processes and information management requirements of BIM. However, this approach offers multiple benefits including faster, safer and ultimately, more efficient solutions for clients. As the construction industry is being revolutionised by the increasing adoption of BIM, it's crucial that all parties in the supply chain are aware of these changes and what it may mean for their organisation.

## BSI's collaborative approach

At BSI, our approach around certification and training has been clearly defined by listening to, and understanding the needs of our clients. Designed with all parties in the supply chain in mind, from Tier 1s, Tier 2s and beyond, we've developed the first in a series of certification solutions which critically verifies compliance with one of the key standards as defined in the BIM Level 2 toolkit, known as PAS 1192-2 (the design & construction phase). Tier 1 and 2 organisations such as Skanska UK, BAM Construct UK, Balfour Beatty, VolkerFitzpatrick, AHR and many others have already achieved verification to PAS 1192-2 as their route to compliance, and are reaping the benefits.

"We've been able to spread our brand wider by marketing the company as a Certified Practitioner of Level 2 BIM for Design & Construction... Client assurance is a major benefit of BSI certification for us," commented Rob Dingwall, Head of Planning and Design, VolkerFitzpatrick.

**"What has become evident to the BSI BIM team over the last few months, is that companies are at different stages on their BIM journey. From our insight, there is an appetite to get on board, and levels of awareness vary as to what that means in practice."**

## Companies should seize the opportunity to get ahead

It's possible that some companies may be left behind as BIM gathers pace. Besides the UK Government condition of contract for all UK Government projects since April 2016 to be delivered using BIM Level 2, it's clear that the industry could be split between companies who do, and those that don't deliver BIM projects. Commercial opportunities could be retained only for those who have embraced this technology and collaborative approach. There may be challenges along the way including a cultural acceptance of collaboration, trust and embracing of the digital world, but the rewards could be significant.

Being amongst the first to market with BSI's Verification Certification to PAS 1192-2 has significant commercial advantages. For those bidding for public sector or local authority contracts, PAS 1192-2 certification is cited in the pre-tender pre-qualification questionnaire (PQQ): PAS 91 (Table 8). Our Verification Certification delivers proof of an organisation's capability to work in compliance with PAS 1192-2 and enables companies to bypass the BIM questions in the PQQ.



The time saved through no longer having to provide evidence of BIM capability is a significant advantage with associated cost savings to be made too. For Tier 2 organisations, Verification to PAS 1192-2 can support their case in being selected as a preferred supplier for a Tier 1 organisation. Clearly, there is a competitive advantage both up and down the supply chain.

### **Levels of awareness in the industry and the journey**

What has become evident to the BSI BIM team over the last few months, is that companies are at different stages on their BIM journey. From our insight, there is an appetite to get on board, and levels of awareness vary as to what that means in practice. Some company representatives are fully aware of the importance of BIM, and are looking to help educate others in their business to get them up to speed and realise the opportunity. Others are already at this stage, have a good understanding of how they can use it to get ahead, and are now looking to implement BIM into their business.

**“Our objectives are clear – we want to help delegates identify the importance of BIM, the processes and procedures that relate to BIM Level 2 and the importance of information management.”**

### **BSI training: the journey towards certification**

Clients who have attended our training courses have confirmed that we have dispelled the myths around BIM Level 2.

Alan Harris, Quality Manager, Voestalpine Metsec plc commented:

“The BSI BIM fundamentals course gave clarity to the standards and provided a true definition of BIM and its true intentions. Metsec was able to quickly transfer the knowledge gained from this course and implement into our design and manufacturing activities.”

Our objectives are clear – we want to help delegates identify the importance of BIM, the processes and pro-





cedures that relate to BIM Level 2 and the importance of information management. We are working with all types of companies to help improve their understanding, and make sure that they have the best preparation to take them to the next stage.

**“Besides the UK Government mandate for all UK Government projects since April 2016 to be delivered using BIM Level 2, it’s clear that the industry could be split between companies who do, and those that don’t deliver BIM projects.”**

### Help is at hand

Our training solutions have been designed to clearly support our clients on their journey towards certification. For example, some clients choose to use our training services after they have completed the gap analysis prior to their formal assessment to PAS 1192-2. It’s at this stage when training needs could be identified.

The BSI BIM courses are written using the BIM Learning Outcomes Framework that have been developed by the government funded BIM Task Group to ensure training and knowledge is consistent in the UK market. These courses form a strong foundation for those wanting to understand the importance of BIM (BIM Fundamentals), those wanting to embed BIM within their organisations (BIM Implementation) and then in

a more detailed fashion, the practical application of the processes and procedures and management of BIM in the context of the UK construction industry.

Our courses provide delegates with an overall view of the process that supports BIM, not only through design and construction but into asset management. The courses break apart how the processes should be undertaken and the roles and requirements needed to successfully achieve this. ■



**Charlotte Broady**  
**UK Propositions Manager,**  
**Construction & Personal Safety**

BSI Group

Tel: +44 345 0765 606

[bimlevel-2.org](http://bimlevel-2.org)

[bsigroup.com/bim-uk](http://bsigroup.com/bim-uk)

[bsigroup.com/training](http://bsigroup.com/training)

[www.twitter.com/BSI\\_UK](https://www.twitter.com/BSI_UK)



# Is BIM the solution to improving project controls?

**P**roject controls is a mix of science and art that is used particularly in the process and infrastructure sectors as a standalone discipline to control what are often large and complex projects, with the aim of bringing the project to a successful conclusion from the aspect of time, cost and quality. The science is that there are recognised techniques to be applied to a project to measure the status and better predict the outcome; the art is that all the information is rarely in the right form to make all the necessary analyses while, at the same time, the shape and form of the most pertinent form of progress measurement changes across the lifecycle of the project.

Typically projects (and the sub-projects within an overall programme) start and end with a critical sequence of tasks before running through a period of volume based delivery and finally ending with a critical closeout sequence. To compound the lack of simplicity offered by a fixed set of rules (as opposed to an established set of principles) the information to base the judgement of status and recommendations for actions are affected by:

- Ambiguity in the source information. Invariably the full information is not available until the end of a project, unlike manufacturing when it is available at the outset, so judgements, allowances, etc, have to be made and these can often be found later to be inadequate;

- There are often several sources of the truth in a large fast moving project and reconciling the analysis from the various sources can be time consuming and frustrating;
- Information is fragmented, held in documents, schedules and drawings but the computation of key information such as a count of the number of doors to allow determination of how much the doors will cost or how many are currently fixed requires a detailed review and analysis of many drawings and associated information. The reality is that the analysis often doesn't get undertaken or may get undertaken many times by many parties. Such an example represents only a small part of the overall challenge of determining the full scope of the project at a project level, or the scope of a sub-contract when one party supplies and another fixes and even a third may commission and handover;
- An inability to see information in context. A window is quite a different proposition to build when it is on the ground floor compared to being located on the 5th floor, on the east wing above an embankment overlooking the sea;
- And of course when the information is shown on drawings even experienced personnel can interpret the information differently especially when they have limited time to view and reconcile.

So the challenges to produce pertinent real time measurement and predictability in project controls are immense. It involves applying the most appropriate technique that most accurately reflects the challenge of the project at that point in time, and then having to work around all the limitations and challenges by interpreting disparate sets of information to derive the right analysis and recommendation before being challenged by the essential optimism and hunger of the construction team undoubtedly presurises the balanced status. With margins often in the low percentage points of the overall cost and each party to the contract having their own interpretation of the information to hand it is hardly surprising that considerable time and effort expended and mistakes and claims can arise.

BIM, on the other hand, thrives on definition. When you model an object in BIM you have to position it and size it and say what it is! So while designers prefer not to add items to a drawing until the item is defined and understood, cost planners and construction teams want to better understand what is required even if it needs further definition at a later date. In essence the foundation of BIM and its interaction with delivery relies on some key principles:

- There is accuracy and definition in the content which by the very nature of the output being in 3D places many elements of the requirements in context;



- There is the ideal of a managed process around a single model, whilst perhaps harder to achieve it should nevertheless be a core aspiration, invariably wrapped in an integrated CDE;

- There is a managed process to define, add and enhance the object data to create an appropriate level of information and richness at every stage in the project leading to digital handover and operation;

- When we manage 3D object information, we are able to enhance it with the attribution of time, work packaging, cost and asset coding, etc, to allow us to aggregate and analyse the information as well as simulate and visualise the outcomes in every which way we choose.

However while the foundation of BIM is strong it is as an enabler that BIM presents the real opportunity to do new things that really accelerate it beyond its traditional space into that of integrated project controls. For example:

- Visual simulation and understanding of program changes. Being able to see the impacts of design changes on the program is traditionally quite difficult. Firstly, identifying changes can be time consuming and then finding the tasks affected in the program Gantt chart can also be difficult. When BIM is introduced with automated mapping between construction elements and tasks the process becomes much quicker, easier and more visual with the ability to run

scenarios across multiple program versions (e.g. baseline vs current/actual). This yields significant benefits for the planner and allows the focus to be on value-adding work rather than handling fragmented, disconnected data;

- Short term programming and logistics planning. Projects are typically founded on structured strategic programmes with discrete local short-term programmes. The desire to better display the detailed sequences often results in the strategic programme becoming overly complex with the result that progress updates, risk analysis and other similar tasks themselves become overly burdensome. However short-term programming within the model space is quite feasible under the umbrella of the

strategic programme and of course allows the richness of the information such as resources to be made available to provide greater assurance of the outcome. Short-term sequencing the permanent works and the temporary works and even simulating material movements are all opportunities for BIM driven products and will undoubtedly expose issues, reduce risks and improve the communication amongst the project team;

- Cost estimating and cost management. While a model doesn't often reflect the complete scope early in the project, it does provide the scope from which other elements of content can invariably be attached. For example, a wall in the model might attract, plaster, paint, skirting, builders work-restraint, acoustic treatment, etc, but these elements do not need to be detailed in the model. However the size and number of each can be associated to the wall and made available to other users. Automated measurement and sophisticated association with external pricing and resource estimation allows objects to be resourced and priced paving the way for more accurate progress updates;
- Risk management can be better enabled allowing the discipline to be applied more readily to more projects. In common with resource levelling the key time consuming task with risk management is the population of the programme with cost, association with the risk register and

the subsequent set up ready for the analysis to take place. BIM will be able to facilitate and even automate much of this process allowing experienced users to concentrate on the outcome and the subsequent actions rather than the non-value adding and time-consuming preparation of the necessary information;

- Combine the measurement and costing with progress measurement in the model, given that each activity knows the components associated with it, and fast, accurate progress measurement can now contribute to the reconciliation of cost and value;
- Change management. Of course if we can see what has changed and been measured from the model we can also see and measure change with the appropriate time impact and opportunity to display potential disruption, so effective change management, essentially the measured appendix to the variation notice, is a very real opportunity;

In conclusion, given the foundation and objectives of BIM, why would project controls as a function not jump at the opportunity offered by it? Is it that BIM is often still seen as pictures or videos, or is it that very few businesses and software providers have aligned their thoughts and products to the aspirations of the opportunity and the enablement of project controls through BIM? What will come first, the production of this robust information to better enable project

controls or the demand for more robust information and consistent processes to feed the opportunity for improved project controls?

Whilst the reality is that leadership on the matter is invariably critical to make it happen and lead the change, certain software solutions are now focussed on delivering the robust information to support the foundation for the more efficient and more effective production of project controls outputs. The ultimate aim is to produce the outputs in real time as the exhaust gases of the process, thereby allowing the project controls team to apply their art whilst making an experienced judgement based on current up to date information. There can hardly be a client or owner that won't be keen to achieve this outcome.



**Graeme Forbes**  
**Managing Director**  
Clearbox  
Tel: +44 (0)800 085 9872  
sales@clearboxbim.com  
www.clearboxbim.com





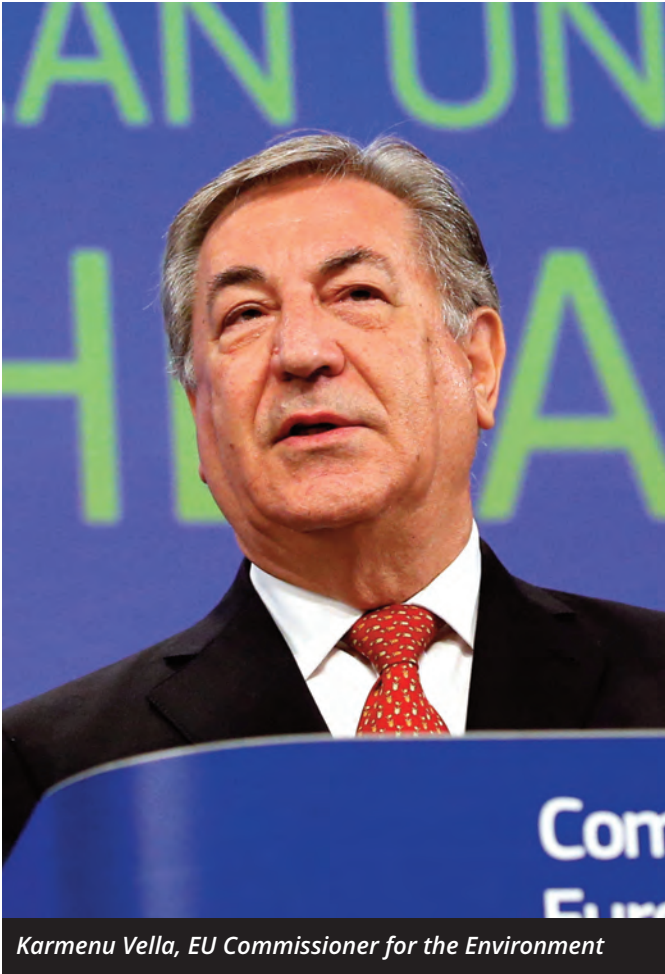
## A softer footprint in the Arctic snow

Karmenu Vella, EU Commissioner for the Environment details why a stronger and more focused approach is needed to protect the Arctic...

If there is one place in the world where climate change is plainly visible, it is the Arctic region. The Arctic is warming twice as fast as the rest of the world. The winter ice has lost an area of over one million square kilometres – the size of France and Germany combined.

The impact is increasingly clear in Europe too: the drier summers, the shorter winters, the frequent floods and storms we have been experiencing of late – all are a product of this massive Arctic thaw, which alters ocean currents and weather patterns on a global scale.

But our concern for the Arctic is not only an environmental one. The region's importance for the EU is also strategic. European companies are developing innovative cold-climate technologies, for instance new fish-farming techniques and innovative processes for clean energy like offshore wind, wave and geothermal power. The northernmost part of our Union has brought forward novel technologies, and we must make sure these are granted effective access to the Single Market. Nature tourism has taken off in Iceland and Lapland, with a positive impact on the local economy, and can be further developed.



*Karmenu Vella, EU Commissioner for the Environment*

These are some of the reasons that have pushed High Representative Mogherini and me to present in April an integrated European policy for the Arctic. For many years the EU has been invested in the region, but we believe it is time for a stronger, more focussed approach: one that champions social and economic development for the entire region above the polar circle; that promotes responsible behaviours vis-à-vis the Arctic ecosystem; and that fully recognises the Arctic's strategic value for global security, and its crucial place in our foreign policy.

We are also strongly committed to the 4 million people who live in the region, whose way of life, cultures and traditions need safeguarding must continue to thrive. Some are EU citizens, since Denmark, Sweden and Finland are EU members with Arctic territories. Their culture is part of our European culture, it is part of who we are. Together we can be a driving force towards a more circular and sustainable economy.

It is clear to me that these aims of environmental, economic and cultural sustainability can only be achieved

through dialogue and cooperation – consensus being the only acceptable way to drive sustainability forward. So far the Arctic has been a primary example of constructive regional and international cooperation, but it is also true that the challenges we all face become more complex by the day: it is now even more important to engage with all relevant players, craft common positions and make collaborative solutions emerge. This is true for environmental protection and scientific research, but also for the safety and security of all maritime activities in the Arctic – areas in which we all have stakes and responsibilities.

Speaking of responsibilities, the EU has its own share. The people and ecosystems of the Arctic feel the influence of our emissions, our plastic bags, our industrialised fishing. We are not shying away: the European Fund for Regional Development is to invest more than €1bn in the north of Sweden and Finland by 2020. At least another €40m will go to Arctic research in 2016 and 2017 alone, while various European Structural and Investment Funds are supporting climate mitigation and adaptation strategies.

**“We are also strongly committed to the 4 million people who live in the region, whose way of life, cultures and traditions need safeguarding must continue to thrive.”**

My own vision is for the Arctic to become a global beacon for sustainable development, and that is the rationale of our new initiative. The region lies at the intersection of three continents: what happens beyond the polar circle impacts on the whole of Europe and the world. Think of this new initiative as the EU putting a softer, more positive footprint in the fragile Arctic snow, for a better future for us all. ■

.....  
**Karmenu Vella**  
**EU Commissioner for the Environment**

European Commission

[www.ec.europa.eu/commission/2014-2019/vella\\_en](http://www.ec.europa.eu/commission/2014-2019/vella_en)

[www.twitter.com/KarmenuVella](https://www.twitter.com/KarmenuVella)





# Open source towards safe flood defences

Efficient, open minded and international collaboration of research and engineering is vital to safeguard the densely populated and growing urban areas across the world which are facing the consequences of sea level rise and natural hazards

In times of political uncertainty and economic turbulence, the global challenges of population growth and climate change are as relevant as ever before. The perspectives are clear. Even achieving the ambitious goal of last years' COP21 in Paris, which was to keep the increase of global temperature well below 2°C, climate change will have a significant impact on our critical infrastructure. Causes and consequences of global warming are not further discussed here, but some particulars are important going forward. NASA<sup>1</sup> and CSIRO<sup>2</sup> report 25 centimetres of sea level rise in the past 135 years, and currently measure a rate of 3 to 4mm per year. Furthermore, projections for the IPCC Assessment Report 4 suggest a plausible rise of sea level between 15 and 75cm until the end of this century.

Should this be worrying us? Consider one of the aspects of sea level rise: the

direct relationship between the average sea level and the risk of flooding for the low-lying areas in the world's deltas. Moreover, extreme events of high water levels – like flooding or storm surges – play a key role in assessing flood safety. For example, for the existing Thames Barrier protecting the London area, the frequency of water levels able to breach the barrier could increase from initially about 1 in 1000 years, to a 1 in 20 risk by the end of this century<sup>3</sup>. The reliability and safety level of flood defences are more and more under pressure by these changing boundary conditions.

Population and assets are increasingly concentrated in these vulnerable regions and are demanding better protection and higher levels of safety. A recent study by the World Bank<sup>4</sup> concludes that climate change alone will increase the number of people exposed to flooding by up to 15% by

2030 and 30% by 2080. Accounting for population growth, these numbers are expected to rise by another 15% and 45% respectively. As the rate of population growth has been higher in areas at risk of flooding, this is likely to be a conservative estimate<sup>5</sup>.

Can we stop or at least limit sea level rise? Can we reduce population growth or prevent people settling in floodplains? Needless to say, finding remedies for the causes and mitigation of risks is crucial, but depends entirely on time frame and costs, and, not at least, suffers from divergent interests. In parallel, deliberate engineering solutions for coastal protection are needed to meet the new requirements of an increased safety demand (growing population and economic activities in vulnerable areas) on one hand, and to deal with higher safety threats (sea level rise and natural hazards) on the other.



**“We are developing software tools for engineers in order to model large deformations of soils in contact with water – for the design and assessment of coastal processes and structures.”**

Flood defences form the interface between land and sea. As such, their design needs a deep understanding of multiple disciplines. Coasts consist of soils and rocks which are affected by the presence of water. In many places, soil in coastal areas is quite sandy, and flowing water can erode the soil and carry it away. The impact of waves on the shoreline, or on dykes, can cause erosion and damage structures, for example flood defences. To assess the stability and safety of coastal structures and flood defences, an understanding of both soil mechanics and fluid dynamics is therefore necessary.

Modelling soil and water, however, is conflicting in many existing numerical concepts. Soil is a natural material where the properties are heterogeneous and varied – from organic peats in the fens to sands and gravels at beaches and rivers. Soil remembers its past, so it is history-dependent, and its material behaviour is non-linear. Water can flow, it can be very dynamic, turbulent and can move across large distances. Concepts of both fields – soil and fluid mechanics – are adopted and combined in the material point method (MPM). Based on this unified numerical framework a computational software tool is being

developed, aiming to model the interaction of soil, water and structures.

In the scope of the European research project MPM-DREDGE<sup>6</sup> (grant agreement PIAP-GA-2012-324522) partners from academia and industry are developing physical concepts and implementing modelling approaches in a free and open software product. Several companies of the dredging and offshore sector are closely involved in the development to ensure the engineering applicability and to foster the highest possible impact on the market. They provide their expertise to validate the developed software by using measurements and monitoring data from their daily practice.

**“We believe in openness and transparency, as is evident from the free availability of our software and models. It is our firm conviction that sharing knowledge and innovative insights worldwide enables living in deltas.”**

**(Jaap Kwadijk, Science Director Deltares)**

Five European universities (Cambridge, Hamburg, Padova, Barcelona and Delft), as well as the Dutch research institute Deltares, are joined together in a research initiative to further develop their ideas of advanced scientific methods which are implemented for engineering use in freely accessible and open source software. In January 2017, the first international conference on the modelling of large deformation and soil–water–structure interaction will be organised to share the developments.

The answer to global challenges should be an open and sincere cooperation of the scientific and engineering communities in Europe and beyond. This is in line with the appeal of European Commissioner Carlos Moedas<sup>7</sup> who identified the benefits of open access and open science. Daring to share knowledge and developments in open source collaborations is a key issue to develop engineering solutions to ensure future living in deltaic regions.

1 <http://climate.nasa.gov/vital-signs/sea-level>

2 <http://www.cmar.csiro.au/sealevel>

3 <https://www.gov.uk/government/publications/thames-estuary-2100-te2100>

4 <http://documents.worldbank.org/curated/en/2015/11/252508571disaster-risk-climate-change-poverty-assessing-global-exposure-poor-people-floods-droughts>

5 <http://dx.doi.org/10.1016/j.gloenvcha.2012.07.004>

6 [http://cordis.europa.eu/project/rcn/105988\\_en.html](http://cordis.europa.eu/project/rcn/105988_en.html)

7 [http://europa.eu/rapid/press-release\\_SPEECH-16-1225\\_en.htm](http://europa.eu/rapid/press-release_SPEECH-16-1225_en.htm)



**Alexander Rohe**  
**Senior Researcher and Advisor**  
Deltares, Delft, The Netherlands  
Tel: +31 88 335 7351  
[alex.rohe@deltares.nl](mailto:alex.rohe@deltares.nl)  
[www.anura3d.com](http://www.anura3d.com)  
[www.deltares.nl](http://www.deltares.nl)  
[www.twitter.com/Anura3D](https://twitter.com/Anura3D)  
[www.twitter.com/Deltares](https://twitter.com/Deltares)



## European Network for Redistributing Geospatial Information to User Communities – Open Data

In the present era of big data, geographic information (GI) is ubiquitous and being characterised by a high level of variety as far as granularity levels, conceptual models, metadata schemas and encodings. The same is true for the web-based discovery and access services utilised by the diverse groups of GI consumers.

This heterogeneity has led to an utter lack of agreement on a “simple” and effective baseline of interoperability standards, creating a barrier to realising the full exploitation potential of GI.

### **The Virtual Hub technology**

To address such a crucial challenge, several international and European

programmes adopted a Brokering approach<sup>1</sup>, applied to GI content and services. The Virtual Hub (VH) technology implements a brokering approach leveraging the Cloud infrastructure and platform capabilities. Virtual Hub is a single point of access to open Geospatial and Earth Observation datasets and information.

Through VH, users are able to access datasets provided by a plethora of remote and heterogeneous systems, as if they were provided by a unique system. Using VH services, users will not need to solve (often complex) interoperability issues, such as: unfamiliar discovery and access protocols/models implementations,

coordinate reference system transformations, format mapping, etc. Datasets discovered and accessed via VH are adapted and transformed according to the user’s needs, making them available for use. In addition to mediation and adaptation services, VH can introduce advanced services, including: semantic discoverability, multilingualism support and discovery and access hints.

### **The ENERGIC-OD Virtual Hubs**

The ENERGIC OD (European Network for Redistributing Geospatial Information to user Communities – Open Data) project, funded by the EC, introduced a VH framework that performs all interoperability actions required to

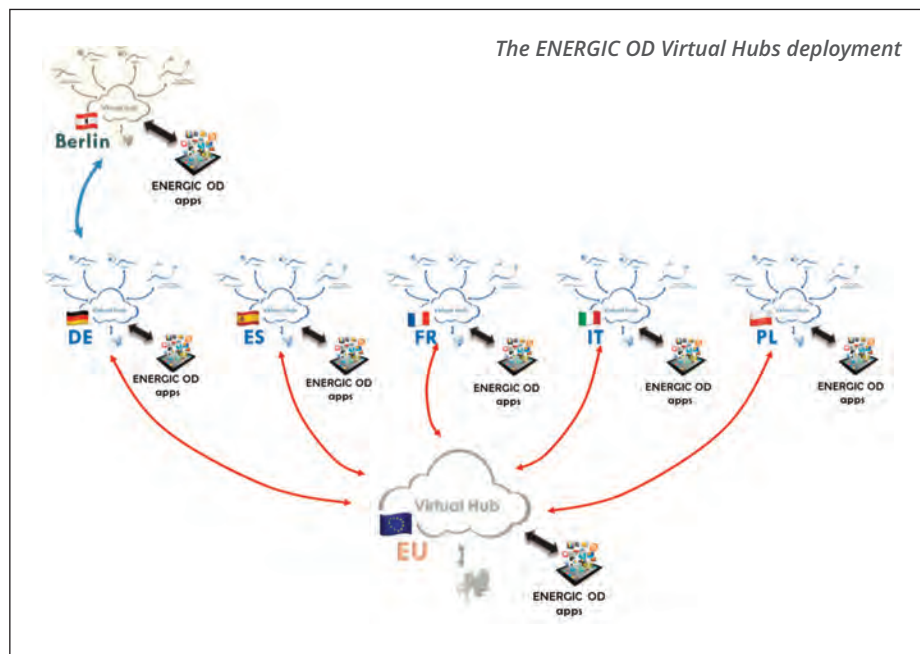
## PROFILE

interconnect heterogeneous data systems. VH implements a brokering approach where specific components (brokers) provide the needed mediation and harmonisation capabilities. ENERGIC OD deployed 5 VHs at national level in France, Germany, Italy, Poland, Spain, and 1 VH at local level in Berlin. From a technical point-of-view, the deployment was made possible on diverse local infrastructures and on private and public clouds providing Infrastructure-as-a-Service (IaaS) and Platform-as-a-Service (PaaS) functionalities.

The broker architectural approach adopted by ENERGIC OD was designed and developed in recent European and International research programmes<sup>2</sup>. In this approach, specific components (the brokers) perform all interoperability actions required to interconnect heterogeneous systems.

**“Through VH, users are able to access datasets provided by a plethora of remote and heterogeneous systems, as if they were provided by a unique system. Using VH services, users will not need to solve (often complex) interoperability issues...”**

Ten innovative pilot applications in different domains (ranging from land use, protection of the environment, health, cultural heritage, natural hazard assessment, biodiversity, etc.) have been developed by the ENERGIC-OD partners making use of the services offered by the deployed VHs. These innovative applications are addressing



the needs of businesses, citizens and public institutions, making use of both public and private (open) geospatial data, encouraging innovation and business activities. The new applications, together with the newly developed VHs, will optimise the exploitation of (open) GI and the development of new marketable services.

ENERGIC OD involves 15 partners from 6 EU member states (Italy, France, Germany, Poland, Spain and UK) and is co-ordinated by Stefano Nativi of the Consiglio Nazionale delle Ricerche – Istituto sull’Inquinamento Atmosferico (CNR-IIA) in Italy.

<sup>1</sup> Nativi, S., Craglia, M., Pearlman, J., The Brokering Approach for Multi-disciplinary Interoperability: A Position Paper. International Journal of Spatial Data Infrastructures Research, 2012, Vol.7, 1-15. Available at: <http://ijsdir.jrc.ec.europa.eu/index.php/ijsdir/article/view/281/319>

<sup>2</sup> <http://www.geodab.net/>



Co-funded by  
the European Union



**Dr. Stefano Nativi**  
**Project Coordinator**  
National Research Council of Italy  
Institute of Atmospheric Pollution Research  
(CNR-IIA)  
Via Madonna del Piano, 10  
50019 Sesto Fiorentino (FI) Italy  
Tel: +39 055 522 6590  
[stefano.nativi@cnr.it](mailto:stefano.nativi@cnr.it)  
[www.energic-od.eu](http://www.energic-od.eu)

Project Reference: 620400





# Look to the Arctic

Dr Jan-Gunnar Winther, Director, and Gunn Sissel Jaklin, Communications Director  
at the Norwegian Polar Institute...

**T**he Arctic is a hotspot – literally, as it is more affected by global warming than the rest of the world, but also in the sense that several nations are directing their political interest towards the far north – or the High North, as Norwegians call it.

For the past decade, several countries have looked to the Arctic and strengthened their interests in this part of the world. In Ny-Ålesund, a research village in the Svalbard Archipelago at 79° N, which best can be described as a natural laboratory, institutions from 10 countries now run research stations. The Norwegian Polar Institute has been a cornerstone of the settlement since 1968, whereas institutions from

countries like China, India and South Korea inaugurated their stations in the 2000s.

An important reason for this interest is global warming. The regime of the High North's ecosystem is changing. Warmer waters from the south alter the balance in the sea. The sea ice is diminishing in extent and thickness, causing trouble for seals and polar bears, and allowing for more heat from the sun to be absorbed by the ocean. In winter, spells of milder temperatures melt snow on the ground, which freezes during cold snaps, preventing reindeer from reaching their food. Melting glaciers cause sea levels to rise. As glaciers shrink,

marine mammals and seabirds lose the upwelling of rich nutrients that occurs when glacier fronts drop chunks of ice into the sea. Rising waters, less sea ice and thawing permafrost cause coastal erosion which is threatening to eradicate villages and settlements. Both onshore and undersea permafrost thawing release the potent greenhouse gas methane to the atmosphere. In addition, there is evidence that Arctic climate change affects weather and climate elsewhere through atmospheric and oceanic connections.

The ice in the Arctic Ocean is now primarily ice that is less than one year old, while not long ago multiyear ice,

## PROFILE



much of it more than 5 years old, was the norm. A younger ice cover absorbs more of the energy from the sun and lets more of it pass through to the ocean, starting a feedback that leads to even faster warming.

The opportunities in an Arctic with much less summertime sea ice are numerous. New shipping lanes, commercial fishing, bioprospecting and marine ingredients for bio-production (including those further down the food chain) are among the main gains from the situation. Oil, gas and minerals are other resources that may be possible to exploit increasingly further north in the near future. Norway manages a substantial part of the High North, and taking care of the natural environment is of importance to Norway. However, today's rapidly changing climate and the major ecosystem changes that go with it, impose a fundamental challenge for management: the system is highly dynamic.

We must avoid making decisions and investments for the future based on

yesterday's situation. This calls for a continuously updated knowledge base and sophisticated earth system models to project future changes. For 6 winter months, from January to June 2015, the Norwegian Polar Institute froze its research vessel, Lance, into the Arctic Ocean on 83°N, 30°E, with climate researchers from 11 countries on board. The N-ICE2015 programme focused on themes within oceanography, atmospheric science, sea ice and ecosystems, and the need to understand the implications of the transition to thinner, first-year ice in the Arctic Ocean. The scientists' efforts will generate important new knowledge that will improve weather forecasts and climate models.

Other initiatives to help increase the knowledge base will materialise soon. Norway is building a state-of-the art polar research vessel to be launched in 2017. So are Germany, the UK, and China. New technologies for research in remote and hostile conditions will make a huge difference: unoccupied underwater robots (Remotely Oper-

ated Vehicles, ROV) and unmanned aerial vehicles (UAV) will provide far more data than ever before.

**“An important reason for this interest is global warming. The regime of the High North's ecosystem is changing. Warmer waters from the south alter the balance in the sea. The sea ice is diminishing in extent and thickness, causing trouble for seals and polar bears, and allowing for more heat from the sun to be absorbed by the ocean.”**

Further collaboration between nations with an interest in climate change and the Arctic is expected to give enhanced results with global benefits. With projects such as N-ICE2015, the international polar research community will be able to make even stronger contributions towards tomorrow's decisions about our future.



**Gunn Sissel Jaklin**  
**Communications director**  
Norwegian Polar Institute  
Tel: +47 95104045  
jaklin@npolar.no  
www.npolar.no

# Worldwide glacier monitoring system

Professor Martin Hoesle from the Department of Geosciences, University of Fribourg sheds light in the importance of measuring the increased fever of world's climate...

The cryosphere as a whole system consists of snow, river and lake ice, sea ice, glaciers, ice shelves and ice sheets, and frozen ground. The word cryosphere derives from the old Greek word kryo, which stands for cold. The different components of the cryosphere can be categorised as seasonal and perennial ice, or as ice in the sea, in rivers and lakes, in the ground and on land. Perennial surface-ice on land, one can differentiate between ice sheets, ice shelves, and glaciers. There are fundamental differences in time-scales and processes involved between the different components of the perennial surface-ice on land. Due to the large volumes and areas, the two continental ice sheets actively influence the global climate over time-scales of months to millennia. Glaciers, with their smaller volumes and areas, react much faster to climatic effects (i.e., time-scales range between months and centuries).

Concentrating on earth land surfaces, ice masses are covering today about 10% with glaciers and continental ice sheets and during the ice ages this amount was about a factor of three. The present ice cover corresponds to about 75% of the world's total fresh-water resources. The sea level would rise by almost 65 metres, if all land ice melted away, with the continental ice sheet in Antarctica contributing about 57 metres and Greenland 7 metres, respectively. All other glaciers would

roughly contribute half a metre to this rise. Glaciers especially represent a unique resource of fresh water for agricultural, industrial and domestic use. They are also an important economic component of tourism and hydro-power production, a major component of the culture, landscape, and environment in high-mountain and Polar Regions and sometimes they create situations with serious risks of natural hazards. They also constitute a key variable within climate-related observation programmes, because they are close to the melting point and react strongly to climate change, therefore they provide some of the clearest evidence of climate change and are one of the most important terrestrial Essential Climate Variables (ECVs) defined by the Global Climate Observing System (GCOS). Internationally coordinated glacier monitoring has been initiated already in 1894 when climate change was not at all on the international climate agenda. However, thanks to the foresight of the founders of the international glacier observations like, F.A. Forel, today unprecedented datasets on the distribution and changes of glaciers are available. These data derived from in-situ measurements and remote sensing, which are a fundamental basis for many scientific studies which constitute the present state of knowledge. Usually, scientific articles report on the methods and main results of glacier investigations. The raw data and meta-information

are compiled, and published in standardised formats and made available in printed and digital form by the Global Terrestrial Network for Glaciers (GTN-G; [www.gtn-g.org](http://www.gtn-g.org)) represented through the World Glacier Monitoring Service (WGMS; [www.wgms.ch](http://www.wgms.ch)) and its cooperation partners, the US National Snow and Ice Data Center (NSIDC; [www.nsidc.org](http://www.nsidc.org)), and the Global Land Ice Measurements from Space (GLIMS; [www.glims.org](http://www.glims.org)) initiative. This year is the 30th anniversary of WGMS, which was founded in 1986 by merging the 2 former services of the Permanent Service on the Fluctuations of Glaciers (PSFG) and the Temporary Technical Secretariat for the World Glacier Inventory (TTS/WGI). The extended dataset consists of information about ongoing glacier fluctuations, such as changes in glacier length, area, volume, and mass and on the distribution of glacier area on all continents called glacier inventories. All glacier observations are submitted through an international scientific collaboration network in over 35 countries worldwide, represented by so-called National Correspondents and Principal Investigators of WGMS. The data sent to the GTN-G are converted into standardised formats and uploaded into different databases, which can be accessed by a [web browser](#). Each new version of the databases gets a digital object identifier and are made available to the public free of charge. These glacier databases are today an important



## PROFILE

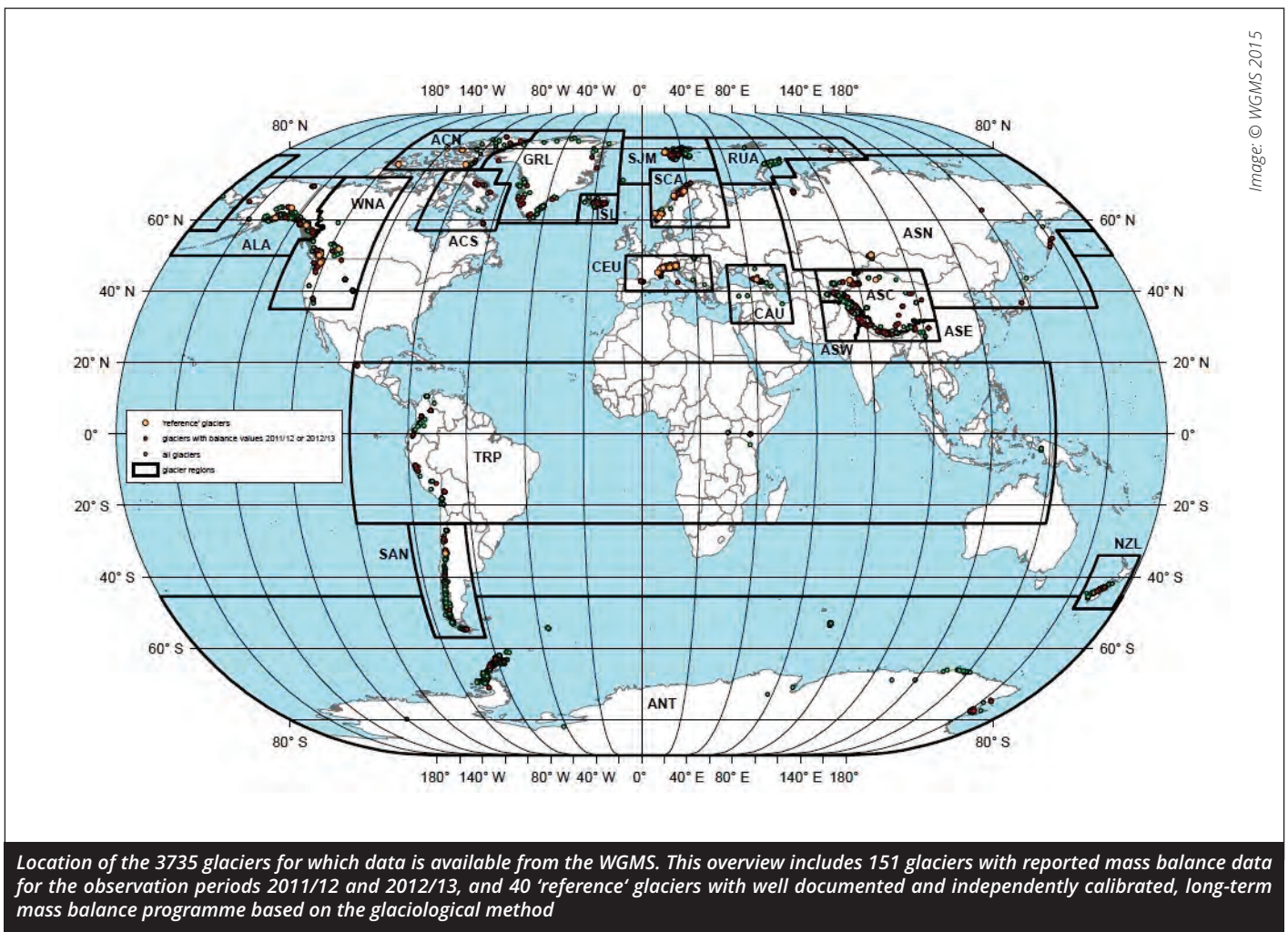


Image: © WGMS 2015

basis for different assessment reports such as the well-known Intergovernmental Panel on Climate Change (IPCC) and also often used in many scientific publications.

In 2014, a near-time reporting was introduced for the official 'reference' glaciers (with more than 30 years of continued mass balance observations), in agreement with the responsible Principal Investigators. This allows the WGMS to report preliminary mass balance data as soon as a few months after the end of the corresponding observation period. The new Global Glacier Change Bulletin series ( <http://wgms.ch/ggcb/> ) aims to provide an integrative assessment of global glacier changes every 2 years.

The main focus is on mass balance and length change measurements. More than 5,500 glaciological mass balance observations from 413 glaciers and 42,000 length change observations from around 2,000 glaciers have been collected and made available by the WGMS. At the end of 2015, during the COP21 in Paris, the WGMS Glacier App was launched for mobile devices in order to increase the visibility of global glacier changes, its observers, and the internationally coordinated glacier monitoring network. The WGMS Glacier App is available at no cost from Apple App Store and Google Play Store. We recommend everybody to explore these rich databases and learn more about glaciers, one of the most unique climate indicators.

**UNI  
FR**

**UNIVERSITÉ DE FRIBOURG  
UNIVERSITÄT FREIBURG**

**Professor Martin Hoelzle**

Department of Geosciences

Tel: +41 263 009022

[martin.hoelzle@unifr.ch](mailto:martin.hoelzle@unifr.ch)

[www.unifr.ch/geoscience/geographie](http://www.unifr.ch/geoscience/geographie)

**Dr. Michael Zemp**

**Director**

World Glacier Monitoring Service

Department of Geography

University of Zurich – Irchel



# Climate change and its impacts on the ocean

Dr Michael A. Ellis, Science Director of Land, Soil, and Coast at the British Geological Survey outlines the impacts of global warming on the ocean, drawing from both its present state to lessons learned from the past...

**T**he oceans play a major role in climate change. That role goes both ways: the state of the ocean is a manifestation of a changing climate, but that state feeds back into the nature of the climate. The connection between the climate and our oceans, however, is far more complex and nuanced than we had ever realised. But let's start with some first-order connections. As global mean temperatures rise, the temperature of the surface waters rises, the volume of water expands and sea-level rises.

Warmer temperatures, both in the atmosphere in ocean currents, also leads to greater melting of land-

based ice, and that extra water adds to higher sea-levels. These two processes largely alone, thermal expansion and extra meltwater, have resulted in a rate of sea-level rise of about 3.2 mm per year. That rate is now known, with great confidence, to have accelerated since 1985 and very likely since the beginning of the 20th Century. Warming temperatures also change the amount and distribution of sea-ice. Sea-ice is already in equilibrium with sea-level, and so that water does not add to sea-level rise, but it does add to the freshening of ocean waters. As salinity and surface water temperature change, so too does the nature of ocean currents.



Ocean currents, like mythical Leviathans, lift and lower sea-levels as they arc their way across and through the major oceans. Sea-levels along the eastern seaboard of the US, for example, are rising at rates higher than the global mean because, as has been proposed, the back of the Gulf Stream is arcing higher as it dives more steeply into a freshened North Atlantic. And still it's gets more nuanced. Future sea-levels will also depend on which parts of the major ice-sheets collapse first. If most of the ice melt is derived from the ice-sheet over Greenland, sea-levels relatively close to Greenland will fall, whereas those farther away will rise more than the mean. The spatial distribution of future sea-levels, particularly over the decadal time-scale, will depend strongly on where the meltwater comes from and how ocean currents respond to equally heterogeneous temperature and salinity changes within the ocean. But over the long-term, at millennial time-scales, we know this: the last time that the Earth had the same atmospheric concentration as today's atmosphere was about 3.2 million years ago. Then, global temperatures were about 2 to 4 degrees higher than today's, and sea-levels were significantly (as in about 10 meters) higher.

Climate change also alters the biological and chemical state of the ocean, but in ways that are only now being understood. We have known for a long time that the oceans absorb significant amounts of anthropogenic CO<sub>2</sub>, which causes the waters to be more acidic and inhibits many organisms from secreting carbonate shells. The slow increase in the oceans' acidity causes plankton to emit less of the sulphur compounds that help seed the formation of clouds. And clouds reflect incoming solar radiation, helping to cool the planet. On the other hand, warmer waters tend to generate greater amounts of these sulphur compounds, and so the net effect is unknown.

Primary productivity within the ocean is fundamentally controlled by the cycling and recycling of nutrients such as nitrogen and phosphorous. Both of these

fertilising elements and related compounds are being altered by increased input from terrestrial sources or by their remobilisation from sediments in estuaries and shallow marine environments. In turn, primary productivity can go into overdrive, as anyone who has witnessed an algal bloom along the coast will verify. As nutrient-induced primary productivity increases, coupled to greater, warming-induced stratification in the ocean, respiration increases and large swathes of ocean water become starved of oxygen.

**“Ocean currents, like mythical Leviathans, lift and lower sea-levels as they arc their way across and through the major oceans.”**

Geology tells us that in times of elevated CO<sub>2</sub> levels, large parts of the global oceanic system become anoxic and biodiversity crashes.

The impact of climate change is not limited, however, to the bottom of the food chain. The distribution of North Sea cod has shifted northwards, and fish migration has generally changed the composition of fisheries and stock distributions. This may be an economic benefit to many nations, but those benefits are likely to be played out in a difficult context of international maritime law. Maritime law itself is historically based on the stability of sea-levels established over the past several millennia, and the makers of maritime law are paying great attention to the implications of higher sea-levels in the future Anthropocene world. ■

.....  
**Dr Michael A. Ellis**  
**Science Director, Land, Soil, and Coast**

British Geological Survey  
mich3@bgs.ac.uk  
www.bgs.ac.uk



# Making the most of ocean data

It's hard to see underwater. That is not just a problem for learning to swim; it is also a problem for getting a full picture of the world's oceans. Satellites in space give us good information on the ocean's surface. Sea surface temperature is obtained from radiometers that measure microwave or infrared radiation. And sea surface height can be measured in a similar fashion, which gives a basic picture of the water column beneath because it shows how much it has expanded or contracted away from its mean. But satellites cannot see under the surface and so do not tell us about the complex activity of water, chemicals and life below. This opacity of the ocean to observation from above presents us with a major scientific challenge: how to collect enough data, and use what we can get effectively, to make an accurate and full assessment of ocean conditions.

Lagrangian data assimilation is a mathematical subject whose aim is to address this situation. Its goal is to extract the most information we can from measurements taken by instruments underwater.

Enormous advances have been made over the past few decades in the design of instruments that give good readings from inside the ocean. ARGO floats are designed to record the water properties, such as temperature and salinity, in a water column down to about two kilometers. They transmit their collected data to satellites while



at the surface, and obtain coverage by drifting for ten or so days between profilings. Sea-borne drone-like vehicles, called Autonomous Underwater Vehicles (AUV), and gliders, which have less power to maneuver but will stay in action much longer, together give us the ability to take readings in specific ocean regions. But given the vast expanse of oceans covering the surface of the Earth, and the complex activity we know to be happening in the ocean, we have relatively little from data to go on.

This lack of observational data means that we have to find a way to fill in the gaps. A very crude approach would be to interpolate between data points. This will only work, however, if we have a reasonable amount of data, which in reality we do not. But there is something else going for us that can be used in this situation: the underlying

physics of the ocean as a fluid is well understood. Indeed, the motion of ocean water obeys the classical equations of fluid mechanics derived by Navier and Stokes two hundred years ago. The state-of-the-art in ocean state estimation is to use data from observations in concert with computational models based on these fluid equations. This process is called data assimilation (DA) and Lagrangian DA is the version of this theory that is specifically targeted at data obtained from instruments that move underwater. The view of a fluid as seen from a moving fluid particle is called Lagrangian and the use of the term here originated with the ancestors of these underwater vehicles and instruments which moved, in principle, only under the flow of water.

The assimilation of data in models of the atmosphere is now routine; and



has led to the considerable improvement in weather forecasts we have seen over the past thirty years. But data from the ocean is a different kettle of fish and the theory is far behind. Nevertheless, we have shown in varying contexts from simplified models of idealized fluids to models of the Gulf of Mexico that tailoring methods for the assimilation of data from underwater brings significant benefit.

There is a glaring problem in using the data obtained underwater: since the vehicles taking the measurements cannot be seen, even by satellites or other above-surface instruments, we cannot track them and so their location when taking the measurements is unknown. They can measure a lot: with modern sensors on board the vehicles can measure a variety of physical properties, including temperature, salinity, and pressure. There are also biomass sensors that can give an assessment of the local biota. The limiting factor nowadays is the cost of the sensors, not what they can measure. Yet they cannot tell us where they are.

So, is this large data-set useless? Obviously not as good educated guesses can be made about the location of the vehicle or instrument. For ARGO floats, they surface and transmit their data to a satellite. The profile it has taken is of the water column beneath the surfacing location, which the satellite can detect. There is a correspondence between pressure and depth and so complete position information can be associated with measurements. But we are not so fortunate with the data from underwater vehicles, such as AUVs and gliders.

These underwater vehicles are moving around according to a mission plan and the information as to where the vehicle should be when taking a measurement, according to the plan, can be used to associate position with measurement. But the best laid plans may be wrong as the flow of the water can throw the vehicle off-course. This is a problem with using the mission plan as a guessing guide, and it will become even more of an issue as missions become longer in duration

with more capable vehicles using longer running batteries.

Lagrangian DA promises the most effective way of addressing this thorny problem. With this mathematical technology, the position of a measuring instrument can be estimated along with the various other physical variables that are drawing on information from observation and model alike. It works so well because it takes into account the special nature of these ocean observing platforms and their Lagrangian character. In proof-of-concept experiments using this approach, we have shown that the integrated platform of Lagrangian DA specifically designed for ocean observations holds the promise of significant improvements in ocean estimation.

renci



THE UNIVERSITY  
of NORTH CAROLINA  
at CHAPEL HILL

**Christopher KRT Jones**  
**Domain Scientist of Mathematics**  
Renaissance Computing Institute  
University of North Carolina  
at Chapel Hill  
Tel: +1 919 923 3569  
ckrtj@email.unc.edu  
www.mathclimate.org

# Identifying climate change hotspots

Prof Dr Daniela Jacob from the Climate Service Center Germany (GERICS) outlines how climate change hotspots can be located

There is a rising awareness that apart from the mitigation of climate change, also activities in the areas of adaptation to the potential climate change related impacts are becoming necessary. The COP21 Paris Agreement has recently raised the issue of adaptation, which is now discussed at the same political level as mitigation. In order to be able to design, implement and evaluate climate adaptation measures, suitable and praxis relevant information on potential future regional and local climate changes is needed.

This necessary information can be taken from climate change projections from regional and/or global climate models – depending on the context and local conditions. However, the worldwide future growth in greenhouse gas emissions is not known. Thus, climate models are fed by different potential future evolutions of concentrations of greenhouse gases. The use of different emission scenarios and different models results in a range of climate change projections, which provide possible future climate evolutions for a region. This often leads to rather complex pictures of potential future climate changes, which are hard for non-experts to interpret. It is far too demanding for practitioners to make decisions based on such complex scientific results.

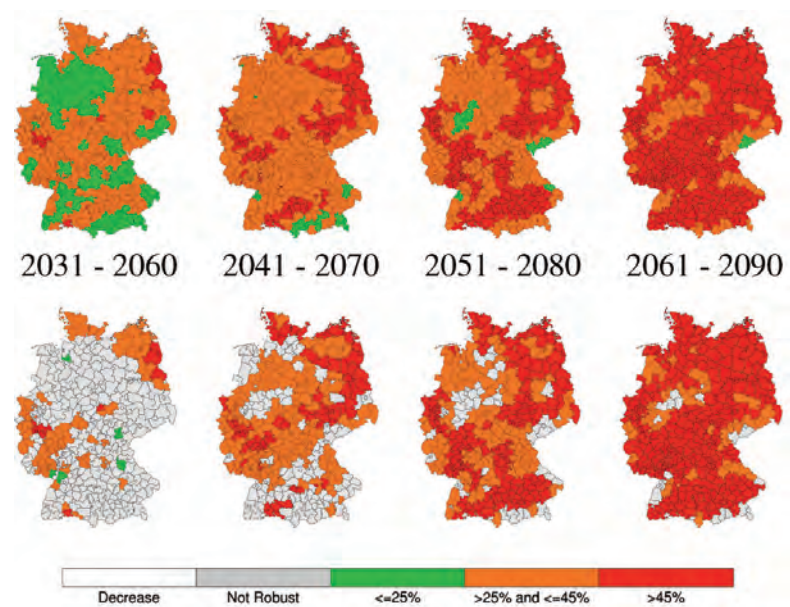
Here is where so-called Climate Services come into play. Climate service providers are situated at the interface

between science and application of climate related knowledge in industry, business or administration. They provide tailored and solution-oriented climate information which is fit-for-purpose in order to support the decision making process. Thus methods are required which help to extract the most important relevant information from the large variety of scientific results. In order to meet this demand, GERICS develops, among others, concepts and methods in order to provide simple, easily understandable visualizations of climate related data – of which the so-called GERICS-Climate Signal Maps are one example.

The GERICS-Climate Signal Maps combine two pieces of information. Firstly,

they help to identify regions with robust projections of future climate change, thereby tackling the issue of uncertainty of future climate development. Secondly, they highlight regions, for which projected climate changes are strongest, thereby addressing the issue of awareness rising.

For the identification of robust climate changes from a large number of climate change simulations, both, the agreement of various climate model results in the direction of change (e.g. wetter or drier, warmer or colder) and the statistical significance of the projected change of the individual model simulations, are assessed and both results are combined. All regions with non-robust changes are greyed out in the map.



*Fig.1: Example for a GERICS-Climate Signal Map for Germany: Increase in the number of winter days with extreme precipitation amounts. For more details see the open access publication of Pfeifer S. et al (2015) available under: [www.mdpi.com/2073-4433/6/5/677](http://www.mdpi.com/2073-4433/6/5/677)*

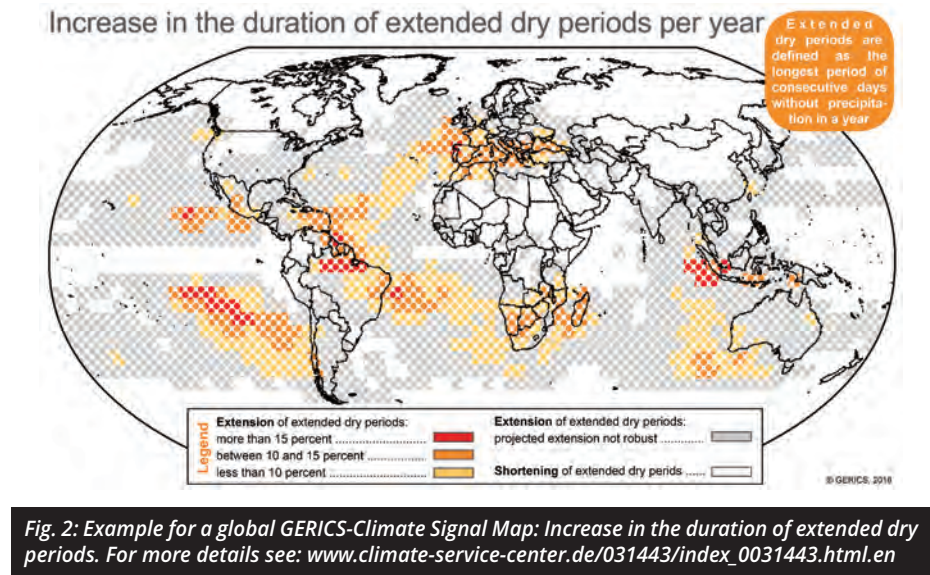


## PROFILE

For the regions with robust projected future changes, a three-fold colour code with individual thresholds is assigned, based on expert judgment and practical relevance. Changes are only depicted into one direction most relevant in terms of related risks. For example, consider the changes in the number of winter days with extreme precipitation amounts over Germany (Fig. 1). Here only projected increases are depicted, because only an increase would require adaptation activities. The colours are chosen in the style of traffic lights, in order to raise awareness: green refers to a small increase, orange to a medium-strong increase, and red to a severe increase. The GERICS-Climate Signal Maps indicate that towards the end of this century for almost all districts in Germany a severe increase in the number of winter days with extreme precipitation is projected.

The GERICS-Climate Signal Maps have further been successfully used for making better informed climate financing decisions. Jointly with the German Development Bank (KfW), GERICS has applied this concept with regard to climate change projections on the global scale. To enable informed decision-making, the maps can help project managers in development financing institutions accelerate financing adaptation activities in region suspected to be seriously affected by future climate change. These would be basically the regions coloured in red.

However, the grey coloured regions that show no robust changes are interesting from the adaptation financing point of view as well. These regions often correspond to regions that have a high demand for development financing. As a result, a lack of robustness in the projected climate change signals should surely not prevent the



financing of projects. Instead, the lack of a clear future trend has also to be considered in the design of the climate adaptation projects in these regions, as the projects require a higher flexibility to be adjusted to yet unclear future conditions.

The global map (Fig. 2) shows the projected future changes for the duration of extended dry periods, due to climate change. This index serves among others as e.g. a proxy for irrigation needs or for intensive water management activities. By means of the three-fold colour code, it becomes obvious that regions situated in the Northern part of the Amazonas basin, in Southern Africa and in Eastern Europe in particular are regions with medium-strong to strong increases in the duration of extended dry periods. On the other hand, future projections show no robustness over large parts of South America or South-East Asia. Here, obviously more flexible adaptation solutions are required.

A further step is to combine climate change signals and regional, multi-sectoral vulnerabilities in order to be able to identify "hot-spots" regions with multiple threads. This combined information can be illustrated in the

well-established GERICS-Climate Signal Maps format which enables decision-makers assessing regions that are affected strongest by future climate change and therefore have the largest adaptation need.

### About us

Climate Service Center Germany (GERICS) offers in a scientifically sound manner: products, advisory services and decision-relevant information in order to support government, administration and business in their efforts to adapt to climate change. GERICS is a scientific organizational entity of Helmholtz-Zentrum Geesthacht and is based in the city of Hamburg.



Prof Dr Daniela Jacob  
Climate Service Center  
Tel: +49 40 226 338 406  
daniela.jacob@hzg.de  
www.climate-service-center.de/

# Why monitor water quality?

Donna N. Myers, Chief of the Office of Water Quality at the U.S. Geological Survey highlights the importance of monitoring water quality to better protect human health and the environment...

**W**ater quality is defined as a measure of the physical, chemical, biological, and microbiological characteristics of water. As shown in the following 2 examples, monitoring water quality provides empirical evidence to support decision making on health and environmental issues. In the United States, an emphasis is placed on monitoring for compliance with the Clean Water Act and Safe Drinking Water Act, which are administered by the U.S. Environmental Protection Agency (EPA). Responsibilities for water-quality monitoring are spread among many Federal, State, and local agencies. The U.S. Geological Survey (USGS) is a Federal non-regulatory science agency with water-quality monitoring, assessment, and research responsibilities.

Monitoring water quality in the 21st century is a growing challenge because of the large number of chemicals used in our everyday lives and in commerce that can make their way into our waters. Methods of chemical analysis and knowledge of chemical toxicity are available for only a few thousand of the more than 80,000 chemical compounds estimated by EPA to be in commercial use in the United States.

An example of why we need to monitor for many more chemical compounds than our current capability allows is illustrated by the spill of a little known coal-processing chemical, 4-Methylcyclohexanemethanol (MCHM), into the Elk River in Charleston, West Virginia, USA on January 9, 2014. The Elk River became contaminated by a leaking storage tank containing MCHM, located about 2.4 kilometers upstream from the public water-supply intake for the City of Charleston. River water contaminated with MCHM was drawn into Charleston's water supply system leaving over 300,000 people and area businesses without water for several weeks. "Researchers had little information on how the

spilled chemicals moved through water, their stability or toxicity, or even how to measure them, as published information was either limited or non-existent." said Dr. Bill Foreman research chemist at the USGS.

At the USGS National Water Quality Laboratory (NWQL) near Denver, Colorado, USA a strategy is in place to focus new methods research and development on priority chemical compounds – those that are widely used, persistent, and of potential health concern. Using one of the new methods, MCHM and methyl 4-methylcyclohexanecarboxylate, a previously unreported compound, were detected for at least 6 weeks in contaminated water samples collected by USGS and analysed at the NWQL. All detections of MCHM from the Elk River, from other affected downstream rivers, and in tap water samples were below levels of concern established by health agencies. The USGS traced the chemicals over 630 kilometers downstream from the spill site. The compounds traveled farther and persisted longer in the environment than anticipated. The Elk River spill influenced the U.S. Congress to pass the Frank R. Lautenberg Chemical Safety for the 21st Century Act. The Act, which was signed into law on June 22, 2016; revamped the 1976 Toxic Substances Control Act providing mechanisms to better manage new chemicals and those already in commercial use.

Another example of why we need to monitor water quality is the case of corrosive water, one of the underlying causes of lead in drinking water in Flint, Michigan, Washington, D.C. and other cities. This example illustrates how well-designed monitoring programs can serve current and future needs even if future needs are not foreseen. The USGS has been consistently collecting baseline measurements of ground-water quality for decades to serve a multitude of purposes. Recently these measurements were quickly retrieved from the



USGS computerised National Water Information System (NWIS) to calculate an index of corrosive water that describes the susceptibility of plumbing to leach lead into untreated water.

Results from 27,000 ground-water sites retrieved from NWIS show that more than half the sites in 25 states contain potentially corrosive water, as may occur in homes dependent on untreated water from private wells. Private wells are not regulated under the Safe Drinking Water Act and well owners are not required, except in some jurisdictions, to test their water. The assessment shows areas of the United States that are most susceptible to lead contamination from plumbing due to the use of untreated corrosive ground water. The study demonstrated that an index of corrosive water, calculated from a wealth of readily available and reliable monitoring data, can inform private well owners where further water testing and treatment might be needed to protect human health.

Why monitor water quality? Monitoring provides the objective evidence necessary to make sound decisions on managing water quality today and in the future. Water-quality monitoring is used to alert us to current, ongoing, and emerging problems; to determine com-

pliance with drinking water standards, and to protect other beneficial uses of water. Assessments based on monitoring data help law makers and water managers measure effectiveness of water policies, determine if water quality is getting better or worse, and formulate new policies to better protect human health and the environment. ■

<https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/how-epa-assesses-chemical-safety>

<https://www.congress.gov/bill/114th-congress/senate-bill/697/all-info#summary>

<https://www.usgs.gov/news/chemicals-elk-river-spill-lingered-longer-traveled-farther>

<https://www.usgs.gov/news/new-study-shows-high-potential-ground-water-be-corrosive-half-us-states-0>

.....  
**Donna N. Myers**  
**Chief – Office of Water Quality**  
U.S. Geological Survey  
[www.usgs.gov](http://www.usgs.gov)



# Illegal, unreported and unregulated fishing – A global fight worth fighting

Honourable Dominic LeBlanc, Minister of Fisheries, Oceans and the Canadian Coast Guard highlights the devastating effects of illegal and unreported fishing...

Illegal, unreported and unregulated (IUU) fishing is a devastating reality facing the world's fisheries today. This criminal activity undermines the responsible fish management practices of nations and threatens the sustainability of fish resources world-wide. It is estimated that 30% of total global fish catches are derived from IUU fishing and that this illegal activity costs the world economy anywhere from \$10 to \$23bn annually.

IUU fishing also has detrimental effects on our environment, directly contributing to the depletion of invaluable fish stocks, upsetting the delicate balance of vulnerable oceanic ecosystems, and jeopardising the safety of fishers at sea. It is a battle without borders requiring global solutions.

**“We are now working with the Arctic Coastal States and other distant water fishing nations to negotiate a new international agreement to prevent unregulated high seas fishing in the arctic.”**

Illegal and unreported fishing is not limited to rogue vessels operating outside of existing management regimes. Equally threatening to the conservation of global fish stocks are vessels operating legitimately, but misreporting catch and overfishing.

Canada is fighting IUU fishing on many fronts. One of our most successful efforts is Operation Driftnet, an intelligence-sharing partnership between 2 federal departments – Fisheries and Oceans Canada and the Department of National Defence. Since its inception in 1993, Operation Driftnet has led to a marked decline in IUU fishing in the international waters of the North Pacific. The operation has only had to apprehend 4 vessels since 2001, down from 14 between 1993 and 2001. This international initiative of the North Pacific

Anadromous Fish Commission is complemented by the enforcement activities of Japan, the United States, the Republic of Korea, and the Russian Federation.

Canada is also working with Arctic Coastal States to prevent unregulated commercial fishing in the high seas of the central Arctic Ocean through an international commitment made in the 2015 Oslo Declaration. We are now working with the Arctic Coastal States and other distant water fishing nations to negotiate a new international agreement to prevent unregulated high seas fishing in the arctic.

Canada's expertise in digital forensics has also been used successfully in discovering key digital evidence for major international investigations against suspected illegal, unreported and unregulated fishing vessels. Recent convictions in Sao Tomé and Príncipe were thanks, in part, to Canada's forensic examination of seized computers, navigational equipment, digital cameras and cell phones.

A collaborative approach is integral to achieving real results in combatting this global problem. Through committed partnerships within the international community we can turn the tide on criminals and protect our marine ecosystems, infrastructure and jobs. Canada recently signed a Joint Statement between Canada and the European Union on Efforts to Combat Illegal, Unreported, and Unregulated Fishing, further strengthening our shared resolve and capacity for increased information-sharing, monitoring and enforcement activities.

Illegal fishers need to sell their catch. The United Nations Food and Agriculture Organization's 2009 Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing



is an effective mechanism to preventing illegally caught fish from entering international markets.

As a strong supporter, Canada signed the Port State Measures Agreement in 2010 and the Agreement entered into force on June 5th, 2016. Canada believes that now that the Agreement has come into force, we will see a decrease in IUU fishing around the world. While Canada is still undertaking necessary changes to domestic regulations before we are able to ratify the Agreement, we are fully committed to eliminating IUU fishing, and will be ratifying the Agreement at the earliest possible opportunity.

Together with our international partners and governments, Canada will continue its efforts to achieve real results and fight IUU fishing on the world's oceans. Illegal, unreported, and unregulated fishing hurts us all, but, by working together nations can combat this destructive activity. ■



**Honourable Dominic LeBlanc**  
**Minister of Fisheries, Oceans and the**  
**Canadian Coast Guard**

Fisheries and Oceans Canada  
[www.dfo-mpo.gc.ca/index-eng.htm](http://www.dfo-mpo.gc.ca/index-eng.htm)  
[www.twitter.com/DFO\\_MPO](https://twitter.com/DFO_MPO)

# Europe's transition to a circular economy has started – let's speed it up

Cillian Lohan, environmental scientist and a member of the European Economic and Social Committee (EESC), outlines why we must push ahead with the transition to a circular economy...

**T**he Circular Economy is not about one big circle, but rather a series of interconnected and inter-influential circles. It is much more than taking the current linear model and feeding the waste back in to production. It is much more than recycling.

We often hear lip service to the recognition that we live on a finite planet, and that we must improve resource efficiency. There are various measurements of this and ways of illustrating it. Last year [the BBC reported that if](#) we all lived and consumed like an average American we would need 4 "Earths" to sustain us. If we consumed like the average French person we would need 2.5 planets to meet our needs. In fairness it should be pointed out that the BBC was reporting on a study carried out elsewhere, lest it seem that the UK's national broadcaster was casting disparaging judgements in the direction of its European neighbour.

Sustainable consumption and production were already part of the discussions taking place at the Earth Summit in Johannesburg in 2002. Resource efficiency is one of the headline targets of the EU 2020 Strategy. We have climate change mitigation goals and we have many national sustainability charters and strategies.

None of this is particularly new, and it could be argued not much of this has been making the drastic changes that would seem to be urgently required in order to set humanity on a very different trajectory to the one currently deployed almost as a disastrous default.

But now we have what may just be a game changer piece of policy. The Action Plan for a Circular Economy, called Closing the Loop, emerged from the ashes of the (former EU Commissioner for the Environment) Potočník driven withdrawn package of 2014. There was criticism of the reduction of headline targets and of

insufficient measures on built-in obsolescence, there was applause and support in recognition of the inclusion of more upstream considerations – specifically the appreciation that the first step in bringing the principles of circularity to an economic model is to get the design of products right. It could be better, it could be worse. The reality is that it now exists, it is a step in the right direction, even though it could be more ambitious and visionary.

**“Resource efficiency is one of the headline targets of the EU 2020 Strategy. We have climate change mitigation goals and we have many national sustainability charters and strategies.”**

The Circular Economy model is driven by a vibrant secondary raw materials market. This requires some basic elements such as a clean and reliable source of good quality secondary raw materials, no matter the industry. It involves moving away from an ownership-based economy and introduces the widespread use of leasing models. In a truly circular economy there is no waste, as every element that is introduced to the manufacturing loop is re-used in one form or another. The concept as promoted by the European Economic and Social Committee in our [opinion](#) on the whole Circular Economy Package involves manufacturers or producers retaining ownership of the component parts of their products, once their functionality has come to an end.

This gives manufacturers a liability for the expected duration of the functioning of the product (which in an attempt to eliminate unidentified planned obsolescence, would carry a life expectancy label) and gives them ownership and responsibility for the component parts of the product once that usage period is over.



This retained ownership and responsibility incentivises the manufacturer to design the product in such a way as to make it economically viable to separate the component parts for reuse. A product which retains ownership and a value is no longer waste but rather a valuable resource.

**“The Circular Economy model is driven by a vibrant secondary raw materials market. This requires some basic elements such as a clean and reliable source of good quality secondary raw materials, no matter the industry.”**

There are many more aspects to the functioning of this new type of economy. In many ways it is a return to the concept of less waste which is something that was lost in recent generations as affluence increased. But for individuals in a circular economy the quality of life and access to products and services is not diminished but enhanced.

All of this sounds win-win. It is not. As with any new economic revolution there are disruptions and there are losers. Policymakers will have to identify those losers as early as possible and ensure that a policy framework can support a just and fair transition, protecting both workers and businesses through education, awareness and support for diversification.

So, why should we feel that this Circular Economy Package is any different to what has gone before? And why does this potentially represent the first step in an impending paradigm shift? There are 2 reasons. Firstly the whole range of legislative proposals that come with this Action Plan give teeth to the ambition. Secondly, the political momentum that can be maintained if this Package is linked to the other initiatives that prevalent.

These include the Sustainable Development Goals, the drive for a low carbon economy, the Sharing Economy, the Digital Economy and the Functional Economy.

Shifting to a circular economic model can drive competitiveness, and signal the first steps in a sustainable re-industrialisation of Europe. It can lead to job creation and wealth in all corners of Europe, both rural and urban.

The European Economic and Social Committee intends to contribute to the necessary discussions on the transition to a circular economy, in particular with a dedicated European platform bringing together interested stakeholders. The Committee will continue to play its part in ensuring that civil society is fully involved and shapes the type of future that we both need and deserve. ■



.....  
**Cillian Lohan**  
**Member**

European Economic and Social Committee (EESC)  
Environmental scientist and chief executive officer of  
the Irish Natural Forestry Foundation  
[www.eesc.europa.eu](http://www.eesc.europa.eu)  
[www.twitter.com/EU\\_EESC](https://twitter.com/EU_EESC)

# Glycol – a rare resource

## Areas of Expertise:

We have developed a globally unique purification method whereby we purify used glycol so that it can be re-used. In this manner, we will save the Earth's resources since glycol is extracted from crude oil and is a non-renewable resource. In addition, glycol is a scarce commodity since demand is consistently higher than the supply. Glycol is used in a number of different industries and there is an abundance of areas of use. Below is a list of some of the most common segments and areas of use for glycol.

## Research Interests:

We have developed a globally unique purification method whereby we purify used glycol so that it can be re-used.

From used glycol we produce, with our globally unique model, new re-usable glycol with concentrations up to 98.5% depending on our customers' requirements. With our re-used glycol, chemical companies are able to offer more ecofriendly options.

Today, most used glycol is incinerated. We currently collaborate with a number of recycling companies to take a more ecofriendly step toward managing glycol.

Recyctec has agreements with some municipalities for glycol management. Municipalities work according to the so-called 'waste hierarchy', which provides a hierarchy for the order in which various methods for managing waste should be used. It is based on the EU directive and is a method for



achieving the EU's environmental objectives. In co-operation with us, they will be able to contribute to taking glycol management from step four to step two in the waste hierarchy, meaning instead of energy extraction (incineration) of the glycol, we jointly take the step to re-use.

With Recyctec's assistance, airports are able to gain both financial and environmental advantages. Airports will be able to become nearly self-sufficient since the glycol can be re-used time and time again with Recyctec's help.

Working alongside Recyctec, the automotive industry can actually impact today's glycol management by ensuring the quality of the handling process and filling with re-used glycol. For example, each new vehicle that rolls out from an automotive plant can be refilled with re-used glycol, which will

enable automotive manufacturers to take another step in keeping their environmental promises.

Unfortunately, glycol is in short supply and demand is always greater. Glycol is also a non-renewable natural resource, meaning the supply will run out. This is one of the reasons that the re-use of glycol is becoming increasingly important.



**Göran Ahlquist**

**Founder & CEO**

Recyctec Holding AB

Tel: +46 (0)76 021 7388

goran.ahlquist@recyctec.se

www.recyctec.se/en



# USING A GLOBALLY UNIQUE METHOD, WE PURIFY USED GLYCOL SO THAT IT CAN BE RE-USED

## We have developed a globally unique purification method

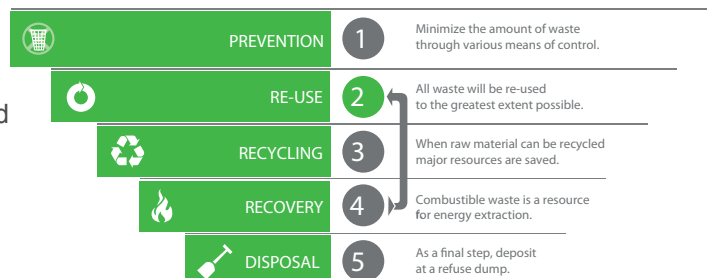
whereby we purify and concentrate used glycol so that it can be re-used. In this manner, we will save the earth's resources since glycol is extracted from crude oil and is a non-renewable resource. In addition, glycol is a scarce commodity since demand is consistently higher than the supply.

Glycol is used in a number of different industries and there is an abundance of areas of use.

**Our vision** is to spread our knowledge throughout the world and thus contribute positively to our common environment and to a better world.

**Our business concept** is to refine used glycol and restore it to an industrial product using an efficient and unique eco-friendly method.

## EU's WASTE HIERARCHY



Read more about us? Visit [www.recyctec.se](http://www.recyctec.se)



Recyctec Holding AB (publ.) Ideon Gateway, Forskningsbyn Ideon, 223 70 Lund, Sweden  
E-mail: [info@recyctec.se](mailto:info@recyctec.se) Webb: [recyctec.se](http://recyctec.se)



# A rare opportunity to ‘turn the tide’

Oliver Johnson, Policy Executive at Environmental Industries Commission outlines the challenges caused by flooding and highlights details from the Turning the Tide report...

Previously occasional, major flooding in the UK is an increasingly dependable disaster. Every year, western and northern parts of the country are battered by ‘unprecedented’ rainfall. Meteorologists on the news proclaiming that this kind of event happens only ‘once in a hundred years’ are undermined by the perceived frequency of their protestations. Even London is at risk from events. Reports emerged in May 2016 that 57 tube stations are at high risk of flooding with TfL revealing that it’s “only a matter of time” before serious flooding strikes.

**“After reports this year that northern areas were receiving far less capital expenditure per capita than fellow citizens in the south-east, we should be clearer about what we want from flood defences – to protect critical infrastructure, economic and population centres, or those who are more vulnerable.”**

The broader processes of urbanisation, changing land use and climate change are driving this shift. The government must understand this longer-term challenge and apply a holistic policy approach to match. Yet the slew of cuts that have befallen relevant government departments as well as local authorities in recent years have made joined-up thinking more difficult.

The environmental technology and services association, the Environmental Industries Commission (EIC), has an expert task force with experience in flood mapping, SuDS, Property Level Protection (PLP), public engagement in flooding and other fields. What the group produced was a report offering ten key recommendations to government policy and decision makers that won’t break the bank.



*Oliver Johnson, Policy Executive at Environmental Industries Commission*

Let’s start with the detail. The report, titled Turning the Tide calls for amendments to Flood Re (the flood re-insurance scheme) so that it insures SME businesses as well as homes and rewards individuals making reasonable preparations for floods by reducing their premiums. The report also advocates for the use of longer-term financial incentives, like a reformed Repair and Renew grant, to encourage people to own their own flood risk. Second, we can make buildings more resilient by making flooding a primary concern in the planning process – basements, carpets and electrics at floor level are out and attics and stone floors are in – while also continuing to clarify standards on SuDS. Lastly, we should make Environment Agency (EA)



flood warning text messages opt-out rather than opt-in, and even consider regulation to make a flood app come as standard on new smart phones sold in the UK.

The report does not shy away from more macro, strategic-level initiatives either. It calls for a national, transparent debate on what our flood defence priorities should be. After reports this year that northern areas were receiving far less capital expenditure per capita than fellow citizens in the southeast, we should be clearer about what we want from flood defences – to protect critical infrastructure, economic and population centres, or those who are more vulnerable. Next, we need a flood measurement scale that works and is easily understood by the public. The ‘one in a hundred year’ event does not mean very much when events seem to happen with such regularity – instead we need a Richter Scale-style system to indicate severity. Furthermore, we need to approach data differently, and must work more collegiately to hold national data in

one accessible place to improve our ability to map risk and opportunity associated with flooding. Finally, and perhaps most controversially, the report suggests that a restructuring of how the government delivers its flood policies should be considered. A new Water Agency could have overall oversight and management of water and flood issues with the EA remaining responsible of environmental protection.

Of course, EIC is not the only body that has taken on the flood debate. Spurred by the latest bout of flooding this winter, the government has launched several initiatives on flooding, making this a moment to truly seize the flood policy agenda. ■

.....  
**Oliver Johnson**  
**Policy Executive**

Environmental Industries Commission  
Tel: 020 7222 4148  
info@eic-uk.co.uk  
www.eic-uk.co.uk  
www.twitter.com/EICUKtweets

# How will Brexit affect the UK's shale gas industry?

Claire Brook, Partner at law firm Bond Dickinson, asks how the UK's regulatory regime for unconventional hydrocarbon development might be impacted post-Brexit...

We are in interesting and uncertain times. Attempting to predict the future for the shale gas industry in the current economic and political climate is not easy. In the post-Brexit world, and under a new Conservative leadership, most commentators have taken the preliminary view that the United Kingdom (UK) coming out of the European Union (EU) will improve prospects for the growth of this nascent industry. The 2 main factors currently influencing this view are the security of energy supplies and the increased cost of importing gas, particularly whilst the pound is weak.

We know the UK government, under its new leadership, continues to believe that shale gas has the potential to provide the UK with greater energy security, growth and jobs. Theresa May, who has previously shown support for the shale industry, has said she wants to see "an energy policy that emphasises the reliability of supply and lower costs for users".

Whilst the new political context will no doubt have an impact on, for example, investment decisions to be made in the short term, the process of exiting the EU and negotiating a new arrangement is likely to be a lengthy process and the outcome is uncertain.

Integral to this overall process will be the need to consider the legal frameworks in the UK which currently govern shale gas development and to determine whether these can – and, if so, ought to – be altered. Even if we assume that legislative changes can be made, we are realistically a few years away from seeing the implementation and consequent impact of such changes.

## The Norwegian model

So far, the UK government has not given any substantive indication of the kind of ongoing relationship with the



Claire Brook, Partner

EU that it will seek following Brexit. Nor do we have a feel for the extent of our ability to achieve a preferable bespoke deal for the UK.

Of the current models that exist for other non-EU states, one option is to join the European Economic Area (EEA) with the three other EEA Member States (Iceland, Liechtenstein and Norway). Under the EEA Agreement, most EU environmental law still applies to the participant Member States, including the Environmental Impact Assessment Directive and a number of other EU environmental regulatory regimes.

Therefore, if the UK were to join the EEA, it would still have to comply with a significant proportion of EU environmental laws. In this scenario, the UK would not be in a position to significantly alter or streamline the regulatory process for securing the relevant planning and environmental consents for shale gas development.



Further, if the UK were to become part of the EEA, going forward, it would not be able to directly influence new EU legislation that may impact on shale gas development in the UK. For example, back in 2014, the UK government successfully led intensive lobbying against a proposed EU Framework Directive on unconventional fuels that would have imposed stricter regulation on shale gas operations, particularly fracking and water monitoring.

**“It will be difficult for the government to materially reduce regulatory controls in the face of the assurances it has given, particularly in view of the extent of public concern surrounding proposed developments to date and the aim of securing community approval.”**

### The Hydrocarbon BREF

More recently, in June 2015, the EU launched a new Hydrocarbon BREF (Best Available Techniques Reference document) with a technical group looking at a gap analysis on regulation of the industry and with a view to focusing the BREF on managing impacts of releases of pollutants and best risk management techniques. Whilst not itself legally binding, it could form part of best practice methods that are imposed on operators under environmental permits in the UK. Again, the UK Government has lobbied hard alongside the industry to resist the imposition of the BREF, regarding it as ‘unnecessary over-regulation’. The proposal is not yet defeated and a refined BREF is expected in draft in June 2017.

An alternative option would be for the UK to negotiate a Free Trade Agreement with the EU and trade with the EU on terms governed by the World Trade Organisation (WTO). If the UK went down this route, the UK would no longer be directly bound by EU rules on environmental regulation, but would still be bound by International Conventions including the Kyoto Protocol on reducing greenhouse gas emissions. The UK would still need to review the existing regulatory controls and determine whether it would be appropriate to amend them.

### Striking a balance

In these circumstances, the indications are that the UK government may seek to relax the regulatory regime to some extent in order to facilitate the growth of the industry in the UK. That said, the government will need to tread a fine line. The stated aims of the Office of Unconventional Gas and Oil (OUGO) are to promote the safe, responsible, and environmentally sound recovery of the UK’s unconventional reserves of gas and oil.

Yet in the Gas Generation Strategy in 2012, the now defunct Department for Energy and Climate Change (DECC) stated that, “as with any industrial activity, shale gas exploration and development could give rise to unacceptable safety and environmental impacts. To extract shale gas safely in the UK and without damage to the environment, it is critical that competent companies follow best practice and work under a robust planning and regulatory regime.”

It will be difficult for the government to materially reduce regulatory controls in the face of the assurances it has given, particularly in view of the extent of public concern surrounding proposed developments to date and the aim of securing community approval. Equally, one might have some sympathy for the arguably disproportionate lengths that operators are currently having to go to in order to secure exploration and fracturing consents and the cumbersome burden this is placing on the regulatory bodies who have to determine such applications. Only time will tell if an acceptable middle ground can be found. ■

.....  
**Claire Brook**

**Partner**

Bond Dickinson

[www.bond dickinson.com](http://www.bond dickinson.com)

# Working together to tackle disasters worldwide

Addressing Members of the Board of the World Food Programme (WFP), Christos Stylianides, European Commissioner for Humanitarian Aid & Crisis Management highlights the excellent work of the WFP and how Europe should tackle crises together...

**N**eedless to say, WFP is a vital partner for the EU. In particular for me as Commissioner for Humanitarian Aid.

WFP can get the job done. They can intervene quickly and at scale. And, most importantly, they are innovative and forward looking.

You all know that we are witnessing more crises. More disasters. And, therefore, more needs. The world has become even more unpredictable, and complex. Never before has our world been more connected.

The challenges that we are facing are simply unprecedented. This is not a cliché. This is a reality. I see it everywhere I go. From Africa, to the Middle East to Asia.

I have personally had the opportunity to see first-hand what WFP does. And I would like to express my gratitude.

Allow me to share with you my impressions.

In Lebanon. I witnessed the excellent work done by many of our partners. Despite the very difficult conditions, and the complex political climate.

WFP is a key part of the process that has resulted in better coordination between all partners, that rely on joint assessments and targeting. And to provide refugees in Lebanon with a better service.

In Iraq, I saw emergency cash assistance distributed to displaced people in Baghdad. An operation funded by the European Commission.

WFP has been at the forefront in Iraq. In promoting a harmonised approach to cash assistance.

Our joint fight against Ebola demonstrates our partnership. We worked very closely with WFP to ensure a coordinated response. It shows that, together, we delivered.

These are only some examples of our strong partnership.

Let me now turn to the unprecedented refugee crisis. A crisis that, in one way or another, has touched all of us. Because this is not only a European crisis. It is a global crisis. With global consequences. Requiring a global response.

There is no question: the war in Syria and the unprecedented flows of migrants continue to affect European and neighbouring countries.

Many of these countries are fragile. Absorbing vast numbers of refugees is pushing them to breaking point. Take for example Lebanon. Where the number of refugees is almost 30% of its population. Where the situation is quite alarming.

The international community has responded massively to the Syrian crisis. The EU has led the international response with more than €6bn.

But at the end of the day, only a political solution will end human suffering. But, unfortunately, no solution is in sight.

However, the tragic truth is that the Syrian crisis is not the only refugee crisis that the world is facing today. But it remains the major global threat.

At the same time we remain focused on developments in Africa. Regional conflicts, terrorism, natural disasters,



*Christos Stylianides, European Commissioner for Humanitarian Aid & Crisis Management*

as a result of El Nino, have displaced people. Forcefully.

They have dramatically increased the needs.

Responding together to these needs requires a coordinated, systematic and structured approach. Strengthening the links between the humanitarian phase and the development phase.

This is why last week, the Commission set out plans for a Partnership Framework. With key third countries to manage migration. We will develop these with Jordan, Lebanon, Niger, Nigeria, Senegal, Mali and Ethiopia.

It is clear that in the medium to long term, only development opportunities can address the root causes of migration. Therefore, we decided to release immediately €8bn to help deliver these partnerships.

In Europe we are struggling to cope with the numbers of refugees reaching our shores. We are here in Italy. A country at the frontline. A country under huge pressure. A country doing an excellent job to tackle it.

All of us recognise that this is a defining issue for Europe. A defining issue for all.

More than that, it is a test of our values and principles. Of our unity. Of our determination to preserve this unity. We cannot afford to go back to the politics of fragmentation. Only together can we face this crisis effectively.

More than 1 million migrants and refugees entered Europe in the past year. This is why we have set up an emergency support instrument. Within the EU. Which is a first.

Since April we are providing humanitarian aid to refugees in Greece. We do this with our usual partners. Including the UN family.

On the other side of the Aegean Sea, we are supporting the refugees hosted in Turkey. Combining humanitarian and longer-term structural support. For a total of €3bn. The design and implementation of our programmes in Turkey has already involved many partners. Including WFP.

The next step, under the Facility for refugees, is to create the so-called "Emergency Social Safety Net". So refugees begin to rebuild their lives. Providing access to health care. Providing access to education.

This should materialise during the summer.

This is a big operation. Bigger than anything we have done before. But it is well under way. And I have no doubt it will succeed. For the good of all the vulnerable people it will reach.

We have just come away from the first World Humanitarian Summit. Where we were able to take stock of the challenges that we face.

It is true that we had greater expectations about the outcome of the Summit. But now we need to look beyond, to the day after and follow up on the useful elements that came out of the Summit.



Such as the importance of education in emergencies. The potential role the private sector can play in humanitarian aid. The “Grand Bargain” on making aid more efficient. And, of course, the strong support for the respect of International Humanitarian Law.

WFP has always played a vital role. To ensure that the most basic of basic needs, food, is advocated for.

In many ways our food policy sets the standard for many of the things we do. WFP has been able to innovate with the support of donors like the EU. To seek new ways to deliver food assistance. New ways to assess and monitor its programmes. New ways to ensure that the right people receive assistance.

WFP recognised early that food security does not necessarily mean food delivery.

Providing cash can be a more flexible way to meet people’s basic needs. First and foremost this allows people to live with dignity. Cash-based assistance has huge potential. This was clear to me when I spoke to families in Gaziantep. It is about choice and flexibility. It is about greater efficiency. It is about value for money. And ultimately improved effectiveness for donors and taxpayers. This does not mean we are shrinking our toolbox. On the contrary. We will always need to maintain capacity to respond in kind.

Let me conclude by sharing with you my vision for education.

Education, especially in emergency situations, is not a luxury. It is a basic need. It is a human right.

Children in emergencies cannot be left behind. It is paramount to secure adequate education. Attending school gives children a sense of normality. It helps them regain their childhood. It helps them regain their dignity.

Through education, we give them hope. We give them opportunity. It is the best protection against radicalisation. Against extremism. Against forced recruitment.

Against forced marriage. Against ignorance.

This year I am increasing our humanitarian assistance to education in emergencies by 4 times.

This funding will help over 2.3 million children, in 42 countries around the world. To access safe and quality education.

I am well aware that needs are much higher. And I call all donors to follow the EU’s example. On our side, I assure you that we will allocate even more support to education in emergencies in the years to come.

We cannot allow a lost generation of children in crises. This is our obligation. It is our moral duty.

I want to close my remarks by recalling something that Pope Francis said a couple of years ago about the poor of the world. This is something which remains very relevant today. The poor of the world, the vulnerable people, all those in need “ask for dignity, not for charity”. Let us never forget that. ■

This is an edited version of a speech, which can be found here – [http://ec.europa.eu/commission/2014-2019/stylianides/announcements/address-members-board-world-food-programme-wfp\\_en](http://ec.europa.eu/commission/2014-2019/stylianides/announcements/address-members-board-world-food-programme-wfp_en)

.....  
**Christos Stylianides**  
**European Commissioner for Humanitarian Aid & Crisis Management**

European Commission  
[http://ec.europa.eu/commission/2014-2019/stylianides\\_en](http://ec.europa.eu/commission/2014-2019/stylianides_en)

# APhoRISM – Advanced PROcedures for volcanic and Seismic Monitoring

The European project APhoRISM is helping to create innovative solutions to crisis management, particularly with volcanic eruptions

The European project APhoRISM – Advanced PROcedures for volcanic and Seismic Monitoring, is now going to reach its third, and last, year of life. APhoRISM consortium of 7 partners, led by the Istituto Nazionale di Geofisica e Vulcanologia (INGV), Italy, which includes top European research Institutes and Universities – for details see the project website: [www.aphorism-project.eu](http://www.aphorism-project.eu).

The project's aim is to provide reliable answers to the growing needs to protect the population and preserve the human habitat from environmental emergencies and natural disasters.

APhoRISM has developed innovative methodologies and solutions based on the integration between space and ground based sensors, to support the management of seismic and volcanic crises. Within these latter topics, the project addresses specific domains like the safety of civil aviation and the earthquake crisis management. This is part of the European Space Policy and long term strategy to strengthen the EU capability to take action and carry out solutions towards disaster mitigation and management.

Finally, in perspective, APhoRISM will help the development of the innovative Copernicus Emergency Management Services.

APhoRISM has 2 research branches. The first one deals with the genera-



tion of products for characterising the volcanic ash cloud, and the second one is focused on the production of urban damage maps to help support emergency management during seismic events. These 2 branches complete the development of 2 new methodologies, called MACE – Multi-platform volcanic Ash Cloud Estimation, and APE – A-Priori information for Earthquake damage mapping, for the 2 thematic areas, respectively.

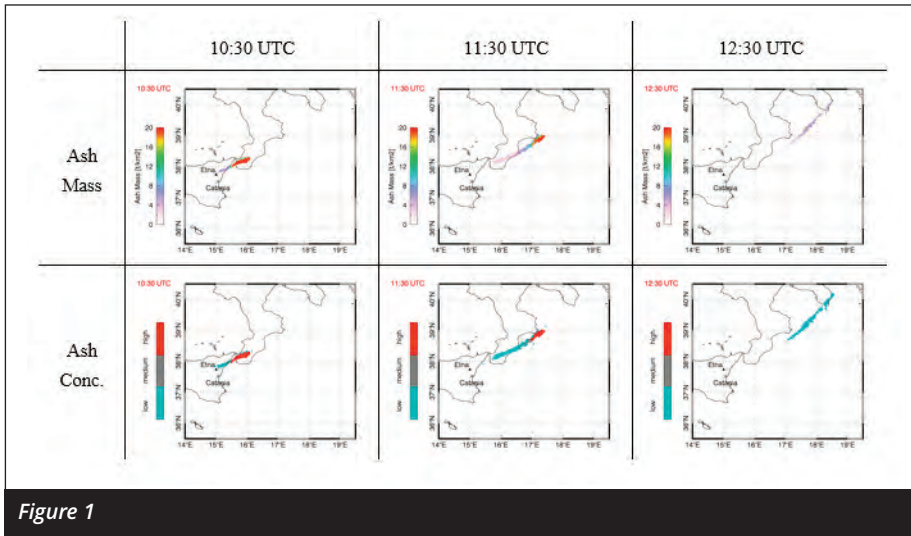
## Volcanic products

The MACE procedure, developed in the sphere of the APhoRISM project, exploits the complementarity between GEO (Geosynchronous Earth Orbit) sensor's platforms, LEO (Low Earth Orbit) satellite sensors and ground measurements, to improve the ash detection and retrieval and to fully characterise the volcanic ash clouds from their source to the atmosphere. The basic idea behind MACE is to

calibrate and integrate, in a novel manner, the volcanic ash retrievals at the space-time scale of typical geostationary observations using both the LEO satellite estimations and in-situ data. Moreover, the possibility to detect the volcanic clouds during particularly cloudy sky conditions has also been investigated. MACE has been applied to different recent eruptions such as the Eyjafjallajökull (Iceland) 2010, Etna (Italy) 2013 and 2015, Holuhraun (Iceland) 2014, and Calbuco (Chile) 2015 events.

As an example, Figure 1 shows the ash mass and ash concentration time series maps, obtained from MACE for the 23 November 2013 Etna test case. Because of the volcanic ash cloud particles' harmful effects on aircraft engines, the ash concentration classification is used to highlight the volcanic cloud regions where the ash is more concentrated and more danger-

## PROFILE



thetic Aperture Radar (SAR) images, and a-priori information layers that include geological data (such as soil type, landslide and liquefaction susceptibility) and structural, geometric and constructive characteristics of buildings. The main goal of APE is to investigate the potential of such a-priori information for increasing the reliability and accuracy of earthquake damage maps.

The seismic theme of APhoRISM is centred on 4 case studies, where the integration methodologies have been setup and tuned. In particular, the seismic events are: Izmit, Turkey, earthquake (Mw 7.4) that hit the Marmara Sea region on August 17, 1999; the L'Aquila (central Italy) earthquake, a Mw 6.3 event that took place on April 6, 2009; the disastrous event of Haiti (Mw 7.0) occurred on January 12, 2010; and the Mw 6.3 earthquake that damaged the city of Christchurch, New Zealand (February 22nd, 2011). These earthquakes are characterised by different mechanism, dataset, type of buildings and ground input data. Such differences are very important to investigate and to analyse the performances and robustness of the APE methodology.



**Salvatore Stramondo**  
**Satellite Earth Observation, Head**  
 Istituto Nazionale di Geofisica e Vulcanologia  
 Tel: +39 06 5186 0521  
[Salvatore.stramondo@ingv.it](mailto:Salvatore.stramondo@ingv.it)  
[www.ingv.it](http://www.ingv.it)  
[www.aphorism-project.eu](http://www.aphorism-project.eu)

ous for aircraft. The classification shown in Figure 1 (low, medium and high) is based on the European Aviation Safety Agency (EASA) directives.

### Earthquake products

Prompt response after an earthquake is of primary importance to save lives and effectively manage the emergency. A rapid damage mapping can provide valuable support to rescue teams and to all those involved in the

emergency management cycle. In such a context, satellite remote sensing has already proved its potential to contribute to post-earthquake damage assessment. The APE method is developing new procedures based on the integration of satellite-derived change indexes, and ground data to provide damage assessment maps, at different scales. In particular, APE exploits change detection maps from satellite imagery, including optical and Syn-

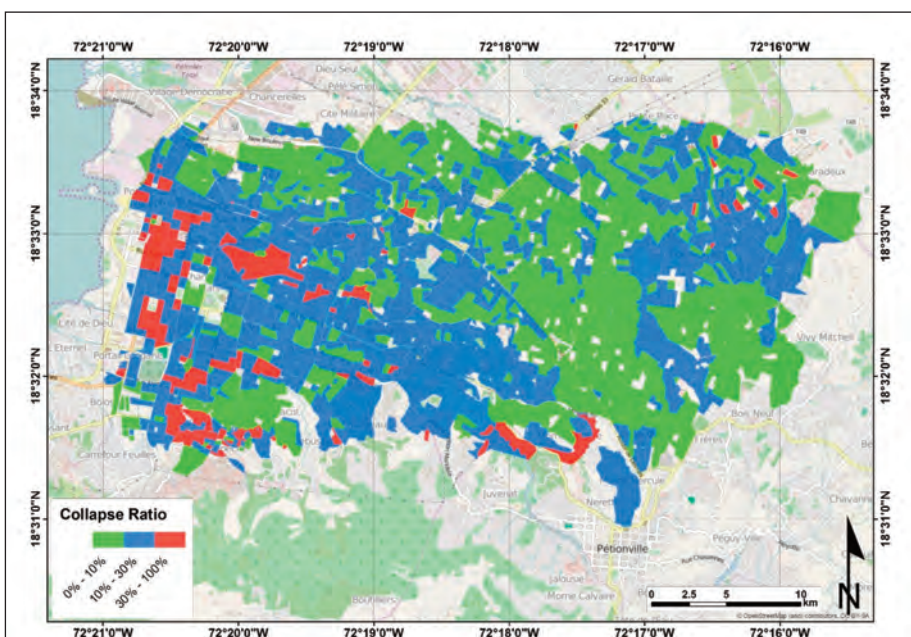


Figure 2 shows an example of a damage map for the Haiti case. In particular, it reports the so-called quantity Collapse Ratio, i.e., the ratio between the number of collapsed buildings and the total number of buildings within a city block, for Port-au-Prince. This type of map is useful when very destructive events occur. The map has been derived by integrating 2 different type of images captured by Synthetic Aperture Radar, optical sensors on board space satellites



# Looking beyond the Rhetoric of ‘Refugee Crisis’

What are the long-term impacts and transgenerational effects of violence?

After ten years of conducting interviews and field research with Punjabi diaspora communities in Frankfurt and Toronto, Professor Michael Nijhawan highlights the vulnerability, resilience and agency of young migrants as important change-makers in our contemporary world.

At a moment when the European Union seals its morally convoluted refugee relocation deal with Turkey and as we see how in North America the debate about admitting more refugees is triggering new moral panics around Muslims as potential terrorists, it is worthwhile to pause and take a deep look into how state policies of immigration affect the displaced and vulnerable even further.

This issue has been the focus of a Social Sciences and Humanities Research Council (SSHRC)-funded research project led by Michael Nijhawan of York University Toronto in conjunction with a similarly themed and funded conference on youth migrations in collaboration with Sociologist Ratiba Hadj-Moussa.

Selecting Frankfurt and Toronto as two global and interconnected cities that have been recognised for their progressive multiculturalist policies and vibrant migrant communities, Nijhawan situates migrant lives as they strive for legal and cultural citizenship. Working with Sikhs and

Ahmadis as religious minorities, he shows the multidimensionality by which violence affects migrant precarity.

Whereas the public sphere is often exclusively focused on how well migrants integrate, Nijhawan uses a different optic and demonstrates how it is not so much the lack of a “will” to integrate, but instead the forces of law, state and public discourse that causes profound problems. His main findings concern the role of refugee determination procedures, the public image of religious minorities that don’t fit common frameworks of recognition and the everyday exclusion and violence faced by those pushed to the social margin. Nijhawan’s work further considers the new and important role of next generations: young people in both communities who break with common stereotypes and emerge as visible social actors pushing for the recognition of injustices past and present and social change.

## Impact 1

With the gradual erosion of asylum law and the imperative to deport those who don’t qualify current admission policies, how are those not typically eligible affected? While much of the current refugee determination procedures in Europe are in flux, Nijhawan shows how in the recent past, the German asylum courts have assumed a pivotal role in affecting migrant lives very differently. This is

especially true for Sikhs and Ahmadis, who were offered dramatically different results in legalisation. Examining the relationship between the legal field and religion is particularly telling in this context. Considering the discourses of judges in the administrative court, lawyers and asylum claimants’ testimonies, as well as recent appeal courts’ decisions, Nijhawan arrives at a new understanding of the cultural transactions and interpretations that inform adjudication in the field of asylum law. On the one hand, credibility assessments are often highly arbitrary and betray a cultural bias. On the other hand, judges and courts (including the EuHC) have developed theories of religion and religious persecution that intersect with communities where such religion is practiced and where it remains subject to change. In this context, it matters how religious sincerity is defined and validated before the court. Compared to international legal debates, he finds how asylum adjudication influences the debate on the recognition of religious freedoms, even though we do not typically think of this legal domain as affecting the governance of religion.

## Impact 2

As religious minorities, Sikhs and Ahmadi migrants are also subject to negative public sentiments. Being entangled within a social nexus of migration, race and religion has at specific points of time led to a ques-

## PROFILE



*Professor Michael Nijhawan*

tioning of their claims to belonging as Germans or Canadians. In Canada this was particularly so in the context of the Air India Inquiry as a consequence of the continuing debate about the support for Sikh militant groups among Canadian Sikhs. In Germany as in other European countries, public anxieties over the presence of foreign bodies have resulted in a discourse of suspicion that is felt as profoundly alienating by both Sikhs and Ahmadis. Members of both communities are often called out and mistakenly profiled as terrorists, something that is widely discussed on social media and has led to new forms of advocacy and recognition campaigns. Nijhawan demonstrates how Islamophobia has had important repercussions in everyday life in places such as Frankfurt or Toronto, despite the significant transatlantic differences with regard to such presence and force by which such sentiments are played out. Prejudiced discourse brands many minority religious groups as inassimilable in mainstream society. Importantly, suspicion co-exists with increasing recognition of Sikhs and Ahmadis as

model minorities and hence the effects of assimilation often remain tacit or are not intelligible to publics and policy makers.

**“At a moment when the European Union seals its morally convoluted refugee relocation deal with Turkey and as we see how in North America the debate about admitting more refugees is triggering new moral panics around Muslims as potential terrorists, it is worthwhile to pause and take a deep look into how state policies of immigration affect the displaced and vulnerable even further.”**

### **Impact 3**

The group that most openly contests these pressures is the so-called millennial- or next generation of young Sikhs and Ahmadis. Nijhawan contributes to a better understanding of their positioning with respect to institutionalised religion and forms of religious and political organisation that the youth wants to see overhauled. What is moreover interesting is the continuing importance of class

and race when it comes to how families have struggled with legacies of violence. This is seldom understood by a public preoccupied with the many, and certainly important, success and integration stories of Punjabis in Canada. Yet, Nijhawan portrays a next generation of young Sikhs and Ahmadis who openly confront issues of colonialism, genocide and oppression while seeking solidarities across community boundaries and localities in a context in which national identity is being redefined. In this context, he finds that intergenerational transmission is a complex process that entails social narratives around labor, migration and religion. Contrary to the common crisis motif of portraying religious immigrant youth as a problem category, we instead find that these young individuals make sense of their everyday in constructive ways, actively create new and innovative cultural spaces and find ways to imagine their cultural and religious belonging that promise a better future.



**Michael Nijhawan**  
**Associate Professor**  
York University  
Tel: 1 416 736 2100  
nijhawan@yorku.ca

# The future of agriculture and sustainable development

Phil Hogan, EU Commissioner for Agriculture and Rural Development looks at how the Commission is supporting Europe's farmers to succeed and be resilient...

The Common Agriculture Policy (CAP) was originally designed to feed the starving populations of Europe in the post-war era, and it has met that challenge with resounding success.

These days, the CAP has grown into an over-arching policy which supports farmers and rural communities at home, while developing solutions to ongoing global challenges. The CAP provides stability of income to EU farmers and supports their role in rural job creation, climate action, and safeguarding our environmental heritage.

Internationally, with the population of the world expected to be more than 9.3 billion by 2050, the CAP has a vital role to play in feeding the world with high-quality, nutritious products. The policy has also evolved to have a clear international dimension – it is more in tune with international markets, more ambitious and supportive of young innovating farmers, and more focused on sustainable growth. In line with this international outlook, the CAP is playing a part in the EU's commitment to making the 2030 Sustainable Development Goals a reality.

If the world is to meet the Agenda 2030 challenge of Zero Hunger and ending extreme poverty in the next 14 years, we have to find new ways to encourage responsible investments in agriculture and rural areas. In fact, the EU's rural development policy can be considered a model for maintaining livelihoods in rural areas.

The CAP supports sustainable rural communities at home by providing them with the economic opportunities and social and cultural cohesion they need. We are eager to help our international partners use our experiences to build models of their own.

As well as this, farmers are expected to play a role in

combating climate change and managing precious resources like soil and water. Climate action is the priority of Sustainable Development Goal 13, while "life on land" – in other words how we manage forests, tackle land degradation, and stop biodiversity loss – is the focus of Sustainable Development Goal 15.

So how do we create the conditions to make these things happen? The development of smart, sustainable agriculture policies is a good starting point.

Next, we must enhance the contribution of the private sector and develop the resources of individual nations. The private sector, with its immense capacity for investment in innovation and research, must be mobilised in new and smarter ways. Food security, sustainable development and climate action require new investments.

This will lead to adapted production techniques, training and advice for farmers, as well as specific support for testing new and innovative approaches for a better and more efficient agriculture.

However, when it comes to investment – while I am fully convinced that agriculture can only prosper with private investment, we have to ensure 2 conditions: first, that the investment is responsible and socially and environmentally sustainable; and second, that the countries wanting the investors have a business friendly environment. The CAP is already supporting investment in all these areas, and will do even more in the coming years. ■

.....  
**Phil Hogan**  
**Commissioner for Agriculture and**  
**Rural Development**

European Commission

[http://ec.europa.eu/commission/2014-2019/hogan\\_en](http://ec.europa.eu/commission/2014-2019/hogan_en)

[www.twitter.com/PhilHoganEU](http://www.twitter.com/PhilHoganEU)



# Organic sector in need for improvements of animal health

Prof. Dr. Albert Sundrum, Head of Department of Animal Nutrition and Animal Health at the University of Kassel highlights the need of structural amendments in the organic sector...

The organic dairy sector has developed rapidly over the last decades. Premium prices reflect (in part) the consumer expectation that animal health is better in organic than in conventional systems. An interdisciplinary EU-project (IMPRO) aimed to assess the current state and investigate options to reduce the prevalence of production diseases (PDs). Results of on-farm assessments in four different European countries (DE, FR, SE, ES) revealed that PDs varied a lot between organic farms and did not generally differ from levels reported in conventional dairy farms. It is concluded that the enhanced minimum standards approach in organic agriculture has failed to promote a reduction in PDs.

## Farm centric and equifinal approach

While organic farms in Europe are obliged to the same standards, they differ widely in the living conditions of dairy cows and in the availability of resources required to keep animals healthy. Thus, generalised recommendations for health measures are often both ineffective and inefficient as they do not always suit the specific farm situation. They result in hindering farmers' readiness to invest in costly health measures. Farmers often do not know which measure they should prioritize in order to combat particular problems and which investments could provide an appropriate return on capital.

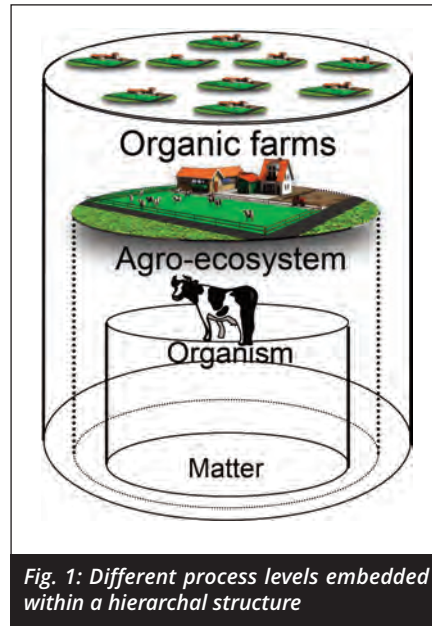


Fig. 1: Different process levels embedded within a hierarchal structure

To overcome this barrier, the heterogeneity of living systems both on the farm and the animal level and their interactions within a hierarchal structure have to be considered appropriately (Figure 1). Within the IMPRO-project, a farm centric and equifinal approach has been developed, based on the principle that the same end state (low level of PDs) can be achieved via many different paths while relying on different tools (Figure 2). The new approach is based, inter alia, on an impact matrix as a participatory concept (involving farmer, veterinarian and advisor) for diagnostic work. The approach has been created to provide ways of reducing selected PDs (mastitis, metabolic and fertility disorders, and lameness), using particularly data from monthly milk records. Results from telephone interviews regarding the uptake of the

preventive measures suggested, indicated that 95% of the farmers had implemented one or more of these preventive measures recommended. The feedback from the project was encouraging and provided positive incentives for further development of a farm level diagnostic approach. Farmers would be encouraged to work towards a low level of PDs if this goal were mandatory for all organic competitors. Competition would be an effective motivator if reduced levels of PDs made an impact on farmers' market returns.

## Evidenced based use of alternative remedies

Additionally, a pilot project was conducted to deal with the question whether the use of homeopathy and phytotherapy holds potential to replace the use of antibiotics in treating bacterial infectious diseases keeping negative side effects to a minimum. Literature reviews revealed that cure rates after treatment with either antibiotics, alternative treatments or a placebo varied greatly between the studies. None of the scientific studies with alternative products have been re-produced. Thus, the use of homeopathic or phytotherapeutic products cannot claim to have a reliable and repeatable effect and a prognostic validity. Evaluations on organic dairy farms in Germany, France and Spain revealed that there were no uniform procedures for homeopathic treatment in

## PROFILE

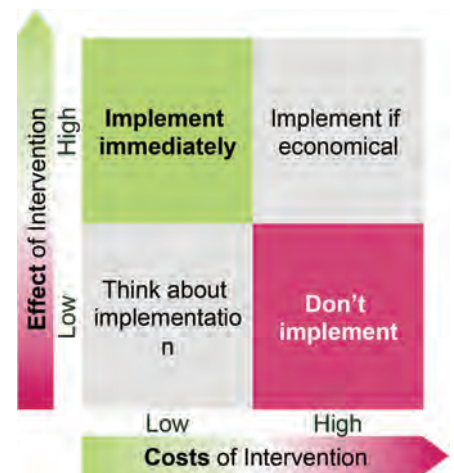
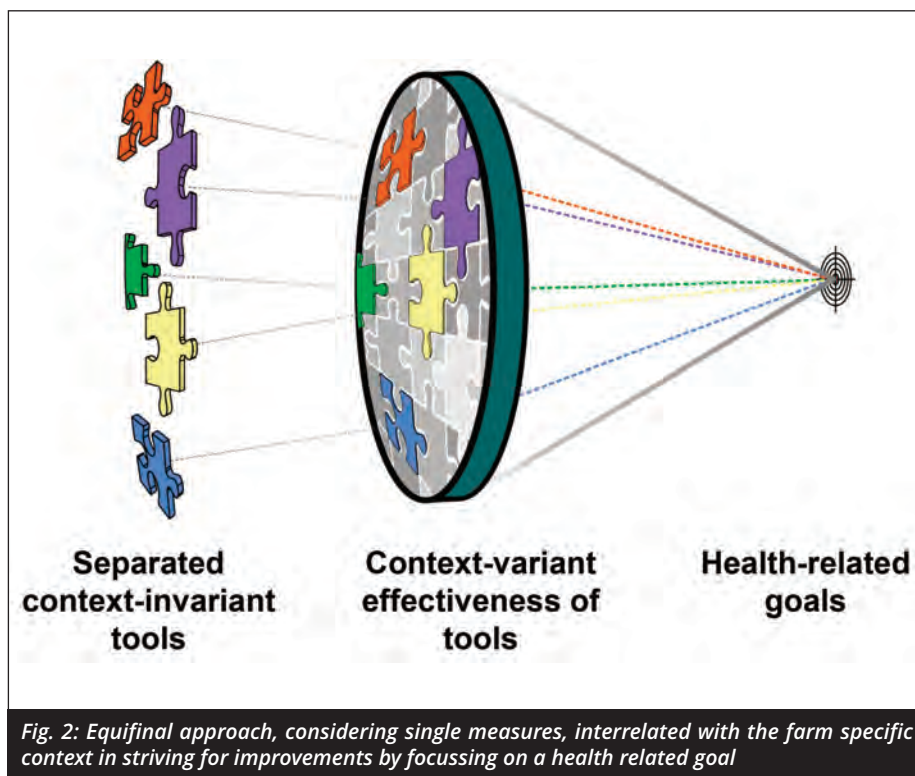
the case of mastitis. It seemed that each farmer had developed his/her own treatment strategy; regardless of the principles of homeopathy.

Remedies are means to an end. The effectiveness of treatments in farm practice is highly context-dependent and is doubtful without the consistent implementation of lege-artis procedure, including follow-up check and documentation of the recovery progress. Thus, the employment of homeopathy or phytotherapy in favour of conventional products cannot be sanctioned unless these alternative products are administered by highly skilled people. Otherwise, alternative treatments could be blamed for increasing health and welfare problems due to lack of therapeutic success and thus extended suffering of diseased animals. Therapeutic success in the individual and on the herd level is the result of the overall effort invested, while the envisaged level of PDs determines the degree of effort required to achieve the target sets. Deciding which level of therapeutic

success and what prevalence of PDs is acceptable should not be left to each farmer to decide for themselves. These values are essential to the common good and should be set using external reference values.

### Exploration of policy options

The large PD variation amongst organic dairy farms goes against consumers' expectations and conflicts with the ethos of a brand label reflecting greater homogeneity. The EC should focus on farms with below-average performance. Such large variation constitutes unfair competition, as organic farmers all receive the same price for their products although the quality differs considerably in terms of PDs and product standard. Farmers who produce products at lower production costs yet risk higher prevalence of PDs are favoured above farmers who invest money, time and effort without obtaining premium prices for higher quality. Thus, unfair competition is an important impediment to any possible improvements. To reduce and prevent unfair competition, regular monitoring



*Fig. 3: Essential precondition for the implementation of expertise into practice is the knowledge about the effectiveness and the costs of measures under farm specific conditions*

of health data is required. In the IMPRO project, tools have been constructed that might serve as a basis of possible monitoring approaches. Minimum standards should be supplemented by target values with respect to the prevalence of PDs. These should not be exceeded without facing significant consequences. Processors, manufacturers and retailers should be encouraged to force farmers to change their attitude to tackling PDs through a two-pronged approach e.g. by offering bonuses when a low prevalence of PDs has been achieved and penalties when a high one is present, in order to bring the milk payment system more in line with the high value expected of organic dairy products.

UNIKASSEL | ORGANIC  
VERSITÄT | AGRICULTURAL  
SCIENCES

**Prof. Dr. Albert Sundrum**  
Head of Department Animal Health  
and Animal Nutrition  
University of Kassel  
Tel: +49 5542 98 1707  
sundrum@impro-dairy.eu  
www.impro-dairy.eu

# Soil biodiversity

## Keeping the Earth alive

Soil condition underpins food security, green growth, bio-economies and aboveground biodiversity; it regulates climate, the hydrological and nutrient cycles, while mitigating climate change. Soils provide resilience against floods and droughts, buffers the effects of pollutants and preserves cultural heritage. Healthy, functional soils underpin several of the UN's Sustainable Development Goals.

What is not widely perceived is that functions, such as soil fertility, carbon sequestration and nitrogen cycling, are actually conditioned by the presence and interactions of soil-dwelling organisms which not only keeps the planet, but also us, alive. Life-saving penicillin, one of the most widely used antibiotics, comes from the soil fungus *Penicillium chrysogenum*, while new types of antibiotics based on culturing bacteria in soil (e.g. Teixobactin) have proved to be very effective against both *Staphylococcus aureus* (respiratory tract infections) and the Koch's bacillus, which causes tuberculosis. There is a growing body of evidence that the human immune system requires activation and exercise in order to function properly and that a lack of contact with soil microorganisms during childhood could be the cause of the epidemic of allergies in developed countries.

In reality, soils are full of life. A single gram of soil may contain millions of individual bacteria and several thousand species. A handful of arable soil



Figure 1. A colourful springtail that lives in the soil

under a temperate climate contains approximately 0.5g of fresh biomass, which is mainly microbial. This equates to around 5 tonnes of animal life in the topsoil of a single hectare – equivalent to 100 sheep or 20 African elephants. Under grasslands, the amount of living organisms can be 20 times greater, which is 2,000 sheep per hectare – orders of magnitude more than the average stocking densities for grazing sheep. In fact, a healthy soil can contain species of vertebrate animals (e.g. moles), several species of earthworms, 20-30 species of mites, 50-100 species of insects, tens of species of nematodes, hundreds of species of fungi and probably thousands of bacteria species. On the other extreme, a single colony of the honey fungus, *Armillaria ostoyae*, can cover an area of about 9 km<sup>2</sup>. Even the smell of wet soil after rain falls on dry ground is due to the release of an organic compound (known as geosmin)

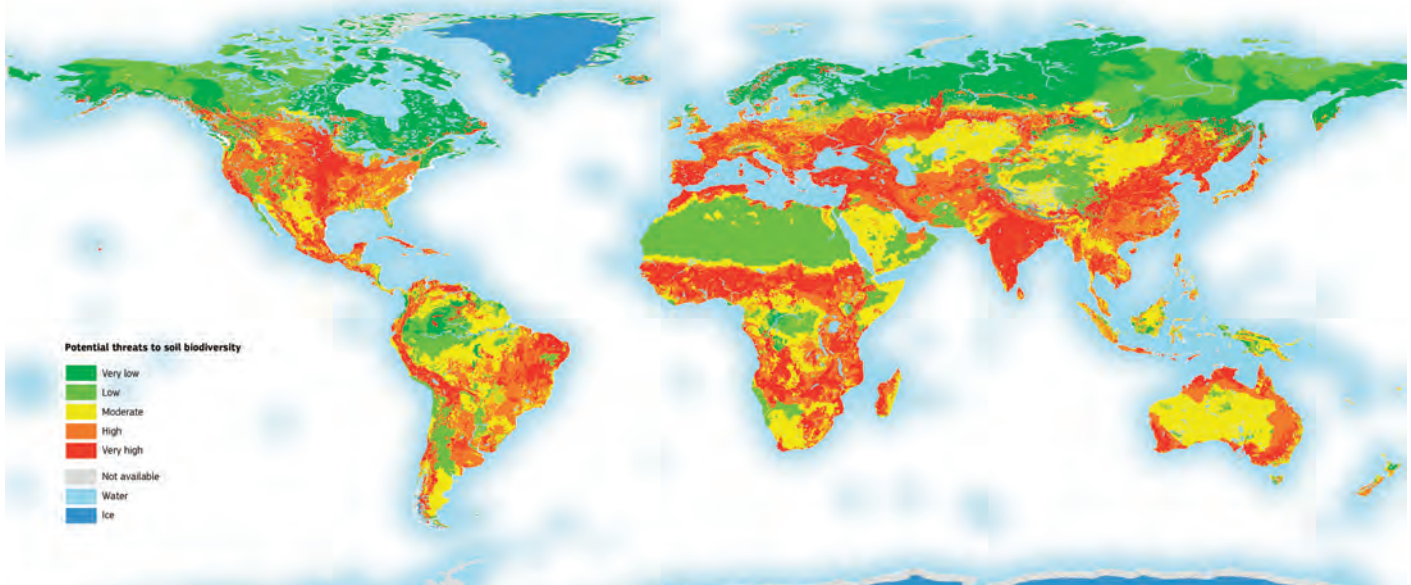
from a type of soil bacteria.

However, our knowledge and understanding of soil as a habitat is limited. While it is thought that 60% of the world's ants have been classified, only 3% of the nematodes, 6.5% of fungi and 1.5% of bacteria, have been identified. Soil biologists estimate that there may be between, 1.5 to 5 million species of fungi on the planet – to date, only 100,000 have been identified.

Apart from a few exceptions (e.g. moles, earthworms and ants), public awareness of life in soil is almost completely lacking. To overcome this deficiency, and help decision makers develop policies to safeguard these organisms and their associated services, the European Commission's Joint Research Centre (JRC), together with the Global Soil Biodiversity Initiative<sup>1</sup>, has recently published the first ever Global Atlas of Soil Biodiversity<sup>2</sup>.



## PROFILE



**Figure 2.** This map is an initial attempt to denote levels of potential risk to soil biodiversity at a global scale. The areas with the lowest level of risk (greens) are generally less subjected to both direct (e.g. agriculture) and indirect (e.g. climate change) anthropogenic effects. At the opposite end of the scale, the areas with highest risk (reds) are those with the greatest exposure to human activities. An important point to highlight is that the map conveys potential rather than the actual level of threat. This means that in the areas with high or very high levels of risk, soil organisms may not necessarily be in real danger. However, these areas present a combination of factors that lead their soils, and thus the organisms living in them, to be more sensitive to risk. This map will require continued effort to improve both its reliability and resolution

Freely available to download from the JRC's website<sup>3</sup> (hard copies can be published from the EU Bookshop<sup>4</sup>), the 180 page publication is the result of a global effort between more than 120 researchers. Developed with the non-expert in mind, the Atlas guides readers into the fascinating world of soil biology and explains how soils form and evolve in to specific habitats where physical and chemical soil characteristics condition soil-dwelling communities. A striking element of the Atlas is a group by group guide to soil organisms. Starting with the smallest and working its way to mammals, reptiles and even birds, the reader is presented with a clear and comprehensive description of the diversity of soil organisms, the factors controlling their geographical and temporal distribution, and the ecosystem services and functions that they provide.

A key message of the Atlas is the diverse array of threats to soil biodiversity coming from land use change (e.g. deforestation), the sealing of soils by artificial surfaces, the introduction of invasive species, pollution, acid rain

and nutrient overloading, agricultural practices (including overgrazing), fire, soil erosion and land degradation, desertification and climate change. For the first time, the Atlas presents a global overview of the potential threats to soil diversity based on the previously mentioned factors (Figure 1).

Soil biodiversity is critical for achieving sustainability goals on healthy food, reducing greenhouse gases emissions, lessening desertification and soil erosion, and preventing disease. Gaps in our knowledge of soil biodiversity must be acknowledged. The collection and synthesis of soil biodiversity data globally should be sustained and enhanced in order to better understand and predict the effects of global drivers of land degradation on soil organisms and the functions that they deliver. It is time for people to broaden their view of biodiversity, not just thinking about plants and large mammals, but also the tiny, colourful and fascinating tardigrades and springtails that live in the soil. It is in our interest to understand better life in the soil as our very existence depends on them.

<sup>1</sup> <https://globalsoilbiodiversity.org/>

<sup>2</sup> Orgiazzi, A., Bardgett, R.D., Barrios, E., Behan-Pelletier, V., Briones, M.J.I., Chotte, J.-L., De Deyn, G.B., Eggleton, P., Fierer, N., Fraser, T., Hedlund, K., Jeffery, S., Johnson, N.C., Jones, A., Kandeler, E., Kaneko, N., Lavelle, P., Lemanceau, P., Miko, L., Montanarella, L., Moreira, F.M.S., Ramirez, K.S., Scheu, S., Singh, B.K., Six, J., van der Putten, W.H., Wall, D.H. (Eds.), 2016, Global Soil Biodiversity Atlas. European Commission, Publications Office of the European Union, Luxembourg. 176 pp

<sup>3</sup> <http://esdac.jrc.ec.europa.eu/content/global-soil-biodiversity-atlas>

<sup>4</sup> <http://bookshop.europa.eu/en/global-soil-biodiversity-atlas-pbLBNA27236/>



**Arwyn Jones and Alberto Orgiazzi**  
European Commission Joint Research Centre  
Sustainable Resources Directorate –  
Land Resources Unit  
[arwyn.jones@jrc.ec.europa.eu](mailto:arwyn.jones@jrc.ec.europa.eu)  
[alberto.orgiazzi@jrc.ec.europa.eu](mailto:alberto.orgiazzi@jrc.ec.europa.eu)

# The environmental aspect of agriculture

Czesław Siekierski, Chairman of the Committee on Agriculture and Rural Development at the European Parliament, outlines how agriculture can benefit the environment...

The environmental aspect of farming, and in general the modern agribusiness, is continuously receiving more and more attention and the spread of good practices in agriculture benefits both the environment, and the quality of foodstuffs available to the consumers. Environmental concerns are relevant for many reasons, such as the future challenge of providing larger quantities of food for the growing world population, without putting too much pressure on natural resources, that could be depleted, as well as on climate and the environment.

The importance of the environmental aspect and the need to promote rational and intelligent agricultural solutions in rural areas can be illustrated by the formula of sustainable development that provides a variety of possibilities for improving the quality of the environment. The very notion of sustainability extends also to social aspects such as the creation of jobs, which is most important in areas where too many people are employed in agriculture, or where there is the risk of depopulation of rural areas with natural constraints.

For these reasons, we are forced to rethink our approach and practices connected with production, processing and storage, consumption as well as recycling and waste management. These measures need to be taken if the above mentioned future increase in the demand for food is to be met, but also to allow future generations to inherit a natural environment that is not degraded due to irresponsible exploitation. That is our responsibility and obligation towards those that will in the future take our place at the helm.

In order to build a sustainable world that could serve many generations to come, some of the key investments in rural areas should be in the sector of renew-

able energies, such as wind, solar and water power, as well as energy coming from managing waste in biogas plants. Such actions would have a positive effect on downsizing the emissions of greenhouse gases while creating new job opportunities in rural areas. Since investments in the energy sector are usually very costly, it is all the more important to actively promote prosumer energy generation that mainly serves to power individual households with the possibility of selling the surplus to the grid. In terms of the most significant investments there is the need to make use of public funds.

Yet another issue connected with basic resources in rural areas is the continuous degradation of soil. In order to fight this process, additional investments are needed in the area of melioration infrastructure, as well as an overall support of best practices that benefit the soil and prevent erosion and acidification. Another important issue that needs to be tackled is the loss of fertility that poses a problem for many actors in the sector of agriculture.

Already for a long time, the evolution of the Common Agricultural Policy has been oriented towards the implementation of measures, practices and solutions that are climate sensitive. The recent CAP reform has introduced the greening mechanism in the framework of the first pillar, the so called green payment amounting to 30% of the basic payment. The goal is to reward farmers for public goods they are providing to the society and the environment. However, there are several conditions that need to be met in order to be entitled for the green payment: the necessity to diversify crops, retain pastures, set up ecological focus areas or put in place other equivalent practices. Those not following the requirements will face penalties of up to 125% of the green payment. This would mean losing not only



*Czesław Siekierski, Member and Chairman of the Committee on Agriculture and Rural Development at the European Parliament*

the green payment but also some of the basic payment. Some requirements are dependent on the size of the farm as those of up to 10 hectares are excluded from diversification and farms of up to 15 hectares do not need to set up ecological focus areas.

Pro-environmental actions are present also in the second pillar of the Common Agricultural Policy and constitute 30% of its budget. Actions that these funds are responsible for encouraging are: rebuilding, protection and strengthening of agricultural and forest ecosystems (biological diversity, water, soil), promotion of effective use of resources (water, energy), as well as providing support for the transition towards a low-carbon economy (the use of renewable energy sources, limiting the emission of greenhouse gasses, removal and storage of carbon dioxide).

Research and innovations are a very important aspect of the environmental and climate smart development of the agricultural sector. The EU Strategy “Europe 2020” emphasises the importance of promoting innovative solutions in bio-economy if we are to

achieve both an intelligent and ecological growth in the EU. It is important for attaining more efficient use of renewable biological resources and causing less harm to the environment while retaining a competitive position on the global markets. At the same time there is an ever growing development in terms of also looking at waste as an additional source of income for the EU economy if handled and processed properly. ■

.....  
**Czesław Siekierski**  
**Member and Chairman of the Committee on**  
**Agriculture and Rural Development**

European Parliament

[czeslaw.siekierski@europarl.europa.eu](mailto:czeslaw.siekierski@europarl.europa.eu)

[http://www.europarl.europa.eu/meps/en/23787/CZESLAW+ADAM\\_SIEKIERSKI\\_home.html](http://www.europarl.europa.eu/meps/en/23787/CZESLAW+ADAM_SIEKIERSKI_home.html)



# A Global Perspective on Agriculture Research

The USDA National Soil Dynamics Laboratory (NSDL) has a long history of research on developing sustainable agriculture. Originally founded as the Farm Tillage Machinery Laboratory in 1933 on the Auburn University campus in Auburn, Alabama, USA, it was initially charged with researching tillage, associated traction practices, and machines used in cotton production. The lab was instrumental in the development of engineering principles for modern agricultural equipment design. Currently, NSDL's mission is to develop tools, practices, and products to better manage soil for environmentally sustainable and economically profitable agricultural production systems. While the research is centered around Southeastern USA production systems, implications of findings clearly have a more global prospective, especially in the context of efforts to understand how agriculture influences global change.

The Laboratory solves agricultural problems in three major areas:

- Conservation systems;
- Organic waste management; and
- Global change.

Specific objectives include developing conservation systems that reduce drought risk and sequester soil carbon, developing environmentally sound waste management systems, and determining the effects of atmospheric CO<sub>2</sub> levels on above- and below-ground processes that affect crop



production, soil carbon storage, and trace gas emissions.

Currently, there are many uncertainties concerning agriculture's role in global environmental change including the effects of rising atmospheric CO<sub>2</sub> concentration. Agricultural practices have the potential to increase soil C storage which can positively influence soil quality and help mitigate this rise in atmospheric CO<sub>2</sub>. Research at NSDL is examining the effects of atmospheric CO<sub>2</sub> on both biomass production and soil C sequestration.

The concentrations of trace gases (nitrous oxide and methane) in the atmosphere are also increasing with agriculture being a primary contributor. The NSDL has a multi-disciplinary research team investigating ways that agriculture can help reduce greenhouse gas (GHG) loss through improved practices and fertiliser use in cropping and horticulture systems. This work is evaluating new, innovative application techniques that reduce

GHG emissions, including determining fertiliser N use efficiency and fate of fertiliser N in these systems as well as changes in C and N cycling processes. This work showed that soil C storage is sensitive to soil N dynamics and that the decomposition of plant material grown under elevated CO<sub>2</sub> depends on crop species and indigenous soil properties. It has also lead to a US patent on the use of microbial inoculations to reduce nitrous oxide emissions from fertiliser N application (US9,266,786 B2).

Research at NSDL develops conservation systems that improve soil quality, conserve natural resources, and increase production efficiency by considering input costs and profitability. A major focus is to evaluate the use of alternative fertiliser sources, such as poultry litter (a poultry manure and bedding material mix), compared to commercial fertiliser in tillage systems designed to enhance soil organic matter accumulation, crop productivity, and grower profitability. Application of

## PROFILE

poultry litter to soil can improve soil conditions and provide nutrients needed for plant production. This seems to be a viable option for South-eastern USA producers due to rising costs of inorganic fertilisers and the fact that the growing poultry industry generates large amounts of manure. Field and laboratory studies are being conducted to develop improved methods to utilise waste products for soil and crop benefits while minimising environmental degradation since improper manure application can increase hypoxia, eutrophication of surface waters, human health

problems, and GHG emissions. Furthermore, using poultry litter in conservation agricultural systems could sequester atmospheric C in soil. Research has shown that the use of poultry litter in long term research plots resulted in increased soil C levels and thus higher atmospheric C sequestration. However, best management practices must be developed for poultry litter application that maximises nutrient uptake and minimises GHG loss.

Tillage and fertilisation practices used in row crop production can alter GHG

emissions from soil. A new prototype implement for applying poultry litter in subsurface bands in the soil was used in studies to determine the impact of management practices and fertiliser source and placement methods on GHG emissions. As part of this effort, a new method was developed for calculating Effective Gas Flux from soil following band application of manure or fertiliser. Banding of fertiliser resulted in the greatest concentration of gaseous loss compared to surface application and conventional tillage resulted in a higher concentration of CO<sub>2</sub> and N<sub>2</sub>O loss. These results suggest that poultry litter can be used to sequester soil C, but application by banding has the potential to increase GHG emissions.



**Allen Torbert**  
**Supervisory Soil Scientist,**  
**Research leader**  
United States Department of  
Agriculture, Agriculture Research Service,  
National Soil Dynamics Laboratory  
Tel: 1 334 844 3979  
[allen.torbert@ars.usda.gov](mailto:allen.torbert@ars.usda.gov)  
[www.ars.usda.gov/sea/nsdl](http://www.ars.usda.gov/sea/nsdl)

# TAILOR-MADE PROMOTION

**As part of our package of information services, Adjacent Digital Politics Ltd are proud to present the option of a personalised mini publication we call an 'e-book'.**

Our e-books are a bespoke tool used by our clients to target a specialised readership with informative content. They can be 8, 12 or even 16 pages dedicated to your profession and services. Our production, editorial and design teams will work with you to identify and develop your message before delivering it electronically to a targeted audience using the latest digital publishing technology for ease of reading.

We have access to an extensive database of contacts within specialised areas that can be utilised. All our data is cleansed and complies with all data law, so you can be confident that your message will be delivered to the right people at the right time.

---

Our database will ensure your message is delivered and read by those in your sector, so get in touch today to plan your communication strategy.

Tel: **0843 504 4560**



[www.adjacentgovernment.co.uk](http://www.adjacentgovernment.co.uk)

**AG** ADJACENT  
GOVERNMENT



# Tackling AMR – the Danish way

Esben Lunde Larsen, Danish Minister of Environment and Food explains why a united Europe is needed to lead the fight against AMR...

In Europe 25,000 deaths are annually estimated to be related to antimicrobial resistance (AMR). But towards 2050 this number is predicted to increase drastically, and AMR is announced as the biggest single cause of deaths worldwide in the future. The predictions show a horrifying number of 10 million deaths due to AMR in 2050 and thereby emphasise the serious need for action.

AMR is a global threat that knows no borders. In Denmark strong efforts have been made to ensure a future modern health care where infections can still be treated with antibiotics. Preventing infections as well as prudent use of antibiotics both in human health care and animal production are crucial factors in this fight. In the animal sector, reducing antibiotics usage is a strong goal and initiatives have been in place for many years with good results. Despite the good Danish results, problems are imported and it is time for Europe to stand united and to take the lead in the fight against AMR.

European initiatives have led to a very good overview of the use of antimicrobials but further steps are needed. A new ambitious One Health Action Plan must be put forward with focus on strengthened monitoring and a more detailed level of information in order to make informed decisions. I am of the opinion that an EU action plan for the monitoring of the use of antibiotics for animals would complement the EU action plan in this area and strengthen the efforts in combatting antimicrobial resistance at EU level. Thus monitoring the use of antimicrobials is an essential step in the effort of reducing antimicrobial consumption and subsequently reducing the emergence of antimicrobial resistance.

Denmark would suggest an EU action plan taking a differentiated approach to monitoring where the aim



is to collect data at both species and herd level and thus complement the existing monitoring systems of veterinary use at national level. A more differentiated system of monitoring will enable the EU to set smart targets for reduction of antimicrobial use.

Denmark would be happy to share our national experiences gained from many years of collecting data on the use of antimicrobial agents and occurrence of antimicrobial resistance in bacteria from food animals, food and humans in Denmark. This message was given directly to the EU Commissioner of Health as he recently visited Copenhagen and he was presented with the Danish One Health Approach, where solutions are found in a cross sectorial cooperation between the human and the veterinary sector.

It is time for Europe to unite, commit and take action. We have to show the rest of the world that AMR can be fought and that our efforts are indeed effective. ■

.....  
**Esben Lunde Larsen**

**Minister of Environment and Food**

Ministry of Environment and Food of Denmark

<http://mfvm.dk/>

# Development of baits for insect control

Juan A. Morales-Ramos and M. Guadalupe Rojas at USDA Agriculture Research Service – SEA BCPRU outline the development of baits for pest control

Baits are a type of formulation that are used to deliver a toxic chemical or pathogen (i.e., the active agent) via ingestion to an insect pest. A bait formulation consists of a bait matrix which is the carrier and an active agent. The bait matrix is typically a mix of compounds that stimulate insects to feed and constitute most of the content of the bait. These compounds can include ingredients and other substances identified as food by the target insect. Because the active agent is ingested, its concentrations can be considerably lower than if they were applied in a spray. Additionally, active ingredients last longer in baits because they are less exposed to environmental degradation. Baits can be used to apply pesticides in a more environmentally friendly manner by reducing or eliminating exposure to unintended targets (such as beneficial insects and wildlife) and by dramatically reducing pesticide accumulation. Also, baits can be a more efficient way to deliver biological control agents (such as pathogens) to intended pest targets minimising exposure to beneficial insects. Baits not only place insect targets in contact with the pathogens, but also induces their ingestion by the pest. In addition, baits can be formulated to enhance the survival and virulence of insect pathogens. Another advantage of baits is that less toxic chemicals can be used effectively as active ingredients/agents.

Current use of baits has been mainly directed for the effective control of household pests, especially social insects like termites and ants. Baits are the best known method for controlling social insect pests, which tend to live in secluded environments or underground and therefore are protected from direct chemical sprays. For ant control chemicals applied as sprays kill only foraging workers and are not effective at destroying the entire colony thus providing a false sense of security. The workers are quickly replaced by the extraordinary reproductive capabilities of the queens, which remain safely secluded from insecticide exposure. When pesticides degrade, insect problems can rapidly return. However, the active agent formulated in a bait is collected and carried to the nest by the workers, which feed it to the queen and brood; thereby eliminating the entire colony.

The effectiveness of a bait greatly depends on the suitability of the matrix to induce the target pest to feed. The bait matrix must be attractive to the target insect even in the presence of alternative food sources. Baits are ineffective if they are rejected by the target insect when in the presence of natural food sources. For example, termites should completely consume the bait in the presence of wood sources, such as trees and houses. The development of adequate

bait matrices requires a complete knowledge of the nutritional ecology, behavioral responses to food, and nutritional physiology of the target insect. Continuing with termites as an example, for decades, it was believed that cellulose was the only food source termites required and bait matrices effectiveness depended in the purity of the cellulose used to formulate them. Morales-Ramos and Rojas (2001, 2003a, 2003b) demonstrated that termites have preferences on the species of wood they consume and those preferences were associated with the nutritional value of the consumed wood. The presence of some nutrients, such as lipids (fats and sterols), that are commonly scarce in their natural environment stimulated feeding and improved queen fecundity (Morales-Ramos and Rojas 2007). Other compounds, such as organic acids including salicylic and oxalic acids, not associated with nutrition but that stimulated feeding were also identified (Morales-Ramos et al. 2009). These discoveries lead to the development of an improved bait matrix for the Formosan subterranean termite (*Coptotermes formosanus*) (Rojas and Morales-Ramos 2001, 2003).

Ant control is another example where improved bait matrices has led to enhanced control. Household ants are mostly omnivorous and consume a variety of food sources. Omnivorous

insects have the ability to regulate their intake of critical nutrients by selecting from different food items available in their environment (Waldbauer and Friedman 1991). This ability is called self-selection and, in many insects, is a natural way to regulate the natural ratios of major nutrient types (carbohydrate, lipid, and protein) in the insect diet (Waldbauer and Bhattacharya 1973, Raubenheimer and Simpson 1993). Although self-selection has only been experimentally demonstrated in a few species of ants (Cook and Behmer 2010) it is likely that most omnivore ants possess this ability. The ability to self-select food based on their nutrient content impacts the effectiveness of bait matrices to stimulate feeding of target species. Bait matrices composed of a single food item may not be effective in some environments where there is abundance of the particular nutrient types that the bait matrix contains. A bait matrix containing equal ratios of protein, carbohydrate, and lipid is more likely to remain attractive to ants in a wide variety of environments. This idea was applied for improvement of household ant baits by Rojas and Morales-Ramos (2011) with significant success.

The effectiveness of baits used for ant control depend greatly on the lethality of the active agent or ingredient. The active ingredient must have low toxicity so the workers remain alive to carry the bait in their fore guts to feed the queen and brood through the act of trophallaxis. This process consist in partial digestion of the food, which is transferred from mouth to mouth across all members of the colony (Wilson 1971, 1980, Hölldobler and Wilson 1990). Control is achieved by the accumulation of the active agent

to lethal levels in the colony. Even in controlling solitary insect pests, it is desirable to avoid the accumulation of dead insects near the bait to prevent repellency of target and attraction of non-target species. Growth regulators or other physiologically active compounds have been the preferred choices for active agents in bait formulations because of their slow mode of action.

Baits can also be used to deliver biological control agents, such as insect pathogenic (i.e., entomopathogenic) fungi, bacteria or viruses, which are carried by ant or termite workers with the bait into the nest. Although no commercial products currently exist to deliver biologicals in bait formulations, some preliminary studies have shown success using such formulations against ants and termites. Current and future research will focus on the formulation of baits using biological agents in combination with chemicals that weaken insect immune defenses.

### Literature Cited

- Cook, S. C. and S. T. Behmer. 2010. Macronutrient regulation in the tropical ant *Ectatoma ruidum* (Formicidae): a field study in Costa Rica. *Biotropica* 42: 135-139.
- Hölldobler, B. and E. O. Wilson. 1990. The ants. The Balknap Press of Harvard University Press, Cambridge, MA, USA, 732 pp.
- Morales-Ramos, J. A. and M. G. Rojas. 2001. Nutritional ecology of the Formosan subterranean termite (Isoptera: Rhinotermitidae): feeding response to commercial wood species. *J. Econ. Entomol.* 94: 516-523.
- Morales-Ramos, J. A. and M. G. Rojas. 2003. Nutritional ecology of the Formosan subterranean termite (Isoptera: Rhinotermitidae): growth and survival of incipient colonies feeding on preferred wood species. *J. Econ. Entomol.* 96: 106-116.
- Morales-Ramos, J. A. and M. G. Rojas. 2003. Formosan subterranean termite feeding preference as basis for bait matrix development (Isoptera: Rhinotermitidae). *Sociobiology* 41: 71-79.
- Morales-Ramos, J. A. and M. G. Rojas. 2007. Importance of lipids for queen fecundity and colony growth of *Coptotermes formosanus* (Isoptera: Rhinotermitidae). *Environ. Entomol.* 36: 1014-1017.

- Morales-Ramos, J. A., M. G. Rojas, and D. Nimocks, III. 2009. Some organic acids acting as stimulants of recruitment and feeding for the Formosan subterranean termite (Isoptera: Rhinotermitidae). *Sociobiology* 54: 861-871.
- Raubenheimer, D. and S. J. Simpson. 1993. The geometry of compensatory feeding in the locust. *Anim. Behav.* 45: 953-964.
- Rojas, M. G. and J. A. Morales-Ramos. 2001. Bait matrix for delivery of chitin synthesis inhibitors to the Formosan subterranean termite (Isoptera: Rhinotermitidae). *J. Econ. Entomol.* 94: 506-510.
- Rojas, M. G. and J. A. Morales-Ramos. 2003. Field evaluation of nutritionally-based bait matrix against subterranean termites (Isoptera: Rhinotermitidae). *Sociobiology* 41: 81-89.
- Rojas, M. G., J. A. Morales-Ramos, L. M. Hernandez, and J. D. Peters. 2011. Gellable Ant Bait Matrix. Patent Number US 7,914,777 B2.
- Waldbauer, G. P. and A. K. Bhattacharya. 1973. Self-selection of an optimum diet from a mixture of wheat fractions by the larvae of *Tribolium confusum*. *J. Insect Physiol.* 19: 407-418.
- Waldbauer, G. P. and S. Friedman. 1991. Self-selection of optimal diets by insects. *Annu. Rev. Entomol.* 36: 43-63.
- Wilson, E. O. 1971. The insect societies. The Balknap Press of Harvard University Press, Cambridge, MA, USA, 548 pp.
- Wilson, E. O. 1980. Sociobiology. The Balknap Press of Harvard University Press, Cambridge, MA, USA, 366 pp.

### Additional resources:

- <http://www.anbp.org/>
- <http://www.iobc-global.org/>
- <http://www.biocontrol.entomology.cornell.edu/index.php>



**Dr Juan A. Morales-Ramos**  
 USDA Agriculture Research Service –  
 SEA BCPRU  
 Stoneville, MS 38776  
 Tel: +1 662 686 3069  
[Juan.MoralesRamos@ars.usda.gov](mailto:Juan.MoralesRamos@ars.usda.gov)  
[www.ars.usda.gov/main/main.htm](http://www.ars.usda.gov/main/main.htm)



# Harnessing opportunities for agri-food in Ireland

Michael Creed, Minister for Agriculture, Food and the Marine in Ireland highlights the Food Wise 2025 strategy and its aims to tackle the challenges facing the Irish agri-food sector...

**F**ood Wise 2025, the ten year strategy for the Irish agri-food sector published in July last year, is the successor to the Food Harvest 2020 strategy. It identifies the opportunities and challenges facing the sector and provides an enabling strategy that will allow the sector to grow and prosper. It sets out a vision for the industry to continue along the path of sustainable growth and recognises the strategic importance of specific market and consumer insights if emerging global opportunities are to be fully realised in the decade ahead.

Food Wise 2025 puts particular emphasis on harnessing the broad experience, expertise and knowledge of the Irish agri-food sector and in ensuring this collective wisdom is used to deliver future growth in ways that emphasise the improvement, development and adoption of sustainable processes, using natural resources in a manner which protects them into the future. A guiding principle that Food Wise 2025 seeks to embed at all levels of the agri-food industry is that environmental protection and economic competitiveness are equal and complementary: one will not be achieved at the expense of the other.

Food Wise 2025 identifies smarter and greener ways to deliver sustainable growth and recommends actions to best support the sector's development. Food Wise includes more than 400 detailed recommendations, spread across the cross-cutting themes of sustainability, innovation, human capital, market development and competitiveness; as well as specific sectoral recommendations. If these recommendations are implemented, the expert committee which drew up Food Wise considers that ambitious growth projections are achievable by 2025, including increasing the value of agri-food exports by 85% to €19bn, and the creation of 23,000 additional jobs in the agri-food sector, all along the



**Michael Creed**  
**Minister for Agriculture,**  
**Food and the Marine**

supply chain from primary production to high value added product development. Realising these growth projections will be challenging, but I am confident that they can be achieved.

The government is strongly committed to the implementation of the Food Wise strategy. Indeed it is a key element of the Programme for Government. I chair the Food Wise High Level Implementation Committee (HLIC), with representatives from all the relevant government departments and state agencies. The committee reviews progress on detailed actions on a quarterly basis, in order to identify and solve problems



quickly. Stakeholders regularly engage with the committee on their priorities for particular sectors or themes. By the end of this year, the HLIC will have reviewed in detail progress on the 5 cross-cutting themes and the 12 individual sectors outlined in Food Wise 2025. So it is very much a live and continuously updated process.

The agri-food sector is Ireland's largest indigenous industry, contributing €26bn in turnover. Last year, the value of Irish food and drink exports increased to €10.8bn, representing growth of over 50% since 2009.

I believe that Ireland is well positioned to be the world leader in sustainable agri-food production, and indeed environmental sustainability is central to the Food Wise strategy. The Origin Green programme is the first national sustainability programme of its kind in the world. Companies representing 95% of Ireland's food and drink exports have signed up to the programme, and over 800 farms a week are being audited on a range of measures, including carbon foot printing.

Schemes under the Rural Development Programme focus on supporting farming methods which protect the environment, while improving efficiency.

Since my appointment as Minister, I have enjoyed engaging with individual farmers, fishermen and food producers, as well as their representative organisations. I have been struck by the commitment on all sides to work together for the sustainable growth of the sector. I am confident that this shared approach will result in a 'triple win' of economic, environmental and social benefits for Ireland as a whole, and for rural Ireland in particular.

.....  
**Michael Creed**

**Minister for Agriculture, Food and the Marine**

Department of Agriculture, Food & the Marine

[www.agriculture.gov.ie](http://www.agriculture.gov.ie)

[www.twitter.com/agriculture\\_ie](https://twitter.com/agriculture_ie)



# Creating climate solutions for agriculture and forestry

Adjacent Government Editor, Laura Evans speaks to Rachel Steele, National Climate Hub Coordinator at the U.S Department of Agriculture about how they are helping to reduce the impacts of climate change for farmers and foresters...

Agriculture plays a key role in society worldwide. Seen as the backbone of the economic systems of most countries, it not only provides necessary sources of food and fiber, but also offers emerging economic opportunities in renewable energy, broadband, and recreation. Climate change presents real threats to agriculture, in regards to production, forest resources and rural economies. As the risks of climate change are becoming more prevalent, such as more severe storm events, it is increasingly important to help reduce these risks for land managers.

As the world population continues to grow – to an estimated 9 billion people by 2040 – farmers will have to feed not only the U.S, but the rest of the world. To help farmers adapt to a changing climate, the U.S. Department of Agriculture (USDA) is working on solutions to build resilience to climate variability. Rachel Steele, National Climate Hubs Coordinator at USDA, talks to Adjacent Government Editor Laura Evans about the problems climate change causes for agriculture and the Department's solutions.

"Climate Change is having profound direct and indirect effects on agriculture with considerable regional variance," explained Steele. "Some of the direct effects include: increased annual average and seasonal air temperatures; increased extreme precipitation events as well as increased risk of damage to crops, soils, and infrastructure; flood damage is expected to increase; severe wind and storm damage, and warmer temperatures increase the potential for soil moisture stress and drought.

"Indirect effects include: greater weed pressure increases the risk of crop loss; invasive weed competition may increase in pastures, orchards, and other perennial agriculture; populations of many damaging

insects may increase; the risk of plant pathogens may rise, and animals may be affected by heat stress as well as increased pathogens and parasites," she said.

USDA is trying to make sure farmers have all the information and tools they need to deal with these effects. For example in February 2014, Agriculture Secretary Tom Vilsack launched the USDA Climate Hubs. When doing so he emphasised, "for generations, America's farmers, ranchers and forest landowners have innovated and adapted to challenges. Today, they face a new and more complex threat in the form of a changing and shifting climate, which impacts both our nation's forests and our farmers' bottom lines."

The Regional Climate Hubs were established to synthesise and translate climate science into easy to understand information and tools, so that land managers can make climate-informed decisions.

Steele explained, "[The Climate Hubs](#)" work across USDA agencies and through established networks of partners on the ground to transmit information to technical service providers. USDA has the advantage of having an extensive network of staff and partners, such as Natural Resources Conservation Service (NRCS) regional staff, University Extension Agents, Certified Crop Advisers, seed dealers, Farm Service Agency (FSA) agents, and other trusted regional partners. "The Hubs are focused on building climate literacy "in-reach" to USDA staff and "outreach" via regional trusted channels and partners. The Hubs are synthesising the science, producing the tools and ensuring that these existing regional partnerships and networks have a good understanding of what climate change means for them at the local level and at the seasonal time-scale. Farmers are business managers, they need to have the best available information and tools to manage risk



and understand what different decisions will mean for their land. The Hubs are working across the country to ensure that they have this information available to them.”

The Hubs have been effective in their first 2 years of existence. A few of the many developments include: writing eight regional vulnerability assessments; synthesising the forest service drought synthesis report; developing a Climate Hubs tool shed, which is an inventory of tools for working land managers; establishing strong regional partnerships with private, federal entities, and University/Extension partners.

“We’ve developed adaptation handouts, videos, fact-sheets, email alert systems, tools, and also a close working partnership with other federal agencies’ climate networks, such as the Department of Interior’s Landscape Conservation Cooperatives, Climate Science Centers, and National Oceanic and Atmospheric Administration (NOAA) Regional Integrated Sciences and Assessments (RISA), who have regional climate networks as well. We linked up with them to really build on their climate knowledge and information to make sure it gets to the people that need it.”

In addition to the regional Climate Hubs, USDA launched The Building Block for Climate Smart Agriculture a year ago. This initiative represents a comprehensive and detailed approach to support farmers, ranchers, and forest land owners in their response to climate change. The framework includes a road map that outlines progress, implementation plans and case studies for the 10 building blocks. These 10 building blocks span a range of technologies and practices to reduce greenhouse gas emissions, increase carbon storage, and generate clean renewable energy. The building blocks include: soil health; nitrogen stewardship; livestock partnerships; conservation of sensitive lands; grazing and pasture lands; private forest growth and retention; stewardship of federal forest; promotion of wood products; urban forests and energy generation and efficiency.

“Working through existing programs and authorities, USDA is committing to reduce over 120 million metric tons of CO<sub>2</sub>e per year by 2025,” said Steele. “These building blocks are voluntary and incentive-based; focused on multiple economic and environmental

benefits, designed to meet the needs of producers, and measured to evaluate progress.

“The USDA climate hubs have been communicating the building blocks at the regional level providing the latest information and research on the various technologies involved in the building blocks, and providing information about their effectiveness at the regional level. In addition they have been bringing USDA agency staff to the table to discuss climate change and opportunities/barriers as we mitigate emissions and facilitate climate smart agriculture.”

**“Climate change presents real threats to agriculture, in regards to production, forest resources and rural economies. As the risks of climate change are becoming more prevalent, such as more severe storm events, it is increasingly important to help reduce these risks for land managers.”**

Research is a key part of the work that USDA is doing in order to provide information for farmers and landowners. As part of the work at the Regional Hubs, it’s important to be able to communicate the research and information that they receive from these programmes.

“The Climate Hubs not only communicate the research and information that’s coming out, but also take back information from the farmers to the research entities” said Steele.

Looking ahead, the Climate Hubs will continue to focus on partnership building, climate literacy “in-reach” and out-reach, capitalising on regional synergies to communicate climate science, developing tools, conducting assessments, and using innovative strategies to share adaptation and mitigation demonstrations with working land managers. ■

.....  
**Rachel Steele**

**National Climate Hub Coordinator**

U.S Department of Agriculture

RSteele@oce.usda.gov

[www.usda.gov/wps/portal/usda/usdahome](http://www.usda.gov/wps/portal/usda/usdahome)

# Unraveling a complex common bean disease in South East Africa

A complex disease known as root and crown rot (RCR) has become a yield-limiting disease of common beans (*Phaseolus vulgaris* L.), reaching epidemic proportions across Zambia and Mozambique and ravishing subsistence fields of poor farmers who depend on beans for their livelihood. The problem starts when plants emerge and grow enough to develop leaves and necrosis is noticed on lower parts of the stems or wilting of the young plants preventing the absorption of water and nutrients. Climate change along with limited genetic diversity of a mixture of susceptible local varieties are playing a big role in its spread across both countries. In addition to the common insect and foliar diseases that can also plague beans and limit yields, another negative factor is RCR which affects the entire bean plant.

In the Zambian and Mozambique diet, beans are a major source of protein, micro- and macronutrients, they are rich in fibre and have a low glycemic index, therefore local governments and non-governmental agencies advocate the planting of beans more than other legumes to combat hunger and malnutrition in this part of Africa. Over time, research publications have claimed that many unrelated fungi are the primary causal agents. However after many studies and published articles, knowledge of the causal agent is still fragmented and incomplete enough to prevent achieving



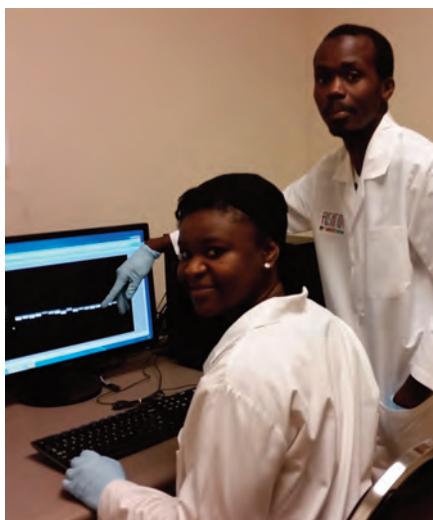
Bean plants showing lower stem necrosis (left) and wilting (right) due to RCR. The disease can occur at any stage of plant development

milestones in breeding for root rot resistance in regions where common beans are an important staple crop.

At the University of Nebraska-Lincoln in the USA, a research team with experienced scientists, Dr. J.R. Steadman, joined by Drs. Carlos Urrea and G. Godoy-Lutz (a visiting scientist from the Dominican Republic) teamed up with colleagues from Zambia and Mozambique to examine this persistent problem using DNA genomic tools. The project entitled: Genetic Approaches to Reducing Fungal and Oomycete Soilborne Problems of Common Beans in Eastern and Southern Africa was funded by a grant from the National Institute of Food and Agriculture of United States Department of Agriculture (USDA).

Three years of sampling hundreds of diseased plants in experimental and farmers' fields, produced infected tissue that were analyzed at the healthy-disease interface. Traditional in vitro culturing, as well as innovative metagenomics technologies, produced fungal cultures and an abundance of DNA sequence reads that identified fungal members of the *Nectriaceae* family, which is mainly populated by species of *Fusarium* such as *F.oxysporum*, *F.solani* and *F.equiseti*, the main species found associated to RCR in the study. Even though *F.oxysporum* and *F.solani* have been implicated as root and flower pathogens in many crops, their role as primary pathogens of bean was not evident prior to this study. *F.equiseti* has been reported to be a pathogen of cereals but not

## PROFILE



Chikote Mukuma and Suzana Fernandes examine PCR amplicons for DNA sequencing

legumes. *F.oxysporum* has been the predominant species found in Zambia whereas *F.solani* was the primary pathogen in Mozambique. However, they are not found alone but co-occur with *F.equiseti* and other *Fusarium* species, which raises the question if, in nature, species of the same genus influence the success of one or more related pathogens.

Species of *Fusarium* make an interesting and complex fungal group, ubiquitous in soil, air and aquatic environments, versatile in their mode of reproduction and survival and causing diseases in humans, animals and plants. Some species of *Fusarium* are capable of producing toxins which increase in their pathogenicity on their hosts.

Training young scientists in plant pathology and breeding is also an important component of this project that will improve human resources available in the host countries where trained professionals are often lacking. M.S. graduate students Chikote Mukuma and Suzana Fernandes, from Zambia and Mozambique respectively, have devoted time and energy to examine

large sections of microbial genomes inhabiting the infected bean tissue as well as healthy plants. They inoculated *in vivo* isolates from diseased plants and replicated the symptoms on bean plants under controlled conditions to prove pathogenicity of the isolates. The graduate students also evaluated and used new technologies to extract, ship and preserve DNA from plants or fungi without resorting to expensive equipment and a constant sources of energy that may be lacking in developing countries.

Another discovery was similarities regarding the role of collective species of *Fusarium* that challenges other hypothesis that confer an important role to oomycetes or basidiomycetes as the causal agents of RCR in neighboring African countries. The other fungal species tied to RCR have been absent or barely present or only present in the same plant with the *Fusarium* species highlighted in this study.

For the bean breeder Dr. Urrea, knowing the primary pathogen involved in pathogenesis of RCR is necessary information to allow his breeding program to screen for RCR resistance and find a molecular marker that will decrease the time to find RCR resistant lines that are adapted to Zambia and Mozambique. Development and deployment of resistant beans is regarded as the most sustainable and effective long term strategy to offset the effects of climate change in parts of the world where resources are scarce and the economy relies mainly on agriculture.

With the collaboration of the project's African PI's Dr. Celestina Joshua (Mozambique) and Mr. Kennedy Muimui (Zambia), over 500 diverse

bean lines were tested in field nurseries over 3 years. There were at least 12 lines that were selected with no or low foliar diseases, good seed yield and no RCR symptoms where other lines were decimated by RCR. These African collaborators have shared the project's outputs including improved bean lines with government and farmers' associations often composed of women and demonstrated the existence and seriousness of RCR leading to the need to replaced local susceptible varieties with improved and productive bean lines resistant to RCR. Moreover, when the students return with their degree and a wealth of knowledge and experience, they will be able to use their abilities to develop and assist research programs and attract and collaborate with new international projects to improve and develop agriculture in each country.



**James R Steadman**  
Professor and Head of Plant  
Pathology Department  
University of Nebraska-Lincoln  
Tel: 1 402 472 3163  
jsteadman1@unl.edu  
<http://plantpathology.unl.edu>

**Carlos Urrea Florez**  
Associate Professor  
University of Nebraska-Lincoln  
Tel: 1 308 632 0556  
currea2@unl.edu  
<http://agronomy.unl.edu>



# THE EVOLUTION OF YIELD IN CORN

*Dr. Ronnie Heiniger  
North Carolina State University*

## Why is Corn Yield so Important?

The key to feeding a growing world with less demand on scarce resources and lower environmental impacts lies in increasing yield. Research has shown that increasing corn yield results in better efficiencies in nutrient and water use thanks to the fact that corn plants that yield more also have bigger root systems and more effective leaf area. The challenge for corn producers is to find management practices that allow them to maximize yield given the soil and environmental constraints they are operating with. Among the many management options that corn producers have what practices will provide the best return on investment in terms of increasing yield with the lowest cost and risk. This publication discusses some of the key principles and practices corn growers should consider when seeking to increase yield in corn.

## It is All About Intercepting Light

At the most basic level corn is a starch factory that depends in turning light energy into starch. Therefore the most critical practice in managing for higher yield is maximizing light interception. There are three management practices that can be used to increase light interception. These are growing longer season hybrids, increasing seeding rate and plant population, and decreasing row spacing. Of these three the most effective practice is increasing seeding rate and plant population. While growing hybrids that require a longer growing period increases the amount of light intercepted it also increases water requirements and does not improve root mass or leaf efficiency. Using narrow rows only increases light interception for a short period of time. In contrast high plant populations increase light interception across the entire growing period, result in improved efficiency in light interception, and along with other key management practices increase root mass in the field. Figure 1 shows the impact of increasing plant density on the morphology of corn plants. As plant population increases the corn

plant grows taller resulting in more effective placement of leaf area to intercept sunlight. This results in optimum yield potential. However, there is a limit to this response. As plant density increases so does the need for water and nutrients. When the demand for water and nutrients exceeds the ability of the environment to provide these to the plant the corn plant responds by reducing its height and yield potential is reduced. Note that in Figure 1 there is a narrow range of plant densities over which the plant reaches maximum height and productivity. Corn producers must precisely match plant population to the environment of the field.

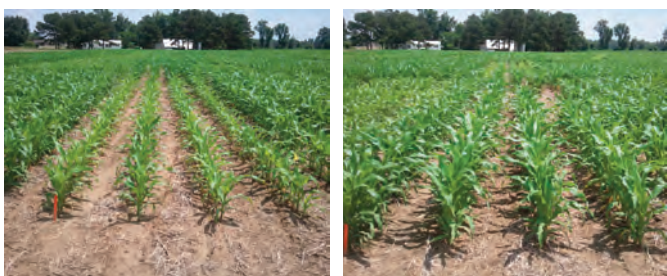


*Figure 1. Change in plant density from 29,343 plants ha<sup>-1</sup> on the left to 107,593 plants ha<sup>-1</sup> on the right.*

## Supporting Plant Density with the Right Management Practices

As is apparent in Figure 1 planting at a higher seeding rate is not the only step producers should use to achieve higher yield. Higher plant densities result in individual plants that have smaller root systems and thinner stalks.

These negative effects must be compensated for. There are two key practices that must be used in a systems approach along with higher seeding rates to make higher corn yield possible. These two key practices are starter fertilizer and multiple applications of nitrogen. The root is the first plant part to be developed in the growth cycle of the corn plant. The faster the corn plant grows from germination to flowering the more root mass will be produced. Since the root system is the key to better nutrient and water use efficiency this is a critical component of a high yield corn plant. Starter fertilizer which contains small amounts of nitrogen and phosphorus increases the early growth of the corn plant (Figure 2). Research shows that increasing early growth by using starter fertilizer results in a plant with more root mass and thicker stalks overcoming the negative effects of higher plant populations.



*Figure 2. No planting or starter fertilizer was used on the four-row plot on the left while 22.5 L ha<sup>-1</sup> of 11-37-0 was applied in a 2 x 2 band at planting to the four-row plot on the right.*

Likewise, a corn plant depends on nitrogen to maintain leaf chlorophyll levels and efficient conversion of light into starch. Unfortunately, most growers only apply nitrogen at the beginning of the season or, at most, twice at planting and again at canopy closure. Since nitrogen is mobile in the soil and subject to loss these applications often don't cover the full season nitrogen demands of the plant (Figure 3). Growers often apply more nitrogen than the plant actually needs to cover the fact that some nitrogen will be lost by the time the plant reaches the reproductive stages. A better system for producing high yield corn is to apply small amounts of nitrogen throughout the season. This approach allows growers to just meet the needs of the plant at a given time resulting in little or no waste while ensuring optimum growth and

yield. Furthermore, nitrogen rates can be adjusted as the growing season progress to match changes in weather (particularly rainfall) resulting in maximum nitrogen use efficiency.



*Figure 3. Nitrogen was applied at four different times during the growth cycle of the corn plant to the four-row plot on the right while nitrogen was only applied at planting to the four-row plot on the left.*

### **In Summary – A High Yield Corn System**

Capturing more light while increasing root mass and light use efficiency requires a systems approach to corn production. The future of high-yield corn production lies in precisely matching plant population with the environment of the field and then supporting that population with starter fertilizer and regular feeding with small amounts of nitrogen. This approach has the potential to increase yield resulting in less demand on land resources. Research at the Vernon G. James Research and Extension Center at North Carolina State University over the past three years documents that this systems approach consistently produced maximum corn yield ranging from 21.1 to 23.7 mt ha<sup>-1</sup>. Only by using a systems approach can growers increase water and nutrient use efficiency in corn production resulting in better utilization of scarce resources and improving the amount of carbon fixed in a corn field resulting in less climate impacts.

# Delivering a sustainable and low carbon economy

At the 7th Summit of the Regions and Cities in Bratislava last month – of which Adjacent Government was in attendance – Vice-President of the European Commission with the responsibility of the Energy Union, Maroš Šefčovič spoke about the role of cities and regions in the transition towards and sustainable and low carbon economy...

Let me first of all congratulate the Committee of the Regions for having – once again – convened this Summit; a broad and very useful platform for sharing best ideas and practices at a European level. Indeed, I see in this audience representatives from EU institutions, like the European Commission, local leaders, investors and leaders of start-ups, and others.

We are here to talk about the role of cities and regions at a time when everything has the prefix ‘smart’; from ‘smartphones’ to ‘smart financing’ adding up to building the ‘smart cities’ of tomorrow.

Indeed, Europe is in the midst of a fundamental transition towards a sustainable, low-carbon economy and society. And for this transition to be successful, we need at least 3 elements to be in place: we need a convincing and appealing vision; we need a political framework within which we can act effectively and efficiently; and we need concrete pioneering projects that serve as an example to others. Let me go a bit deeper in these elements.

First, the vision. As Jeremy Rifkin eloquently asserted, the new Industrial Revolution is unfolding as we speak. Its key drivers are ‘digitisation’, Big Data, the ‘Internet of Things’, bringing together – in Jeremy’s words – the ‘Communication Internet, the Energy Internet and the Transportation and Logistic Internet’. We are moving towards a new collaborative economy, in which we enjoy a range of services and products without the need of owning them. We are embarking on a digital journey with new business models. And we are entering a period where ‘near zero marginal costs’ becomes the new economic ‘normal’ in more and more fields, from the entertainment industry to the energy sector.

This is also the vision we developed in the European Commission under the Energy Union Strategy. More than one year ago, when we presented the Energy Union Strategy we restated our commitment to move away from fossil fuels, old technologies and outdated business models, to innovative clean energy solutions, integrated with smart systems of mobility, ICT, waste etc. This is the future economic system that is genuinely sustainable, competitive and circular. I would add, this will be an economic model that surfs on the waves of digital democratisation. Look at the way we produce energy. Already now, in some member States, most of the electricity is being produced by active consumers, so-called “prosumers”. The new energy markets are becoming more and more decentralised, a trend that will continue, also in other economy sectors.

With this vision in mind, we are currently revising our European legislation. Together with several other Commissioners, we are taking a fresh look at our mobility system. In a couple of weeks, we will present our long-term vision on a mobility system that is low-emission, more collaborative, more future-proof. After summer, we will present proposals on how we can become more energy-efficient and how we can make our buildings ‘smarter’. Before the end of the year, we will present a proposal on how we can make the energy market more fit for renewables. We will also present an Innovation Strategy, all of this in line with the vision I just set out. In other words, we know where we are heading to, and we now have to act fast.

Of course, we want to make sure that all our actions reinforce each other. That’s why we need a coherent framework, the second element I mentioned. Such a framework is by definition – and I think the Committee





Image: © European Union / Tim De Backer

of the Regions will be very happy when I mention this – ‘multileveled’.

We need action at the global level. That’s why it is so important that we now have a common frame, the Paris Agreement, which I was proud to sign on behalf of the European Union last April in New York.

We need action at the European level, as I just illustrated.

We need action at the level of the Member States.

And of course, we need action at the local or subnational regional level.

We have managed to take some decisive steps forward to create the right framework, both in Europe and globally.

In Europe, it is the Pact of Amsterdam, which has been endorsed by all Member States, that provides the overall framework. We, in the Commission, intend to follow-up on its 3 core elements: better regulation, better

access to finance and a better knowledge base. That’s why we intend to present, in October, a “One-Stop-Shop for urban areas”. It will ensure that information on European legislation that is relevant for cities and regions, on data as well as on financing instruments are just one click away. And let me in particular stress the importance of access to finance, since this is so high on today’s agenda. We have several important instruments, such as the European Structural Investment Funds, the Juncker Investment Plan and other facilities such as Horizon 2020. But too often, these resources are fragmented. The One Stop Shop is a first step to address this.

But also at the global level, we now have a common framework. The Global Covenant of mayors which will ensure that cities can play their role together. Cities from all over the globe will now have one point of reference.

Now that we have the vision and the framework, let me turn to the third and last element: pioneering actions. What is the purpose of a vision and a framework if our citizens do not see the benefits in their daily life? So this

is my main message today: let's shift the discussion from the abstract to the concrete, from big policies to down-to-earth action.

**“Indeed, Europe is in the midst of a fundamental transition towards a sustainable, low-carbon economy and society. And for this transition to be successful, we need at least three elements to be in place: we need a convincing and appealing vision; we need a political framework within which we can act effectively and efficiently; and we need concrete pioneering projects that serve as an example to others.”**

In this panel, we heard how 2 concrete regions – Haute-de-France and Rotterdam-The Hague – are rolling their sleeves to make the transition to a low-carbon economy and society visible and tangible. How they have had to overcome practical obstacles, financial challenges, and how important political will is in all this.

These pioneer projects can only be successful if local authorities and citizens are in the driver's seat. If these projects have strong roots in the concrete local context and have strong local ownership. That is the true meaning of subsidiarity.

But this does not mean that other players, such as the European institutions, cannot facilitate. On the contrary, every week, many mayors contact me to see how Europe can be helpful.

The European Commission is certainly ready to do its part of the job. How?

First, I will use my Energy Union Tour next year not only to actively engage with Member States, but also to visit and showcase prime examples of cities and regions that are making a difference. It is more important than ever to exchange best practices. No city, no region has to re-invent the wheel. I therefore invite Member

States to identify a city or region that can play such a pioneering role, and you – representatives of cities and regions – to show us what you are doing.

Second, we will keep this topic high on the political agenda, as unanimously asked by the Council just a couple of days ago. I hope, and I am confident, that the Slovak presidency, as well as subsequent Presidencies, will also do their utmost to also keep this on the Council's agenda.

And thirdly, we will help where we can to support partnerships between cities that are willing to implement proven sustainable solutions. Partnerships between European cities, but equally, as I said, between European cities and cities outside Europe.

Ladies and gentlemen, by joining today, by sitting in this room – you are taking part of this very important journey.

Let me stop here and wish us all a very successful 7th European Summit of Regions and Cities, the 1st in my home country of Slovakia. ■

This is an edited version of a speech as delivered at the Summit – [http://ec.europa.eu/commission/2014-2019/sefcovic/announcements/7th-european-summit-regions-and-cities-bratislava\\_en](http://ec.europa.eu/commission/2014-2019/sefcovic/announcements/7th-european-summit-regions-and-cities-bratislava_en)

.....  
**Maroš Šefčovič**

**Vice-President responsible for the Energy Union**

European Commission

[http://ec.europa.eu/commission/2014-2019/sefcovic\\_en](http://ec.europa.eu/commission/2014-2019/sefcovic_en)

[www.twitter.com/MarosSefcovic](http://www.twitter.com/MarosSefcovic)

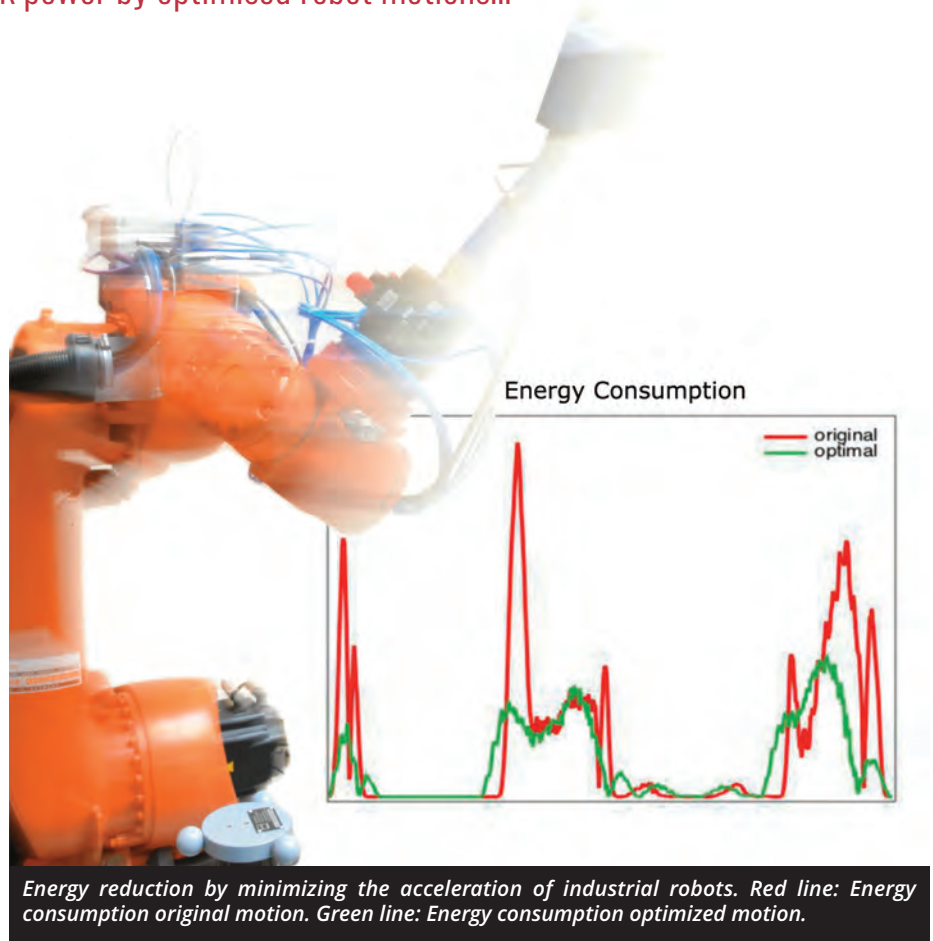
# Reducing energy consumption through optimised robot systems

Bengt Lennartson at Chalmers University of Technology explains how you can save up to 30% of energy and 50% peak power by optimised robot motions...

By minimising the acceleration of industrial robot systems, energy consumption can be reduced by up to 30%, while retaining the given production time. This is the result of a new optimisation procedure that has been developed by researchers at Chalmers University of Technology. The research was initiated by General Motors, Detroit, which asked Chalmers to add environmental aspects to earlier collaboration. The last three years this optimisation concept has been further developed in the EU/FP7 project Automation and Robotics for EUropean Sustainable manufacturing (AREUS), together with, among others, KUKA, Daimler, and University of Modena.

## Move slower instead of waiting

Energy optimisation of robot motions reduces acceleration and deceleration, as well as the time the robot is at a standstill, since being at a standstill also consumes energy. A basic idea in the proposed optimisation concept is to let a robot move slower instead of waiting for other robots to catch up, before carrying out the next operation sequence. The optimisation also determines the order in which the various operations are carried out, to minimise energy consumption without reducing the total execution time. The result is an energy optimal schedule, where all robots, but also other moving resources and machines, can be included in the optimisation procedure.



## Reduced energy and peak power

Evaluations on industrial robots show that it is possible to save up to 30% energy and 50% peak power, neither substituting any hardware nor provoking negative consequences on the overall plant production. Note that the required peak power determines the necessary capacity of the power supply system, including the amount of copper in power cables. Also observe the interesting peak power coordination, where a rapid robot motion should be avoided when another robot is performing a power consuming welding operation. This

type of coordination is easily included in the energy optimal scheduling, which is the core of the proposed optimization procedure.

## Recorded robot paths

The fact that the optimal solution still keeps a desired production time is crucial to get industrial acceptance. Reduced production capacity is seldom an acceptable solution. Furthermore, the paths of the robots are preserved. Only velocity profiles, and waiting times are adjusted in the optimisation, which means that the original robot path planning is maintained. A detailed



## PROFILE

energy model is normally expected in mathematical optimisation. Since such a model depends on physical parameters, including masses and damping factors that are hard to obtain, the proposed solution does not depend on such detailed models. It is only based on a simple recording of the robot paths, generated by the original robot programs.

### Simple optimisation procedure

The robot joint angles are in the current KUKA Robot implementation recorded and saved every 12ms. This sampling interval is then adjusted by the optimisation procedure. A shorter interval in the optimised solution implies higher velocity, while a longer interval reduces the velocity of the different robot joints. This simplified procedure, including an optimisation of the weighted squared sum of robot joint accelerations, and a resampling of the updated robot motions, generates a significant energy and peak power reduction. The reason is the close connection between power and acceleration, although it is an approximation where not all dynamic aspects are included.

### Planning and online adaption

The strength is that the optimisation has a clear connection to the real physical robots, and is based on already existing robot programs. The modification is only focused on energy and peak power reduction, while robot paths and production time are preserved. The optimisation can be used offline in a planning phase. It can also be applied online as an adaption procedure when properties of the system have changed, for instance after reprogramming of a robot, or the introduction of a new product. This makes the proposed method very attractive from a user perspective.

### Collision avoidance

The optimisation tool is included in a software developed at Chalmers, called Sequence Planner. To achieve a safe optimisation, several robots moving in the same area need to be coordinated. Collision zones where robots may collide can then be automatically generated by CAD software for robots. The intersections between sweep volumes of the individual robot motions then determine these collision zones, and a robot needs to book such zones to be allowed to path corresponding region. This collision avoidance procedure is integrated in the energy optimisation. Thus, we obtain both a collision free and energy optimal robot system that keeps the desired production time.

### Exploitation and impact

The goal is to make this kind of optimisation standard, and included in robots from the start. However, since the optimisation procedure is based on the original robot behaviour and does not change the robot's operation path, it can also be applied to existing robot cells. A quick optimisation can then be performed without changing the current production conditions, just reducing the energy consumption. The optimisation concept is also not limited to robot motions, but can be applied to, e.g., automated guided vehicles (AGVs), conveyor systems, press lines, NC and packaging machines.

### Further reduction by DC robots

In the AREUS project, additional activities have been included to further reduce the energy and peak power consumption. The most significant one is to replace AC with DC power grid in production units. This makes it easier to integrate renewable energy sources such as solar panels into factory power grids, and power losses

are reduced due to minimised power conversions. Furthermore, a new type of robots driven by 600V DC implies that motor braking generates energy that can be stored and reused. In current AC robots, this energy is lost in braking resistors. The DC compared to AC robot energy saving is estimated to be up to 15%.

### Significant savings

Finally, we observe that in robot-intensive manufacturing industries, such as bodywork factories in the automotive industry, robots consume about half of the total energy used for production. This means that the proposed energy and peak power optimisation could lead to potentially significant savings, especially in automotive industry.



(Left): Prof. Bengt Lennartson  
(Right): Dr. Kristofer Bengtsson



CHALMERS



**Prof. Bengt Lennartson**

[bengt.lennartson@chalmers.se](mailto:bengt.lennartson@chalmers.se)

**Dr. Kristofer Bengtsson**

[kristofer.bengtsson@chalmers.se](mailto:kristofer.bengtsson@chalmers.se)

[www.areus-project.eu](http://www.areus-project.eu)

# The UERRA Reanalyses map the European Climate

Per Undén, Senior Scientist, Coordinator at the Swedish Meteorological and Hydrological Institute (SMHI) highlights UERRA – the FP7 pre-operational Copernicus Climate Change Service (C3S) Project

**W**eather Forecasting is based on an analysis of the current state of the atmosphere and the surface of land and sea. The forecasts are made with mathematical and physical computer models starting from the analysis. The temperatures, wind, pressure, moisture, cloud contents and other variables are mapped at regular points in space and time. The analysis uses as many observations as possible, but in most places they are not available that close together.

By using the same model of the atmosphere's evolution as is used for forecasting, a prior estimate, a first guess of the analysis can be obtained. That model forecast has in its turn used earlier analysis based on previous observations and from other places. The process of repeatedly combining such a first guess with observations is called data assimilation.

The analysis procedure is updating the first guess with small corrections.

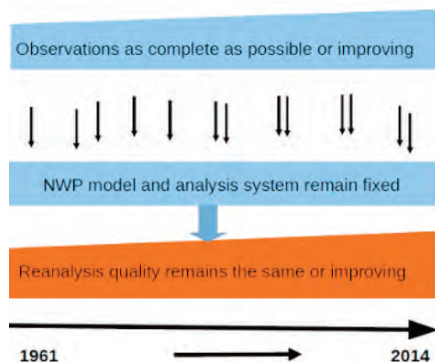
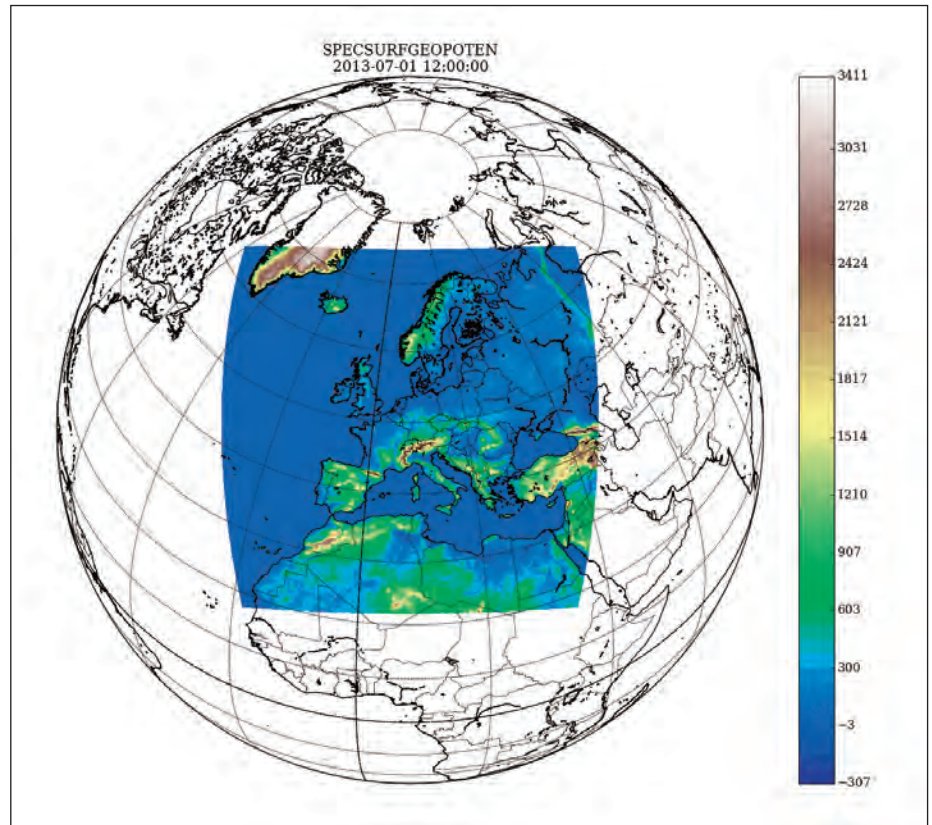


Figure 1



The procedure also uses physical and statistical relationships of the atmosphere when interpreting the observational data. The analyses can in these ways produce values of the atmosphere and the surface away from the observations.

Even though the analyses are made for the purpose of accurate weather forecasting, the mapped variables of the atmosphere have an important value on their own. Many applications and users want to know the best estimate of the atmospheric state at any given time, for assessing past weather events, for statistics of the

climate in a location or an area or for running other fine scale models or validating climate models.

Weather Forecasting models and the analysis procedures are improved and enhanced all the time e.g. with increased resolution. The ever increased quality of the resulting analyses makes it difficult to use a long time series over years and decades. Especially for climate monitoring, it is a requirement to have a fixed system for doing the analyses over the years. The old analyses made a long time ago can be greatly improved by employing a more recent operational system,

## PROFILE

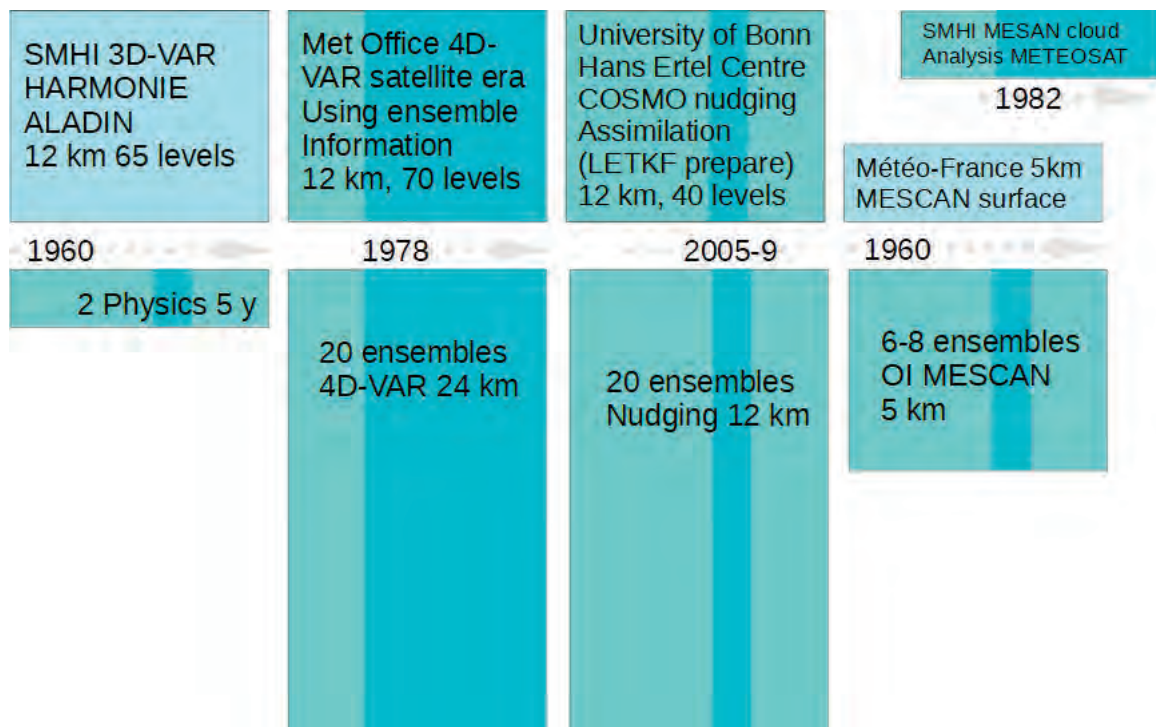


Figure 2

both due to improved methodology and higher resolution. A number of meteorological centres have re-run their old analyses with their most recent system. This is called Reanalysis. (See figure 1).

Another important reason for doing this is that more observations can be made available after the time of the real time analyses. It is both through receiving late-coming data and especially through data rescue of old observational archives often on paper. UERRA has a Data Rescue (and Development) activity and some 8M data have been digitised from several countries in and around Europe and on a sub-daily scale.

Global centres have made a number of generations of reanalyses and there are also a few regional reanalyses covering e.g. North America or Europe or sometimes only a part of Europe.

Now, the current successor project,

UERRA, does much more than the earlier European reanalysis (EURO4M). The horizontal resolution is doubled from about 20 to 10 km and there are 4 different reanalyses in parallel, from 5-35-50 years' time span. Moreover there are 8-20 different ensemble members with slightly different values of the analyses due to uncertainties in the atmosphere, observations and methodology. Both the spread between the different models, (multi-model) data sets and within the ensemble data sets will be used to gauge the uncertainties. These uncertainties will be quantified and derived from independent data sets using other observations or from very high resolution local data sets. The different models and ensembles and the time periods covered are illustrated in figure 2.

Data services including visualisation services have been built and adapted to a common UERRA archive. A common set of meteorological parameters from the Met Office, SMHI, University

of Bonn and Météo-France from the new UERRA reanalyses are being archived from 2016.

The different reanalysis streams together with ensembles and subsequent data services are prepared to be able to continue and evolve in an operational copernicus service and the results stored and disseminated in the Copernicus Data Store.

# SMHI

**Per Undén**

**Senior Scientist, Coordinator**

Swedish Meteorological and Hydrological Institute (SMHI)

Tel: +46 11 4958449

Per.Unden@smhi.se

[www.uerra.eu](http://www.uerra.eu)



# European energy policies in light of climate ambition

Jukka Leskelä, the incoming CEO of Finnish Energy discusses European energy policies and how they must work towards climate targets...

Since the Paris agreement last December there has not been lack of ambition in global climate policy. Holding the global warming to “well below 2 degrees above pre-industrial levels” requires quick and determined global action on all levels and sectors.

The agreement goes even further by pursuing efforts to limit the global warming to 1.5 degree level. Scientists have analysed that this would practically mean the end of all greenhouse gas emissions caused by the developed World within the next few decades. Especially emissions from energy production and use which should be minimised shortly.

## **Strong and comprehensive commitment is needed**

The EU is strongly committed to do its fair share to achieve this ambition. In October 2014, the European Council decided the level of emissions reductions by 2030. Then the total emissions of the EU should be 40% below 1990 level, with an overall target of at least 80% reductions by 2050.

In the EU climate policies, emissions have been split into 2 categories. Approximately 40% of emissions (energy intensive process industry, electricity generation and centralised heat production) are covered by EU emissions trading scheme (EU ETS), and the rest represent the “non-ETS sectors”. The non-ETS emissions reductions are divided to EU member states as binding national reduction targets. In July 2016, the European Commission made a proposal for binding national greenhouse gas emission reductions by 2030.

## **EU ETS is most cost-efficient without other policy measures**

The idea of EU ETS is to give space to markets to find cost efficient emission reductions especially in sectors with remarkable international trade. The EU ETS caps

the emissions to a politically determined level. National climate policy measures in these sectors such as promotion of renewable electricity generation, energy taxes or national greenhouse gas emission standards are in fact not reducing emissions at all. They basically only transfer the emissions under the cap to other sectors or countries and reduce the market signal of the EU ETS.

This clear climate policy infrastructure has been poorly understood by European policy makers across member states. During the last 5 years, markets have provided a lot of learning material for better understanding. National policies have caused massive increases in energy prices and weakened energy security, while emission reductions have only been moderate.

National renewable energy targets under the renewable energy directive gave the member states an obligation to increase renewable energy generation quickly. Most governments decided to do that in electricity generation, which is an understandable decision. However, this created a very strong overlapping policy measure to EU ETS. Markets were not running the investments but the national subsidies. Huge amounts of money were given to generators outside the markets. It collapsed both the emissions markets and the electricity markets. This has costly consequences both to climate targets and to energy cost and security.

In order to meet the ambitious climate change targets with a cost we can bear, stronger coordination and determination in the policies must be taken. The recipes are rather simple.

More markets are needed. Governments cannot continue to base the policies on subsidies that the customers and citizens need to pay. The EU ETS is a market instru-

ment in place and it can deliver the emission reductions needed cost-efficiently. Therefore its role must be strengthened. This can be done best by phasing out overlapping policies. The European Commission has proposed a number of measures to bolster the EUA market. These must be supported.

### **Non-ETS sectors are the major political challenge**

Unlike in the EU ETS, strong national measures and political guidance is needed in the non-ETS sectors. In transport, local heating, agriculture, construction, waste management, etc. The European Commission just gave the proposal on the national burden sharing of these emissions reductions in July.

Renewable energy measures must serve the climate targets. Existing schemes have concentrated on electricity. However, only less than one fourth of European energy end-use is electricity. Much more emphasis is needed on introducing renewables in heating and transport sectors where use of fossil oil and fossil natural gas are major energy sources.

This can be done by 3 parallel routes.

Firstly, by replacing fossil fuels by biomass and waste. Bioenergy is already by far the largest source of renewable energy in Europe, but much more must be done. Agricultural and forest biomasses are cost competitive options in climate policy. Increasing use of biomass must be sustainable. The EU is preparing policies to take care on that issue. These policies need to take account the vast existing use of biomass. As an example, more than 25% of primary energy in Finland is forest bioenergy. Still no forests are grown for energy only. Energy wood is by product of forest management and forest industries. Sustainability is taken care under multiple existing policies and measures. These must be respected in coming European sustainability policies.

Secondly, fossil fuels can be replaced by carbon neutral electricity. Electric transport, heating and processes in industry can replace the use of fossil fuels massively.

Thirdly, some activities outside the emissions trading scheme could be taken under the EU ETS. Heating could be such a sector. Some reports and early analysis

show that this could offer a cost beneficial route to the decarbonising of European heating.

### **Investment in energy efficiency is always worthwhile**

In addition to markets and renewable energy policies, energy efficiency measures are crucial. These require international or European standards, national and local activities from taxation policies to sharing of information. A wealthy energy market is key to energy efficiency measures. Customers must see and feel the actual cost of energy.

Happily, all this can be done. Technologies have developed rapidly. Many renewable and carbon neutral energies are competitive to other alternatives: on-shore wind, heat pumps, bioenergy in heating, geothermal heat and solar energy in many areas, hydro power and nuclear energy. We also have the smart grid under development which enables the customer to be in the center of the transition. With more public and private investments on research and development this great progress can be further enhanced.

Europe can have carbon neutral energy in just a few decades and this can be done by sustaining and improving our competitiveness. This requires good coordination of markets and policies. ■



.....  
**Jukka Leskelä**

**CEO (as of Sep 1st)**

Finnish Energy

Tel: +358 9 530 520

jukka.leskela@energia.fi

www.energia.fi

# What's the return on investment in solar PV?

Ben Robinson, Business Development Manager at BayWa r.e. Solar Systems, shares his thoughts on the return on investment you can expect to see when installing a solar PV system...

According to The [Telegraph](#), more than 300 British households are installing solar PV modules onto the roof of their house every week. The question is, should you be joining them? Here's a rundown of what you can expect your return on investment to be if you install solar panels on your property.

## How much do solar panels cost to install?

The first thing you need to keep in mind when working out whether or not solar PV is worth it to you is its cost: both upfront and in maintenance during its lifespan.

Firstly, the upfront cost. The typical household will require a 4kWp, 28m<sup>2</sup> solar panel system to meet their electricity needs – this will cost you approximately £4,500–£7,000, including installation.

This is a substantial amount of money for a home improvement and many people may be tempted to get their solar panels through a 'rent-a-roof' company. These companies will install a solar system on your roof free of charge in exchange for the full 20 years' worth of feed-in tariff payments that they produce. You will then have to sign a Power Purchase Agreement (PPA) with the 'rent-a-roof' company for the electricity that is used within the home that is produced by the modules, but [as Which? report](#), you'll miss out on thousands of pounds over the twenty-year period, and the contract you sign with the rent-a-roof company is often very much in favour of the provider. Because of this, if you have the money you should always buy solar panels yourself.

After their initial installation, solar panels incur very few maintenance costs due to the fact that they have almost no moving parts. The expected lifespan of a solar PV can be more than 40 years, and it is very rare that it will require any maintenance during this period.

It is likely that the inverter will need replacing after 10 years and by that time, no doubt that they will be significantly cheaper to purchase.

All you will need to do is ensure that the solar modules are not damaged, do not become soiled or shaded by trees etc. and that the inverter is still functioning.

**“...installing a solar PV system can prove an excellent return on investment over its 50-year lifespan, especially with electricity prices set to significantly rise in the future.”**

## How much money can you make through your solar panels?

Solar panels can save you substantial amounts on your energy bills every year. This is because you will not only save money by generating your own energy rather than having to buy it through a provider, but you will also be paid 4.25p by the government for every kWh you produce through the feed-in tariff. In the right situation a 4kWp system will generate a minimum of 3,400kWh per annum, which means that you'll be paid at least £144.50 by the government every year, tax free for the 'generation'.

You will also be paid 4.91p for 50% of what you generate which is assumed to be exported to the National Grid – therefore an additional revenue of £83.47 (3400/2 x 4.91p). According to [UK Power](#), the average medium-sized household uses approximately 3,100kWh a year, so a 4kWp system across the year should provide all a home's electricity requirement.

According to research from [Compare My Solar](#), the average cost of a kWh from one of the UK's major energy providers is 16p, which means you'll also save £496 a year through your energy bill (if you are a





medium-sized household, according to UK Power). This means that a 4kWp system would generate a total of £723.97 a year through the FiT and by savings made on energy bills.

The average 4kWp solar PV system costs £6,000 to install, which means that its payback period is approximately eight years. If the energy rates stayed at their current level, you would then make around £720 profit for twelve years, meaning the additional revenue during the life of the feed-in tariff after paying for the system would be approximately £8,640. However, this doesn't take into account the fact that electricity prices are set to rise significantly in the future – the National Grid claim this could be by double in the next 20 years in their [2015 Future Energy Scenarios report](#).

Furthermore, this doesn't take into account that even after the feed-in tariff has ended, your household will still benefit from free electricity for the further thirty years of your PV panel's expected lifespan. This could rise to almost £1,000 a year if the National Grid predictions are to be believed.

It should also be noted that if you come to sell your house, having a nicely installed solar PV system may be a big draw for potential buyers, especially as electricity prices begin to rise. This could add thousands of pounds to the value of your home.

In conclusion, installing a solar PV system can prove an excellent return on investment over its 50-year lifespan, especially with electricity prices set to significantly rise in the future. As the government lower the feed-in tariff every quarter and the rate you receive over the 20-year period is locked in when you register for it, the sooner you purchase your solar PV modules the better. ■

.....  
**Ben Robinson**

**Business Development Manager**

BayWa r.e. Solar Systems

[www.baywa-re-solarsystems.co.uk](http://www.baywa-re-solarsystems.co.uk)

# A carbon capture and storage reset

Judith Shapiro, Policy and Communications Manager at the Carbon Capture and Storage Association outlines to Adjacent Government what the focus needs to be for CCS in the upcoming months...

CCS has featured a number of times in [Adjacent Government](#) and the last article was published just before all hell broke loose on the 25th November, when the previous Chancellor decided to withdraw the £1bn grant for the CCS Competition in the Spending Review 2015.

To say this decision was disappointing would be a gross understatement. However, in the months that followed, it has become clear that the government is still committed to CCS and is keen to find a way forward with industry. It is also clear that we now need a different story for CCS.

We need to focus more on the wider benefits of CCS to the UK economy – such as the crucial importance of CCS to decarbonise industrial sectors such as steel, cement, refining etc. We could also focus on the potential for CCS to produce hydrogen via steam methane reforming of natural gas (the recently published [H21 Leeds City Gate report](#) proposes to convert the Leeds gas grid into a hydrogen network using exactly this method). The hydrogen can then be used as a zero-carbon fuel to decarbonise other sectors such as heat, power and transport.

Whatever story we choose to tell, there are valuable lessons from the cancelled CCS Competition that must be incorporated. On the 29th June, the Carbon Capture and Storage Association published a report on “[Lessons Learned](#) – Lessons and Evidence Derived from UK CCS Programmes, 2008 – 2015”. This report is based on interviews with the developers of the 2 preferred bidders in the cancelled CCS Competition (Peterhead and White Rose) as well as interviews with a number of other companies interested in developing CCS projects.

Two important themes emerged from this report; firstly, the key barriers to delivering the competition projects were commercial, not technical. Secondly, the report clearly shows that CCS has the potential for very early and

very significant cost reduction. Interviews with potential Phase 2 projects (those which would have been developed after the Competition projects) confirmed that these projects would have been built at a lower cost – this is due to the fact that they would have used the transport and storage infrastructure built by the competition projects.

Looking back it becomes clear that the economic benefits from investing in CCS transport and storage infrastructure have not been adequately considered. For too long, we have focussed on CCS as a technology when in fact it represents a much broader investment in low-carbon infrastructure, that will form the backbone of emissions reductions in large parts of the UK's economy.

We now need to think creatively about how to finance this infrastructure investment – the Committee on Climate Change recently wrote [a letter to Amber Rudd](#), the previous Secretary of State. The Committee urged the government to consider the support required for transport and storage infrastructure as separate to the support required for capture.

In the UK at the moment, the need to retain our energy intensive industries and keep the lights on – whilst at the same time tackling climate change – will not go away.

The UK government has committed to developing a new approach to CCS and this represents the perfect opportunity to reposition the CCS story – joining up the different parts of the economy to deliver this vital low-carbon infrastructure. ■

.....  
**Judith Shapiro**

**Policy and Communications Manager**

The Carbon Capture and Storage Association

Tel: +44 (0)20 3031 8750

[www.ccsassociation.org](http://www.ccsassociation.org)



# Is CCS an affordable route to carbon reduction targets?

Andrew Green, Programme Manager at the Energy Technologies Institute, outlines the possible role of carbon capture and storage in meeting the UK's carbon reduction targets...

In theory the United Kingdom (UK) should be well placed to develop a carbon capture and storage (CCS) industry that offers the most affordable route to meeting the nation's 2050 carbon reduction targets.

The North Sea could soon be home to a new industry worth billions to the UK economy. Storing carbon dioxide in North Sea saline aquifers or depleted oil and gas fields could unlock huge savings in the cost of meeting our long term carbon targets. Carbon capture and storage also means that fossil fuels can retain a place in a low carbon future energy mix.

Recent studies by the Energy Technologies Institute (ETI), a partnership between global energy and engineering firms and the UK government, have found that there are no technical hurdles to storing large quantities of carbon dioxide safely and securely off the coast of the UK from the early 2020s.

## Economies of scale

CCS uses proven technologies, and ETI analysis shows that significant cost reduction can be achieved simply by exploiting economies of scale, sharing infrastructure and risk reduction through a coordinated and co-located series of large deployments.

There is also lots of relevant experience and expertise among the highly skilled oil and gas industry workforce, with transferable skills relevant to developing CCS.

ETI's internationally peer reviewed modelling, in line with analysis by the Committee on Climate Change, has consistently shown that CCS is the single-most valuable technology in the country's carbon reduction arsenal. Failure to develop and deploy CCS could double the cost of decarbonisation, and it looks almost impossible to meet carbon targets if new nuclear developments are seriously delayed as well.



### Making the right strategic choices

Renewable energy has a sizeable part to play in reducing greenhouse gas emissions, but fossil fuels will likely remain a practical, and integral, part of our energy mix in decades to come.

ETI has built an unrivalled knowledge base on the underlying engineering challenges of delivering low carbon energy in the UK and our view is that gas power stations fitted with CCS can deliver competitive low carbon power into the UK market in the 2020s – providing the right strategic choices are made about the scale, location and technology choices for early projects, with a deal that shares risks (and benefits) sensibly between investors and government.

There is broad consensus that the UK power system needs to be largely decarbonised by 2030 if the UK is to hit its long term carbon targets. If there is to be more electrification of heating and more electric vehicles there will be a need for low carbon power generation. This is a huge challenge, given how the UK power system operates today alongside the issue of cost and intermittency of low carbon generation presently.

So, if all that is true, why has CCS not developed and what can be done to get the industry back on track?

### Need to move forward as soon as possible

Although the UK Government cancelled the £1bn commercialisation programme to demonstrate CCS plants at scale, which would have increased developer and investor confidence, it retains the belief that CCS could play a crucial role in the future energy system in the long term if costs can be reduced.

ETI analysis is now showing how low carbon electricity can be delivered by a first commercial CCS project at costs that are up to 45% lower than previously planned projects. And once one CCS facility has been constructed, the cost of electricity from subsequent plants is likely to decrease further as they take advantage of the knowledge gained and shared infrastructure. The most cost-effective and secure way to meet our need for low carbon energy is to move forward as soon as reasonably possible with a strategically-placed, large-scale gas with CCS power project.

**“Failure to develop and deploy CCS could double the cost of decarbonisation, and it looks almost impossible to meet carbon targets if new nuclear developments are seriously delayed as well.”**

ETI has also shown there are no major technical hurdles to storing industrial scale CO<sub>2</sub> offshore in the UK with sites able to service mainland Europe as well as the UK.

If, however, we delay developing CCS, this could cost £1-2 billion per annum in the 2020s, rising to £4-5bn by 2040.

### Keeping options open for CCS

Capturing and storing industrial emissions only becomes practically and economically feasible once infrastructure is put in place: this can only be reasonably done with large-scale power with CCS projects.

As well as the whole-system benefits of CCS, the ETI's latest analysis suggests that the levelised electricity costs of a well-designed power with CCS project could be attractive against other low-carbon alternatives.

The ETI is keen to keep options for CCS in the UK open and, as well as sharing and exploiting its knowledge on potential future costs and storage capacity, is moving forward with a thermal power with CCS project.

However, stakeholders in CCS will need compelling evidence of the business case for a power with CCS project.

ETI wants to move forward and help ensure the UK can take advantage of the knowledge and understanding of CCS and the opportunities of storing CO<sub>2</sub> off the UK coast. ■

.....  
**Andrew Green**

**Programme Manager**

Energy Technologies Institute

[www.eti.co.uk](http://www.eti.co.uk)

# E3-Modelling research finds first-mover advantage for the European Union as frontrunner in climate action

In Paris, delegates from the 196 UN parties met in December 2015 to negotiate a global climate agreement. Countries accounting for roughly a quarter of global emissions met the March deadline to provide targets for curbing Greenhouse Gas Emissions (GHG) while at the same time some of the leading economies have missed the deadline, including Canada, Australia and notably China, lowering expectations for a universal climate agreement by December. However China signed an agreement with the USA on coordinating climate mitigation strategy. In contrast, the EU submitted ambitious emission reduction goals for 2030 well within a decarbonisation pathway.

The stakes are high, as the world is at present on a path to possible above 4°C global warming by 2100. Hitherto preventive action – including efforts to build a carbon market or to subsidise renewables – has been confined to the developed world and is largely insufficient. The European Union is clearly a frontrunner but many question the macroeconomic and industrial adverse effects of unilateral action.

E3-Modelling, based on modelling services to clients such as European Commission, Governments and business stakeholders, published research showing that in contrast with skepticism the EU's economic and industrial benefits can be effectively reaped from pioneering climate action.

## Abatement of GHG emissions & carbon leakage

As stated on numerous occasions by the President of E3-Modelling Prof. P. Capros, “the basis for the deep decarbonisation of the global economy rests in efficient and equitable effort sharing. Lack of consensus on an international agreement for reducing Greenhouse Gas Emissions eventually leads to asymmetric climate policies which not only increase the cost of reducing emissions, but also dent the effectiveness of climate policy, through carbon leakage<sup>1</sup>.” In particular, studies performed by E3-Modelling staff conclude that an international concerted action to reduce GHG emissions at safe levels by 2050, would require 1.5% of global GDP. In the case where only OECD countries embark in GHG mitigation, the carbon leakage rate is estimated to be close to 25%. If China participates to the abatement effort of OECD countries then carbon leakage rate can be reduced to 3%, underlying the importance of allying developed and emerging economies in pursuing GHG emission reduction policies.

## EU as a first mover

Europe has long been a leader in pursuing a global climate deal, and has early outlined – with support from our economic and energy modelling research (PRIMES and GEM-E3 models) – a robust set of targets for drastically curbing the region's emissions by 2030. Indeed, the Conference

of Parties (COP21) submission of EU countries' targets has formally put forward a binding, economy-wide target of cutting the region's GHG emissions by at least 40% below 1990 levels by 2030. The EU COP21 submission has been largely based on modelling work undertaken by E3-Modelling staff, with the use of two highly sophisticated and well established in the European context models: the PRIMES energy market model and the GEM-E3 computable General Equilibrium Model.

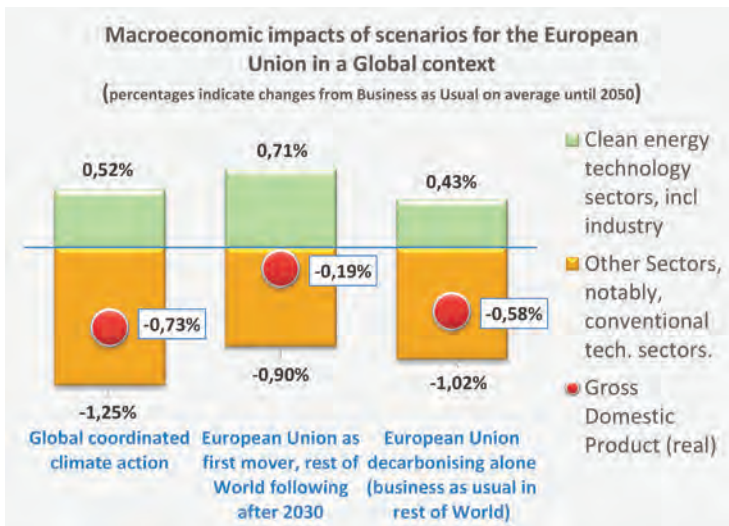
The EU can be considered as a first mover in global GHG mitigation. The net impact on EU economy is uncertain as early movers incur costs, but may also benefit from gaining a cost comparative advantage on producing low carbon technologies; the costs depend on the loss in competitiveness that leads to a decrease of their shares in global markets. A recent study performed by E3-Modelling shows that the net potential gain to EU from undertaking a first mover action can be up to 0.54% of its GDP.

## Modelling tools operated by E3-Modelling

The main energy-environmental-economic modelling work of E3-Modelling rests upon a series of highly sophisticated in-house models:

PRIMES, a workhorse energy market model developed and maintained for all individual European countries and the internal electricity and gas

## PROFILE



markets is a sophisticated market-oriented engineering-economic model with modular structure by sector, with high sectorial resolution including for transport sector. The model has been extensively used in assessing the 20-20-20 energy and climate policy package, the EU's decarbonisation Roadmaps and the recent climate and energy policies for 2030.

In contrast with optimisation models, PRIMES is an agent and market oriented model aiming at representing the reality of actors' behaviors and their interplay in markets, for energy commodities and for the emission allowances (EU ETS). PRIMES is rich in engineering information and includes detailed representation of energy and transport infrastructure. Its sub-models cover power market operation in high resolution, investment and design, gas market strategic analysis, energy efficiency in houses and buildings, industrial energy use and cogeneration, district heating, biomass/waste sector and new technologies including bio-energy, renewables, smart grids, power-to-gas, power-to-liquid and synthetic fuels, as well as storage. The Energy Roadmap publications and the Eurelectric Power Choices scenarios, carried out using PRIMES illustrate the capabilities

of the model in simulating deep restructuring of energy systems in demand and supply sectors, the dynamics of investment and equipment turnover in all sectors, while projecting impacts on markets (incl. EU ETS), commodity prices and costs by agent.

The GEM-E3 general equilibrium macro-economic model is a sophisticated multi-sector and multi-country model used for economic impact assessment and macroeconomic studies. GEM-E3 fully linked with the energy model PRIMES analyse closed-loop energy-economy-environment assessments. The world energy projections, with focus on hydrocarbon world markets, is handled by E3-Modelling using the PROMETHEUS stochastic world energy model. GEM-E3 has been the model of choice for numerous country-specific macro-economic studies for a variety of cases, including Romania, Switzerland, North Africa countries, and others.

### Modelling of Energy Economy and Environment

The researchers of E3-Modelling have provided scientific support and policy advice for the European Commission on many occasions including most recently the 2030 Energy and Climate Communication (January 2014), but

have also provided support to the German Ministry of Economic Affairs and Energy in the run-up to the agreement. They also regularly provide support to the Belgian Government, as well as to numerous non-governmental groups such as Eurelectric, AEGPL, EUROGAS. E3-Modelling participates in international cooperative projects such as the EMF and partners with renowned world institutes such as MIT, IIASA, PIK, FEEM, etc. in order to validate and enhance its modelling tools and regularly publishes its findings in international peer-reviewed journals.

At E3-Modelling, our aim is to communicate to policy makers and stakeholders around the world the quality output of leading scientific research in the areas of energy and the environment, helping them take informed decisions when formulating their optimal pathways towards a low carbon economy.

E3-Modelling is a spin-off company based on research activities performed at the National Technical University of Athens.

More information about E3-Modelling can be found at [www.e3modelling.gr](http://www.e3modelling.gr)

1 The part of emissions reductions in abating countries that may be offset by an increase of the emissions in non-abating countries

**E3-Modelling**  
Energy, Economy & Environment

**Leonidas Paroussos**  
Managing Director  
E3-Modelling  
Tel: +30 210 6775 696  
[paroussos@e3modelling.gr](mailto:paroussos@e3modelling.gr)  
[www.e3modelling.gr](http://www.e3modelling.gr)



# A data drive for energy efficiency

Luke Smith, Principal Energy Specialist at the National Energy Foundation details how by using well-honed data, Suffolk County Council is able to effectively target domestic energy efficiency programmes and campaigns...

Suffolk County Council has an ambition to reduce its carbon emissions by 60% by 2025, and recognises that investment in the region's housing stock will be vital to hitting this target. As an essential first step, the National Energy Foundation was appointed to develop a housing stock database. This provides the basis of a detailed understanding of both the physical characteristics of the region's housing as well as the socio-economic circumstances of its residents – information that is crucial in helping to design and appropriately target domestic energy efficiency programmes and campaigns.

With the Ordnance Survey AddressBase address list for the region and a 40% EPC sample at its core, the Suffolk Housing Stock Database identifies at an individual property address level the built characteristics and energy performance of housing for a variety of geographical scales from property address up to district/borough level. This data is then cross referenced with Mosaic householder data from Experian, thus offering insight into not only the stock, its energy efficiency performance and upgrade potential, but also an appreciation of each household's tenure and socio-economic status.

## Database key features:

- 310,000 addresses with individual property level insight into built characteristics and energy efficiency performance for all homes;
- 140,000 Energy Performance Certificate records as well as information from Land Registry, Xoserve, Census, Defra and also council-supplied information such as conservation and listed building status and managed stock data;
- Experian Mosaic socio-economic householder data mapped to all address points providing insight into householder demographics, financial circumstances, health and well-being and accessibility;
- 25 detailed archetype models mapped to the full stock, projecting the baseline energy performance for properties where an EPC is not present;
- Improvement upgrade packages modelled for all properties, indicating potential energy and CO<sub>2</sub> savings as well as resident fuel bill savings and required investment estimates;
- User interface that allows all data to be searched, filtered and reported upon at all geographical levels – output area, Lower Super Output Area (LSOA), ward, local authority, town, postcode;
- The facility to search and review in isolation non-address level data such as LSOA and Output Area level statistics.



### Initial three aims of the project:

- Collate all the available Suffolk housing stock data;
- Provide an address-level database for the whole of Suffolk county, to support mailshot activities;
- Identify the scale of opportunities to mitigate fuel poverty, reduce domestic energy consumption and deliver CO<sub>2</sub> emission savings.

The National Energy Foundation's work is all about empowering organisations to act and make a lasting impact. Cross-cutting databases such as this can revolutionise the way in which funding is sought and investment programmes are developed and delivered.

### Exciting applications

With no directly managed housing stock of its own, Suffolk County Council's commissioning of the Housing Stock Database was motivated by its drive to effectively tackle fuel poverty across the region, as well as to ensure that investment in existing housing is appropriately directed to help meet its 2025 carbon emission reduction goals.

For the first time, the database offers Suffolk comprehensive insight into all housing in the region – to a level far beyond traditional sample-based stock condition surveys. Whilst this obviously has immediate benefits in terms of targeting energy efficiency and carbon emission reduction programmes, wider uses and benefits include:

- Informing the application for, and targeting of, funding to support investment in energy efficiency measures;
- Supporting the work of the council's Housing and Public Health teams to deliver plans and programmes that aim to reduce the health effects associated with cold and poor quality housing;
- Identification of vulnerable and fuel poor households as well as the potential energy efficiency measures that will benefit them;
- Improved housing-related dialogue and activity in conjunction with other key stakeholders in the region, including other local councils, landlords and social housing providers;



**Luke Smith, Principal Energy Specialist at the National Energy Foundation**

- Targeting of other services and behaviour change campaigns related to housing and residents, including recycling and composting, planning and building control, housing regulation enforcement and also welfare and mobility.

Following the project, the council and its partners can now design energy efficiency publicity campaigns for a targeted audience and which have more effective and tailored messages. For example, Public Health Suffolk is now working on a specific first-time central heating scheme to identify households most affected by fuel poverty, and can use the database to identify properties of a particular type, age and heating system. ■



**Luke Smith**  
**Principal Energy Specialist**

National Energy Foundation  
Tel: 01908 665555  
info@nef.org.uk  
www.nef.org.uk  
www.twitter.com/TheNEF

# Power On Connections

## Self-service – making it happen

It has been just over a year since the new Electricity Market Competition in Connections Code of Practice was formally approved by Ofgem. Customers and ICPs (Independent Connection Providers) are now starting to reap the benefits brought about by the Code.

The Code mandates that DNOs, (the successors to the pre-privatisation regional electricity companies) must as far as reasonably practicable, minimise their involvement in the provision of new connections by Independent Connection Providers (ICP's) to their customers.

DNOs are required to provide as high a standard of service to ICPs, as it would to its own connections business.



Finally, DNOs must work to harmonise their processes and procedures relating to Competition in Connections, in line with industry best practice allowing

ICPs to freely and easily operate across DNO boundaries.

### Leading the way...

Power on Connections founded in 2003, continues to be amongst the first to take the next steps by carrying out works that, until now, had being exclusively completed by the DNO and its contractors. In all of the DNO regions in which Power On operate, the company has the ability to:

- Identify the location on the DNO's network that the new connection is to be made;
- Self-Approve the design of any network extension;
- Complete all of the necessary operational switching activity on the DNO network to facilitate the connection of the newly constructed assets;





## PROFILE



- Complete the final joints to the existing DNO Distribution System.

Power On is driving the change forward and has achieved NER's accreditation for self-assessment, self-design, self-operation and self-connection across many of the DNO regions.

Other ICPs are following in their path, all of which is great news for customers, as further competition will drive up standards and drive down prices.



### **More to do...**

There is still significant room for improvement. The scope of works that ICPs can undertake in each DNO region varies, as a failure of some DNOs to embrace the spirit of the Code of Practice in its entirety.

Power On will continue to push the boundaries, to minimise the touch points between themselves and the DNO during the process of a customer making their original enquiry to Power On, and the electricity infrastructure works energised and handed over for adoption.

Power On is focused on delivering an exceptional level of customer service and would like to have full control over that process and be fully accountable to its client, thereby being able to deliver against our commitment to provide Programme and Cost Certainty.

### **Next Steps....**

DNOs must work to harmonise their processes and procedures relating to Competition in Connections, allowing ICPs to work across DNO boundaries.

The Code of Practice is a living document and changes will be made through the governance process to address the lack of a harmonised approach amongst DNOs. Further process improvements will be implemented through the experience obtained by ICPs complete these Self Services Activities.

**POWER ON**  
*connections*

**Bob Theobald**

**Managing Director**

Power On Connections

Tel: 03453 223322

Mobile: 07557 430558

[bob.theobald@poweronconnections.co.uk](mailto:bob.theobald@poweronconnections.co.uk)

[www.poweronconnections.co.uk](http://www.poweronconnections.co.uk)

# Is now the right time for variable surge pricing?

Bill Watts, Senior Partner at Max Fordham talks about the role variable surge pricing could have in the energy sector...

By now you've probably heard of Uber, the mobile app that's changed the way people book a cab, all over the world. You might also be familiar with their demand-based, variable 'surge' pricing. If you book in the lull when the after-work crowd has moved on, the price is lower. If you book when the bars empty late at night, you'll pay a premium. It's a little bit of social-engineered economics that encourages more drivers onto the roads in peak times (increasing supply) and discourages punters from booking when there are fewer cars to go around (reducing demand). Ultimately the journey you take is the same, but the price is different to manage the relationship between supply and demand.

One day soon, our fuel bills will be determined in a similar fashion by when we use our power, as much as the total amount of energy we use. Apart from off-peak tariffs, consumers have been largely isolated from this

variation in price according to time. But we think that is going to change as the sources of renewable energy increase, leading to periods when the power is, at times, free.

As with any market, the costs of energy are continually varying owing to supply and demand, as energy providers compete to generate the electricity we need. Currently the average consumer is isolated from these fluctuations by providers who set their prices to level out this changing cost. If customers are exposed to this fluctuating cost we are likely to see a change in our consumption habits.

The blue line on the graph in figure 1 shows how the consumption of electricity varies through a typical winter week. There is a sharp peak at the end of the working day when there is an overlap between people coming home from work but before businesses shut

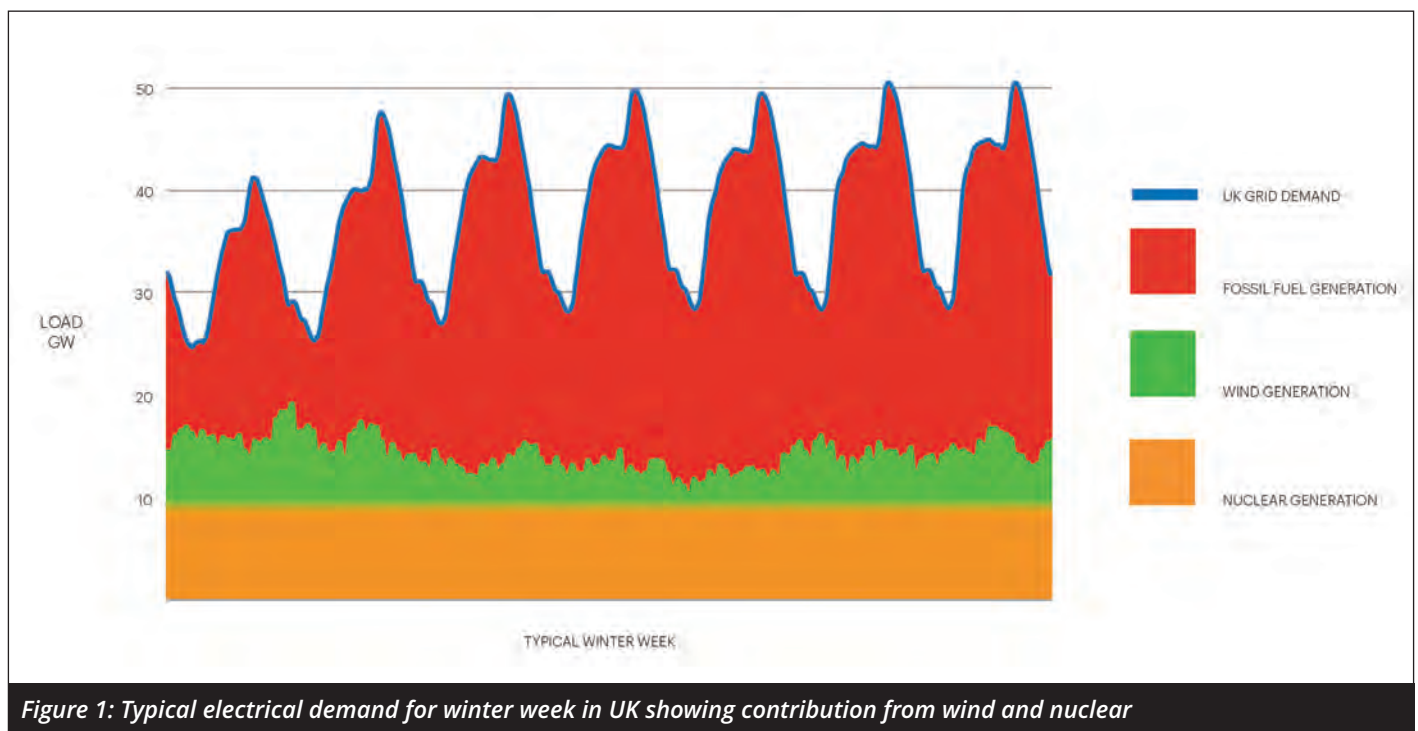


Figure 1: Typical electrical demand for winter week in UK showing contribution from wind and nuclear

## ENERGY

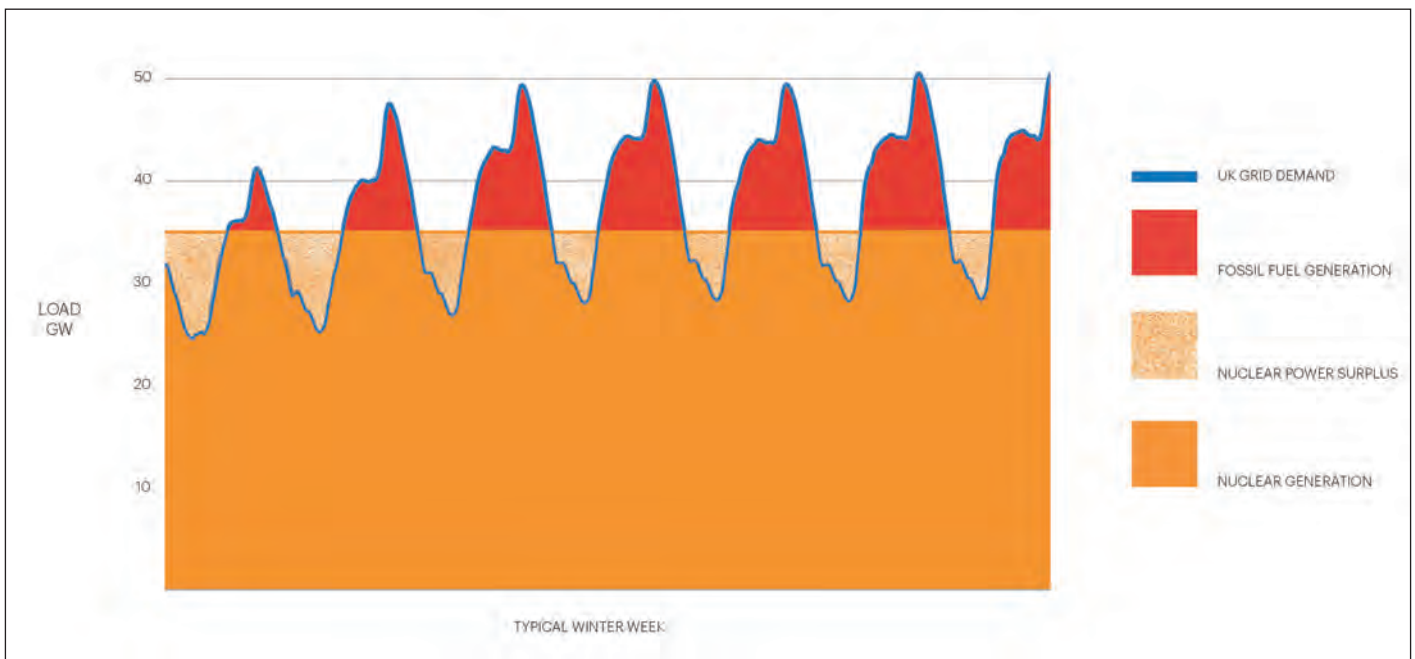


Figure 2: Effect of large increase in nuclear power generating capacity

down for the night. Equally there is a trough at the dead of night when fewer people are up and about.

The graph shows how this electricity is generated at the moment. Nuclear power produces a relatively constant 7 GW of electricity. For context, 1 GW can power 700 000 homes for a year. It is shown as an orange block running along the bottom. Nuclear power plants are best left running, and the operating costs are the same if the power is used or not. The contribution by wind, indicated in green, is a significant component. However wind and nuclear combined never meet the current electrical demand. The bulk of the balance is made up of gas- and coal-fired generation, with additional contributions from generators outside the UK via interconnector cables. These fossil fuel power stations can ramp up and down to meet the peaks and troughs in the demand. In the past there has been a comfortable 20% excess generation capacity available to meet the peaks and planned or unplanned power station shutdowns – in the event of a 2 GW nuclear power plant going off line, for example.

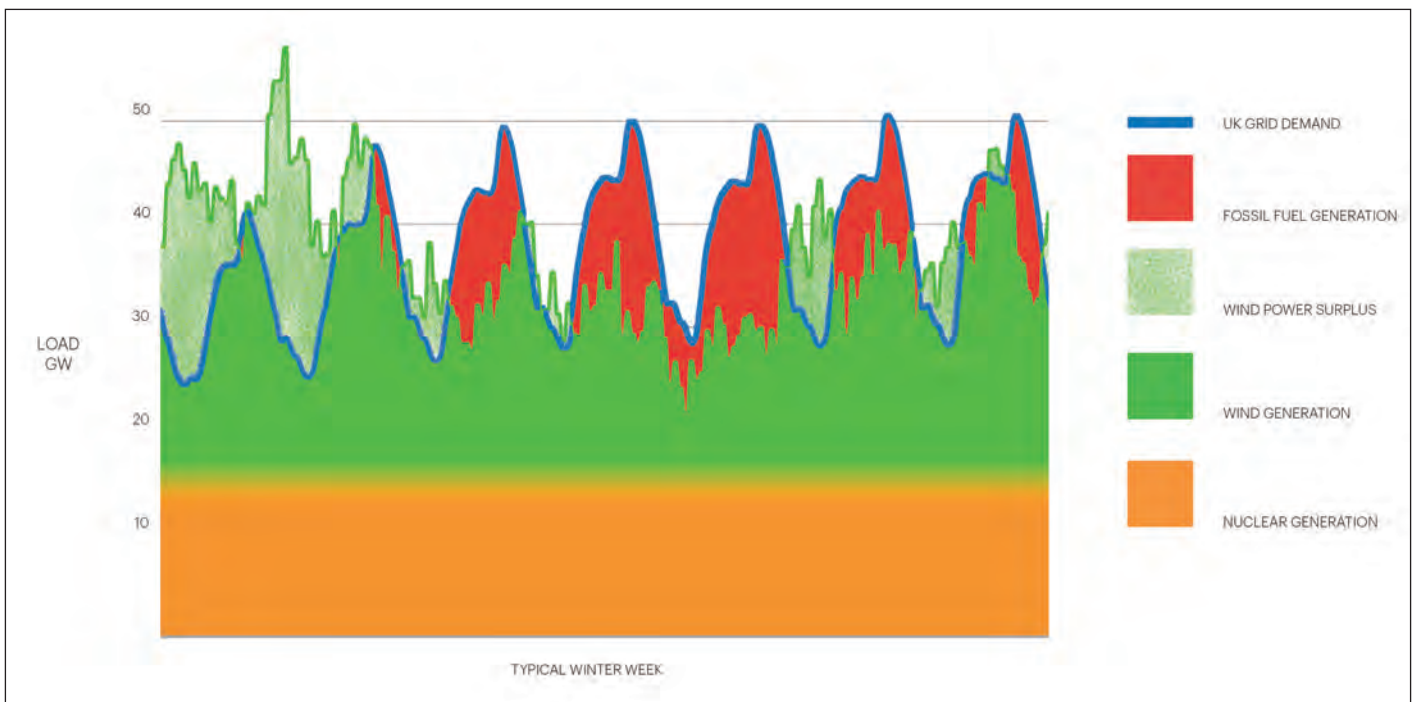
While this is a prudent decision, it is expensive and wasteful of fuel to have an over-capacity of generation sitting idle or fired up and ready to go. Added to this, the government has announced that all coal fired power stations will be decommissioned by 2025. Operators may decide to do it earlier than that, due to the cost of keeping these old power stations in an operable condition. We understand that the excess generation

capacity held in reserve now sits at around 1%. This will drop to zero if production drops further, before the government can persuade reluctant investors to build gas fired power plants to make up the difference. The economics of providing electricity generation merely to cater for peaks is not that great, as the number of hours an asset is able to run and sell power is few relative to the cost of building it. As such the government has to intervene in the market and subsidise the construction of power plants only to leave them idle for most of the time.

The talk of only 1% spare capacity is based on the peak demand of electricity. Of course the other way of increasing the spare capacity is to reduce the peak demand, which may be a lot less expensive than building more power plants. The simplest way of doing this is to avoid using electricity at the peak times. Washing and drying machines are among the most energy intensive home appliances. Arguably the operation of them could be delayed to miss the evening peak. Much work has been done about delaying the running of a domestic refrigerator to avoid times when the grid is stressed. Finally, many devices do have batteries and their charging might also be delayed to outside the peak time.

There are schemes for larger business users to switch off some of their equipment to reduce the rate at which the load on the grid changes and reduce the peak. For this, they are well paid.





**Figure 3: Effect of 2035 projected installed capacity**

It is worth noting that having more nuclear energy will not, in itself, deal with the issue. If the number of nuclear power plants is increased as envisaged in figure 2 to meet the average power consumption, then there is a shortfall some of the time and too much production at other times.

The illustration in figure 3 is based on a view of a 2035 scenario of energy generation against our current pattern of consumption. The green line of variable renewables, such as wind, illustrates the mismatch between the supply and demand. There will be times when the supply from wind and nuclear exceed the demand and times when it isn't enough. The shortfall could be met with fossil fuel generators. But we expect there will be a number of other options by this time. Add to this scenario the incentive to switch off equipment to reduce cost, and therefore demand, and the picture changes slightly but not enough. The storage of electricity is now becoming a holy grail with tech barons investing billions in various battery technologies. Work is being done with heat, water and air pressure to store electricity in another form of energy. The interconnection of power grids is also being improved, across continents and around the globe, to supply power on the basis that there will be excess renewable energy available somewhere in the world that can be exported.

From an economic point of view the cost of electricity at

times of surplus will be very low, if not negative. At times of shortage the price will be high. The technological development of many of the electrical storage systems and long distance interconnectors is in its early days. While they are currently rather expensive there is every expectation that they will come down in cost, similar to the way solar panels have. As the electricity they make use of is cheap or free, we may find that this combination is less expensive than a back-up, gas-fired energy generator, and greener as well.

Currently only larger users can take advantage of electricity market price fluctuations, depending on the supply and demand. However one can see in the not too distant future, with the advent of Smart Meters, that consumers will be exposed to the benefit of this market. Appliances from Europe already have features that allow users or suppliers to determine at what time they run. Controlling the time-of-use of electricity will save you money, and carbon too. It won't help you get home on the cheap after the pub has closed though. ■

.....  
**Bill Watts**

**Senior Partner**

Max Fordham

[www.maxfordham.com](http://www.maxfordham.com)

[www.twitter.com/MaxFordhamLLP](https://www.twitter.com/MaxFordhamLLP)

# A vision for transport investment in Europe

In a speech at the European Parliament, Commissioner for Transport, Violeta Bulc highlighted her key priorities and vision for investment in transport...

**A**s most of you know by now – I have a clear vision for transport. Within Europe, my focus is on the single market. I want to make sure that transport is as efficient as possible. That it is an enabler of the economy and not an obstacle.

My focus is connectivity and global leads through economic diplomacy. I try my best to present our standards and regulatory framework as attractive as possible to create smooth conditions for collaborative and favourable market conditions. This vision is based around 6 content drivers; all with a strong motivation to seize growth opportunities and generate conditions for high value jobs, including new ones. Decarbonisation; Digitalisation; Globalisation, and People-focused solutions. Empowered by: Innovation and Investment.

## The importance of investing in Transport

In order for Europe to deliver on these priorities, investment is essential. Good seamless connectivity, through a safe, clean transport network, meeting the needs of consumers and needs of businesses will help Europe to stay ahead of the curve, and remain competitive globally. To achieve our goals, I would like to stress in particular 2 drivers: R&I with disruptive innovation in the lead; sufficient financing, such as blending public and private funds.

What have we done? Currently there are several mechanisms in place for transport financing:

- The Connecting Europe Facility;
- Structural Funds;
- The European Investment Bank;
- Member States based financing;

- Other financial institutions and individuals;
- The European Fund for Strategic Investments (EFSI).

Much has been done to date. Let us look at the progress under CEF, H2020, and the Juncker Investment Plan / EFSI.

## CEF

The Trans-European Transport Network (TEN-T) and the TEN-T core network in particular are the backbone of our economy and we continue to concentrate our efforts to deliver by 2030. On the Core Network Corridors, around €700bn of investment to 2030 has been identified from the corridor work plans.

In 2014, we launched the first CEF call with a budget of €12.77bn. We concluded it in 2015 with CEF grants being allocated to 263 projects and mobilising €28.3bn of investment. There was an oversubscription of 3 times the amount proposed. Under the current CEF call with a budget of €7.6 billion, 427 proposals were submitted, requesting €12.96bn, meaning an almost 2-fold oversubscription. We expect the third call to be announced by the end of this year. In 2018 a call for the remaining CEF money will be carried out.

## Horizon 2020

The first call in 2014 had a budget of around €570m. In 2015 the call was for €290m. In 2016-2017 we expect to offer funding of a further €434m. This includes special programs to support SMEs, and an important focus on bridging the gap between research and deployment by supporting large scale demonstration projects.

A novelty in 2016-2017 is a strong focus on automation, and a just announced prize of €3.5m for the development of the “cleanest engine”.



*Violeta Bulc, Commissioner for Transport*

In addition, the 4 transport-related joint undertakings (Shift2rail, SESAR, Clean Sky, Fuel cell and Hydrogen) will receive total budget from the Union of approximately €2.7bn over the 7 years of the program. This will leverage at least €3bn in further contributions from the industry. These grants will fund projects and help create resource-efficient transport that respects the environment, smart equipment, infrastructures and services and improve transport and mobility in urban areas. So we are delivering, in a very efficient and focussed way.

### **The Investment Plan for Europe (EFSI)**

As you know, the Investment Plan for Europe is underpinned by 3 pillars.

The first pillar works to make the investment environment more predictable and removing regulatory barriers. The completion of the TEN-T core network is hindered by complex regulatory and administrative procedures. Solvency II, permitting and procurement procedures. Eurostat assessments in connection with PPPs are another example of these obstacles. This leads to increased costs, significant delays and uncertainty especially for cross-border infrastructure projects. The

Commission is currently examining these regulatory barriers to investments and we are actively engaged in development of action plan and its fast implementation.

The second pillar of the Investment plan for Europe gives technical support to projects via an Advisory Hub and visibility on projects to Investors through the European Investment Project Portal. Transport is the second most popular sector for requests submitted to the Hub. But within the Hub I would like to see more dedicated resource for transport and a more proactive approach. The Hub should be supporting the pipeline by actively seeking out potential opportunities and working more closely with Member States and project promoters. Additionally, it is critical that EFSI delivers for all Member States. I want to ensure that EFSI can contribute to closing the gap between the East and West of Europe, generating socio-economic growth and competitiveness. The first phase results are showing contrary results – only one project approved and financed from cohesion countries. A proactive, project-focussed Hub can help achieve better balance and results. This was also one of the proposals of transport ministerial meeting from cohesion countries in Western Balkans Group, which I hosted on April 22 in Ljubljana.

The third pillar of Investment plan for Europe that includes EFSI, facilitates access to liquidity on the market and puts unused sources of funding to more targeted use. The EFSI progress has been strong. As of May 2016, €12.8bn of EFSI financed projects have been approved, triggering investments of around €100bn. 12 transport projects have been approved by the EIB Board, and 2 signed.

Examples include an innovative investment platform to accelerate investments to improve land access to ports in Spain, trains for regional services in Italy, an important project in Slovakia, and infrastructure funds to provide investment across Europe. And these transport projects alone have a potential to generate about 60.000 jobs in the coming years.

Overall, between the CEF and EFSI, over €40bn of investment has, or is soon to be, triggered in the transport sector, allowing us to estimate that it will potentially support about half a million temporary or permanent jobs in the coming years.



And on top of that the EIB itself makes substantial investments outside of EFSI. The total volume of EIB lending for transport in 2015 was around €12.5bn. Last Thursday, the EIB issued a press release that they approved new lending totalling nearly €4bn for large scale investment projects, including the new Terminal 3 at Frankfurt airport, expansion of the ESPOO metro in Finland, new trains on the Liverpool rail network.

But we should not be complacent:

We are working to develop a pipeline that delivers big contributions to society, with a substantial economic return, and significant impact on jobs and growth:

- Projects to support decarbonisation – for example supporting ship owners to fit cleaner engines on their fleets and electrification.
- Projects to support digitalisation – for example ERTMS in the rail sector, and SESAR for the aviation sector.
- Projects such as investment platforms to support smaller investments across urban areas for urban mobility – better connected and cleaner vehicles.
- The pipeline has improved compared to a year ago, but there is still work to do, and my services have been actively supporting EFSI, working very closely with the EIB to deliver new financial products & solutions, and targeting support at new industries equally across all 28 Member states.

### Next steps

I am focussed on making sure that the Investment Plan for Europe, including EFSI, delivers for the transport sector. To achieve this, we need a strategic plan to support Member States and project promoters to transition from a publicly financed approach towards the use of new financial instruments. This in principle means to create a new investment culture in EU. I am more and more convinced that the “blending” of grants with EFSI instruments is an effective way forward. It could also be a smooth bridging between the new and old world. No matter what the project an additional component of grant in a “blending” approach helps fix the funding gap while an EFSI instrument catalyses investments.

I talk from practical experience. This “blending” approach has been successfully and flexibly applied in the financing of the Core Ports of Dublin and Calais under the Connecting Europe Facility (CEF). It is also expected to be used for the EFSI project in Slovakia and more widely under the CEF call that we are currently evaluating. Critical to the blending approach is the availability of CEF grants. So I believe that there is a very strong case, should there be available budget in the upcoming MFF review, to supplement the CEF budget to be used primarily to support a blending approach. And potentially other sources of funds could be directed through the CEF to ensure faster and efficient delivery projects of EU added value. CEF is well defined, well-functioning tool with strong governance structure. It ensures that only the best projects are selected and also delivered within the project specification.

I would seek your support in delivering this extra funding for CEF. Beyond financing and funding, we continue with active promoting of opportunities for EFSI and CEF under the Investment Plan for Europe.

At this point I would like to remind you of the TEN-T days in Rotterdam this year. For the first time we included a dedicated Investors Conference, where we will kick-off a speed-dating exercise bringing together investors who are prepared to invest in transport and mature projects. Project promoters will face investors directly, receiving a hands-on response. Political support to the TEN-T, CEF and EFSI development will be provided in the form of a “Rotterdam Declaration”, which will give impetus to the completion of the TEN-T core network by 2030, as well as to innovatively financed smart and green infrastructure. ■

This part of a speech – the full speech can be seen here – [http://ec.europa.eu/commission/2014-2019/bulc/announcements/european-parliament-speech-vision-investment-transport\\_en](http://ec.europa.eu/commission/2014-2019/bulc/announcements/european-parliament-speech-vision-investment-transport_en)

.....  
**Violeta Bulc**

**Commissioner for Transport**

European Commission

[http://ec.europa.eu/commission/2014-2019/bulc\\_en](http://ec.europa.eu/commission/2014-2019/bulc_en)

[www.twitter.com/Bulc\\_EU](http://www.twitter.com/Bulc_EU)

# Internet of Trains

Mr Marcel Van Velthoven, CEO at Znapz

I borrowed the title to this piece from Hessel Dijkers, Chief Information Officer of NS (Dutch Rail), who gave a very interesting presentation at the beginning of the European Rail Summit in June this year. NS has many initiatives to also be a leading organisation in the world of information technology. While applying Internet of Things in many areas, the organisation is developing standards to fully benefit from the power of this latest development and not suffering too much from the “Taste of the Month” syndrome.

Umberto Malesci wrote an interesting article “The Internet of Things in Rail”, published on LinkedIn November 25th 2014. He writes: “Despite being more than 200 years old, the railroad industry is going through a very exciting phase where heavy use of IT and networking technologies are completely redefining how trains will be run and managed in the next twenty years”.

I like to take this topic into our world of Asset Management. As you all know, Asset Management is generating the highest value of your assets over their lifetime. This means maximum availability (=Value) within the window of operations at the lowest cost, with minimum Risk.

The amount of data that is generated daily is a staggering 2.5 quintillion bytes of data ( $10^{18}$ ), according to IBM in their article – “Bringing Big Data to the Enterprise”. We have measurement



devices in almost all instruments, machines, equipment and other devices. We often measure real-time or close to real-time, so we should know the behaviour of our assets quite well. Here our challenge begins with a view of Asset Management. Why do we take all those measurements, what do we do with it and how does it contribute to optimising the value of our assets over their lifetime?

The availability of all this data forces us to rethink our strategy. Why do we have this asset, what do we expect from this asset, what are the requirements? This requirement definition is the basis of defining the value we get from Big Data and the value from Internet of Things. Only when we combine these 2 elements will the Internet of Things generate value and is worth considering as an element of Asset Management.

There are many examples how the Internet of Things can add value. One practical example which is the interface between the Rolling Stock and

Infra world is the measurement of “Flat Wheels”. Over time the wheels of a train flatten and have to be rounded again, which is a costly operation. But not doing it will cause damage to the wheel and damage to the track. A flattened wheel will also cause an increasing level of discomfort for the passengers or in the worst cases, could cause the cargo to be damaged. This gives us all the right reasons to take this seriously and take action at the right time, but when is the right time?

Today, unknown to many people, a lot of measurements are taken to monitor the quality of railtracks. Of course we want to know how many trains are using the track, if for no other reason, this is a basis for the compensation the track owner receives from the operator. At the same time the load of the train has a direct impact on the deterioration of the tracks, as well as the speed. We monitor temperature, load, speed and vibration along the track. With increasing accuracy this

## PROFILE

gives us an insight into the wheels and we are able to monitor the roundness or flatness of them. This can now indicate at each bogie when wheel maintenance is required based on criteria set for both the train operator and the infrastructure company.

### **What are the benefits?**

The benefits are that we can reduce unnecessary damage to the tracks, to the wheels and reduce the discomfort for the passengers. With an optimised way of working we can extend the lifecycle of both assets, train and track and reduce the risk of failure, a broken wheel or track and in a worst case scenario even derailments. We can now do this instantaneously whilst also reducing the amount of inspections, hence a further reduction in operational cost.

This is not the only benefit, the ability to do better planning, will reduce the cost of maintenance and even increase the availability of assets.

The examples of how Internet of Things can affect Trains and Tracks in a positive way are endless. Taking this further we can view how many passengers are using a train, enabling the planning department to increase/decrease capacity on individual tracks at specific times. This in turn will improve rail travel by providing seating for all passengers.

### **How to achieve this?**

ZNAPZ is involved in all those aspects of Asset Management in the Rail Industry, both on the Asset Management Information Systems side and in training our customers in the awareness of Asset Management for their organization. We have already started a few projects in the area of Internet of Things in Rail, using IBM leading technology, like MAXIMO, PMQ and



Internet of Things. While it is still early days for the combined benefits of these technologies we see how the Internet of Things will completely redefine how trains and tracks will be run and managed.

Our challenge with this increased knowledge of our assets is: "to know what we need to know" from the assets to define the right behavior and request the right data from the system. This will enable the organisation to install the right equipment along the track and learn the behavior of the assets during normal and not so normal usage. We can now start learning the differences under the various operating environments and the effect on asset performance. What does load mean for the track?, what does temperature really mean? and how is the speed affecting the asset performance, immediately and over a longer period? And it is not only at asset level, it is even at system level and higher.

This increased knowledge will require a new way of thinking about our entire rail system and rail assets including a close view of the combination train and track and how the inter-

facing works. Data and information management systems will play an even bigger role in Asset Management. The usability of the information will play an even more vital role in the success of how to apply the Internet of Things in the real world and how to generate the highest value from our assets over their lifetime.

The Internet of Trains era is coming and it will enable the infrastructure and rolling stock companies to deliver a higher service to their customers at a lower cost, increasing the reliability and punctuality, reducing passenger delays and being more predictable overall. Yes Internet of Trains is a great development for the Rail Industry.



**Mr Marcel Van Velthoven**  
**CEO**

Znapz  
Tel: +31 402 668 636  
info@znappz.com  
<http://www.znappz.com>





# Driving innovation in European transport

Maria Kelly Communications Officer at Shift2Rail outlines how the partnership aims to tackle the challenges of changing EU transport needs...

Shift2Rail Joint Undertaking (S2R JU) is a public-private partnership, providing a platform for the key actors of the European rail system to work together with a view to driving innovation in years to come, by implementing a comprehensive and coordinated research and innovation strategy. S2R JU is the first European rail initiative to seek focused research and innovation and market-driven solutions by accelerating the integration of new and advanced technologies into innovative rail product solutions. S2R JU aims to promote the competitiveness of the European Rail Industry and meet the challenge of changing EU transport needs.

Rising traffic demand, congestion, security of energy supply and climate change are some of the major issues that the European Union (EU) and the wider world are facing. Tackling these challenges will require the railway sector to take on a larger share of the transport demand in the next few decades.

EU research and innovation must ensure that rail plays a new, broader role in global transport markets, both by addressing persistent short-term problems that drain rail business operations and resources, and by helping the sector achieve a stronger market position, in particular by supporting the creation of a Single European Railway Area.

The European Rail Traffic Management System (ERTMS), in particular, is a prime example of how the European rail sector can drive innovation and support the creation of a unified harmonised railway areas and improve efficiency, while opening up significant business opportunities for the European rail industry, both within and outside of the EU. Shift2Rail is Europe's most ambitious research programme in the rail sector and is vital to ensuring the long term competitiveness of the industry, while delivering sustainable transport in Europe. The enhanced synergies of a public-private partnership are

motors for innovation and the prospects are very exciting. Shift2Rail is jointly owned by the EU and Industry. This programme is vital at a European level and the Innovation Programmes (IP's) identified in Shift2Rail's Master Plan, anticipates the European Union's 4th railway package. This legislation will reform the EU's rail sector by encouraging competition and innovation in domestic passenger markets. It will also implement structural and technical reforms. The end result being higher levels of safety, interoperability and reliability in the European rail network. It will also make rail more attractive especially for passengers and businesses.

The Shift2Rail programme has 3 ambitious key targets which are to cut life-cycle cost of railway transport by as much as 50%, double railway capacity and increase reliability and punctuality by as much as 50%.

In December 2015, following the adoption of the Shift2Rail Multi-Annual Action Plan (MAAP) and Annual Work Plans 2015 & 2016, the Joint Undertaking published its first calls for proposals to its members and third parties to realise research and innovation activities estimated at €170m in the next 36 months, co-financed up to €90m by the Union contribution.

The topics that S2R launched, and that will start with projects this year, cover most areas of Shift2Rail's programme<sup>1</sup>, notably:

- Rolling stock development of concepts towards the next generation of traction systems, new concepts and architectures for train control and monitoring and advanced brakes;
- Rail signalling technological and operational advancement for on-board automation systems, high-capacity radio communications systems, safe train separation systems, cyber security systems, innovative testing processes, etc;
- Infrastructure whole system-approach progress enhancing and innovating switch & crossings and track systems, extending the life of bridges and tunnel assets, managing assets in a more holistic, intelligent and consistent way;

- Passenger centric IT solution for interoperable framework developments and 'one-stop shop' sale and use of tickets and travel disruption assistance applications across multiple modes;
- Research activities targeting freight including automation, noise and LCC. New developments on freight locomotives, on driver advisory systems and intelligent freight wagons;
- Cross-cutting activities: identification of socio-economic factors that can contribute to an attractive railway system, the development of tools and approaches to enable the impacts evaluation of new technologies. Transversal evaluation and methodologies around energy, noise and vibration. Integrated approaches to deal with the safety of the railway system and planning that takes into account interdependencies in the railway system.

Looking to the future, Shift2Rail will scale up its activities, launching additional calls for proposals and tenders, to ensure adequate funds for the projects in order to achieve the S2R Master Plan targets as they evolve. The S2R JU is a unique partnership representing the commitment and effort of the EU and rail industry at large to deliver a new rail system capable of answering EU challenges in terms of a more attractive and integrated transport system, decarbonisation and climate change, energy supply and efficiency, and digitalisation. ■

<sup>1</sup> [http://www.shift2rail.org/wp-content/uploads/2013/07/S2R-JU-GB\\_Decision-N-15-2015-MAAP.pdf](http://www.shift2rail.org/wp-content/uploads/2013/07/S2R-JU-GB_Decision-N-15-2015-MAAP.pdf)



.....  
**Maria Kelly**  
**Communications Officer**  
 Shift2Rail Joint Undertaking  
[info@shift2rail.europa.eu](mailto:info@shift2rail.europa.eu)  
[www.shift2rail.org](http://www.shift2rail.org)



# European rail supply industry

Natasha Marie Levanti, Association for Consultancy and Engineering discusses the European rail supply industry and outlines what the new EU resolution means for the sector...

On 9 June the EU Parliament has adopted the [Resolution on the competitiveness of the European rail supply industry](#) (2015/2887(RSP)), which will serve to increase the ability of those engaged in the rail sector to compete not only within Europe but also globally.

As the EU represents the largest absolute market worldwide for both rail products and services, according to the UNIFE World Rail Market Study 2014, it is vital that those involved are fully competitive within global markets. Of the EU market, 84% of needs for supplies and services are met by the European rail supply industry.

The European rail supply industry (RSI) accounts for roughly 46% of the world's total RSI market. European

RSI is known to employ approximately 400,000 employees, and the European railway sector overall is cumulatively responsible for more than 1 million direct and 1.2 million indirect jobs through EU member states.

The EU, and subsequently many member states, have repeatedly asserted the key role that the rail industry plays in allowing Europe to achieve their goals for mitigating emissions, limiting other negative factors within climate change, and facilitating the essential achievement of the 20% reindustrialisation target, with the rail industry holding the lowest share of EU transport CO<sub>2</sub> emissions (only 1.8%).

With constant development of rail technologies such as high speed or magnetic levitation, lighter weight



materials, satellite based positioning or timing systems, and cross border connectivity, it is imperative that the European rail industry as a whole continually improves.

In April, the Members of the European Parliament Industry Committee (ITRE) had adopted the resolution by a large majority. The ITRE committee members within this made know their strong desire for the support of European rail suppliers, as well as the need for this to be prioritised to ensure that the European industry continues to lead within the greater global rail market.

Despite the current level of Research & Development at approximately 2.7% of annual turnover, past of the new resolution is to create a renewed European rail industry innovation agenda.

Other major aspects of the resolution include supporting SMEs that work within RSI, increasing the investment in rail projects through a variety of existing EU funding mechanisms, increasing global competitiveness of European rail through various trade negotiations, as well as improve the amount of political knowledge and support of the European rail industry.

Many of these objectives rest in line with the European Union's recent priorities, including decreasing red tape, fostering innovation, supporting SMEs, and ensuring the competitiveness of European industry on global markets.

When it was discussed and adopted during the European Parliament Plenary session, it had the vast support of those in the room, though this was not surprising given the visible support for this throughout Europe as another way to ensure European competitiveness.

Much of the attention gained on this topic has been related to the increasing level of competition with Asian suppliers. While 84% of the EU market is being

met by European rail supply industry, if global competitiveness is not achieved, this percentage will decline without proportionate increase elsewhere. Such must be avoided, and is the key objective of the resolution that has been passed today.

**“The European rail supply industry (RSI) accounts for roughly 46% of the world’s total RSI market. European RSI is known to employ approximately 400,000 employees, and the European railway sector overall is cumulatively responsible for more than 1 million direct and 1.2 million indirect jobs through EU member states.”**

Inevitably, as rail is an essential part of daily transport options for many Europeans, rail also impacts the overall EU economy. Efficiencies in overall productivity of an economy can be made through better transportation, and as is often pointed out in times when transport networks are down, there is a productivity cost associated with poor quality transport.

The Rapporteur for this resolution is MEP Martina Werner, done on behalf of the Committee on Industry, Research and Energy. Martina Werner, is a German Member of the European Parliament with noted involvement and advocacy of actions relating to Energy, Steel, Rail, industries and competitive trade. ■

.....  
**Natasha Marie Levanti**  
**Group Communications Executive**

ACE Group  
Tel: +44 (0)20 7222 6557  
consult@acenet.co.uk  
www.acenet.co.uk  
www.twitter.com/ACE\_updates

**GOVERNMENT  
ENVIRONMENT  
ENERGY &  
RENEWABLES  
TRANSPORT  
HEALTH &  
SOCIAL CARE  
EDUCATION  
FINANCE  
RESEARCH &  
INNOVATION  
HR & TRAINING  
ICT**

# **NEWS, VIEWS AND OPINION**

**www.adjacentgovernment.co.uk** acts as a platform for discussion and debate providing news and topical features with cutting edge policy analysis.

We welcome contact from all experts with an interest in making an editorial contribution, and from those with an opinion to express.

## **CONTACT**

[editorial@adjacentgovernment.co.uk](mailto:editorial@adjacentgovernment.co.uk)



# Europe: The digital revolution

At the 360 Europe Event in Brussels, Günther H. Oettinger, EU Commissioner for Digital Economy gave a keynote speech to share his thoughts on Europe achieving a digital revolution...

The stakes are very high for Europe in the digital revolution that we are witnessing today. This revolution is fast, it is global and it is unstoppable. The issues you are discussing at your conference are of extreme relevance to how we should address the opportunities and the challenges that come with the digital revolution. It is therefore probably no surprise to you when I tell you that these are also the issues that are keeping us busy at the Commission in our daily work.

One huge opportunity is the digitisation of our economies, in particular of those areas where we are strong today. At the same time, it is also a challenge to carry the traditional strengths – for example in automotive, in robotics, in embedded systems and so on – over to the digital world of the future. This is why we must be successful in digitising our industry and all other sectors of our economy.

This is the reason why the Commission has worked hard together with industry, academia and social partners to elaborate an ambitious set of proposals under the “Digitising European Industry” initiative that I presented at the Hannover Industry Fair in April, just after the Commission adopted it. It includes concrete measures to foster the digital transformation of the industry. In that context, 5 core technological domains are called upon to support our vision for digitisation. These are cloud computing, data analytics, IoT, cybersecurity and 5G. These will help enable the digitisation in many areas such as automotive, energy, health, factories of the future, as well as media and entertainment.

An in-depth digital transformation of the economy requires a new breed of communication networks. And 5G will help us take a leap forward.

With 5G, we will have the possibility to use versatile network platforms capable of adapting to the specific requirements of a variety of business cases from the so-called vertical sectors. This will be quite different from today’s mobile networks that are more “one-size-fits-all” networks.

Of course, this will require that we follow in Europe a coherent approach to specialised services. When I say this I mean those future services to be provided by the “vertical” industries that are not yet fully identified today.

As many of you know, exactly for this purpose we have harmonised the rules for Net Neutrality and BEREC is currently consulting on their draft implementation guidelines on this. The Regulation has laid down the rules. They are technologically neutral and will foster the development of innovative 5G and IoT services. They now need to be put into practice.

In that context, it is also essential that we work out the 5G standards to support the use cases within the vertical industries. The use cases linked to superfast broadband, the so-called enhanced Mobile Broadband (“eMBB”), are of key importance, but we should also focus on 5G use cases supporting digitisation. This will help our industries cope with the challenges that the future connectivity systems are facing, such as massive IoT connectivity or mission-critical scenarios with very low latency.

From our perspective, it will be important that these “vertical” use cases get a level of priority similar to that of the “superfast broadband” use cases, especially in the context of the ongoing debates in standardisation bodies, where priority services for early deployments are discussed. This is naturally very relevant for GSMA members, for all mobile network operators providing connectivity across Europe.





*Günther H. Oettinger, EU Commissioner for Digital Economy*

As I announced at the last Mobile World Congress in Barcelona, the Commission is now working together with industry to prepare a coordinated 5G Action Plan for Europe. While it is crucial to foster the research and technology development that will underpin 5G, we can do more. We should also foster 5G deployment in close collaboration with the Telecom sector and also with vertical sectors, which we are asking now to join this effort.

The Action Plan should be adopted later this year. It will comprise proposals towards a common agenda for Europe to deploy 5G networks; it will also set out to overcome possible obstacles, and announce key milestones to demonstrate and showcase 5G technologies. Keeping the momentum is important for Europe, particularly at a moment when the 5G international agenda is accelerating, with several key nations (US, Japan, Korea) already planning 5G deployment and showcasing events.

Let me now turn to another key issue: the review of our telecom regulatory framework. We have analysed the

results of the public consultation and are working ahead full steam. It is clear that we have to look beyond the 2020 Digital Agenda broadband targets and define our ambitions for 2025. We also must make sure that we have rules that are fit for the investments we need for 5G networks and for the digitised Gigabit society.

Enabling the infrastructure investment we need, will be a key feature of the Telco Review in all its parts. Competition will remain at the heart of a healthy regulatory framework, but our intention is to put the right incentives in place for all market players that go the next steps towards Gigabit networks.

To reap full benefits of the digital economy, we have to rely on a competitive telecoms sector which invests. This is of particular importance, because today, this sector is the enabler of the digitisation of the rest of our economy and society.

As mentioned on many occasions – access regulation to dominant networks will remain part of the telecoms framework. But we also need to ensure that those

who take the chance to invest in very-high-capacity networks also get the return that corresponds to their investment.

Of course every market player should have equal chances to invest – or if necessary to co-invest. I believe that efficient investment projects which are based on open, good-faith and reasonable co-investment offers, including a possibility for all players to participate, address the concerns that access regulation normally seeks to resolve and allow a lighter regulatory approach to those who move first or together – to invest in new networks.

A digital single market based on effective spectrum management is more important than ever.

We want all Europeans to benefit from high-quality connectivity serving their needs. Europe should have the best-in-class networks to underpin the digital single market and enable the vision for a Digital Union. I see this as a common ambition and 5G will be a test case for whether we can deliver.

My ambition is to enhance the EU spectrum management framework, in order to increase regulatory predictability for market players and to ensure that regulators focus on the adequate returns on investment.

Networks and specific conditions are indeed often local, but capital markets are not. That is why in the Digital Single Market we need to increase the consistency of regulatory interventions that shape markets, including in the mobile markets.

This is a great opportunity for the sector.

I believe that issues such as spectrum awards, licence duration, coverage criteria, trading and sharing of spectrum are examples of areas where more consistency will bring significant benefits. We also need to enhance transparency and levels of consultation in these processes to ensure regulatory predictability.

The current 5G discussions on spectrum also indicates that we need more flexibility in identifying spectrum of European relevance. Nations such as the United States, China, Japan and South Korea – already well ahead of

the World Radio Communication Conference in 2019 – have identified the 5G bands that they want to operate to initiate the services.

Europe needs a fast-track procedure for this and in that context, I welcome that our expert advisors from the Radio Spectrum Policy Group (RSPG) have published their draft opinion on 5G pioneer bands for public consultation last week.

The challenges of the digital revolutions are important. However, the benefits we will reap, if we are successful in digitising our economy and society are much greater. We must master the challenges of the digital revolution together. We must ensure that we put in place the 5G networks for the future that our industries and our economy need across the board.

As one important contribution to this, we intend to present our proposals for the Telco Review in September and I have the ambition to have them completely agreed by end of 2017, so that they can be applied before 2020.

We have the task to develop a framework for the 3rd decade of the 21st century.

I count on your input and the continuous support from the GSMA in pursuit of these objectives and in particular in the spectrum debate. Together, we need to underline the key role that very-high-capacity networks – wired and wireless – will have to play the success of 5G in Europe. ■

This is an edited version of a speech taken from the EC website – the full speech can be seen here – [http://ec.europa.eu/commission/2014-2019/oettinger/announcements/keynote-mobile-360-europe-event-brussels\\_en](http://ec.europa.eu/commission/2014-2019/oettinger/announcements/keynote-mobile-360-europe-event-brussels_en)

.....  
**Günther H. Oettinger**  
**Commissioner for Digital Economy and Society**  
European Commission  
[http://ec.europa.eu/commission/2014-2019/oettinger\\_en#news](http://ec.europa.eu/commission/2014-2019/oettinger_en#news)

# Dependable, secure and trustable wireless sensor networks

Dr. Werner Rom, Head of Department Cross Domain at the VIRTUAL VEHICLE Research Center highlights a key enabler to the Internet of Things

**W**ireless sensor networks (WSN) are a key to achieve the full potential of the future Internet of Things (IoT). They will significantly increase the level of flexibility for citizens, including professional users, in their everyday lives and environment, by providing new areas of services and applications. Yet, important challenges still have to be overcome, and the VIRTUAL VEHICLE Research Center, an industry-driven applied research center in Graz/Austria, is working at the forefront of WSN, making them dependable, secure and trustable.

## Advantages of wireless solutions

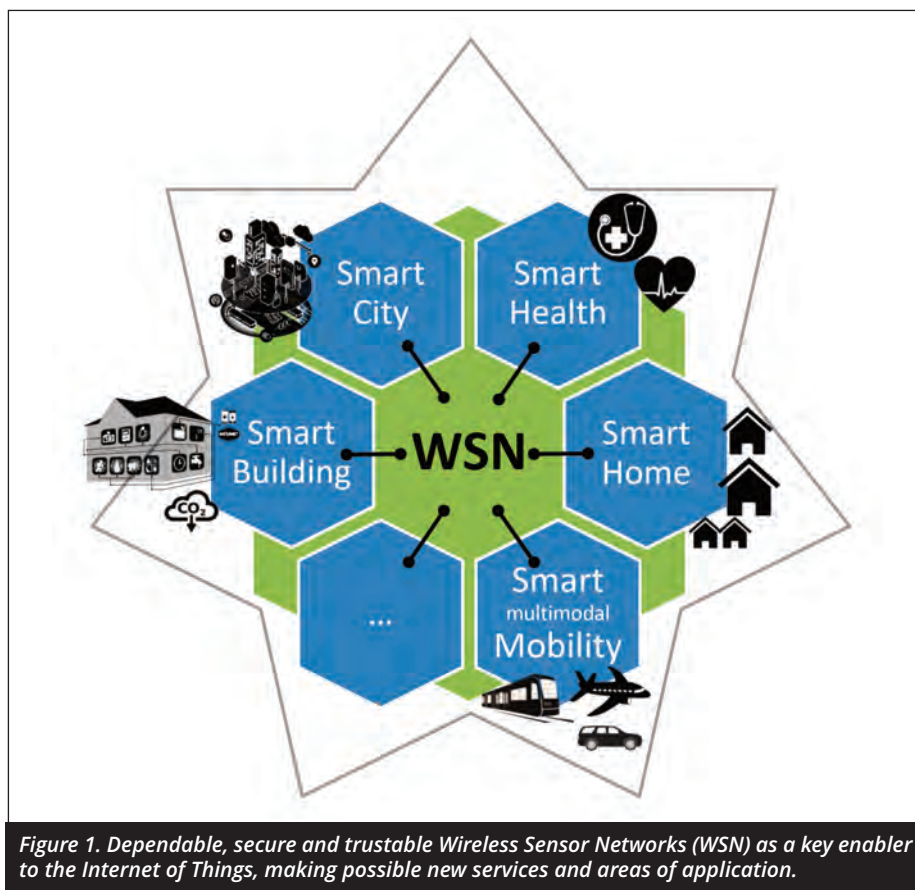
Wireless solutions provide numerous key benefits and enable novel services and applications compared to wired solutions:

- Reducing weight in weight-sensitive environments (i.e. less cabling);
- Enabling novel “bring your own device” applications (e.g. using smart phones);
- Providing redundant backups to wired solutions;
- Easing configuration and self-configuration of systems;
- Increasing flexibility and re-configurability;
- Eliminating errors from faulty wiring, by self-managed wireless networks;
- Increasing reliability through monitoring for reduced tear and wear;
- Facilitating easy, cost-effective feature updates;
- Reducing installation costs, by simplified deployment procedures;
- Enabling easy switching of network topologies, etc.

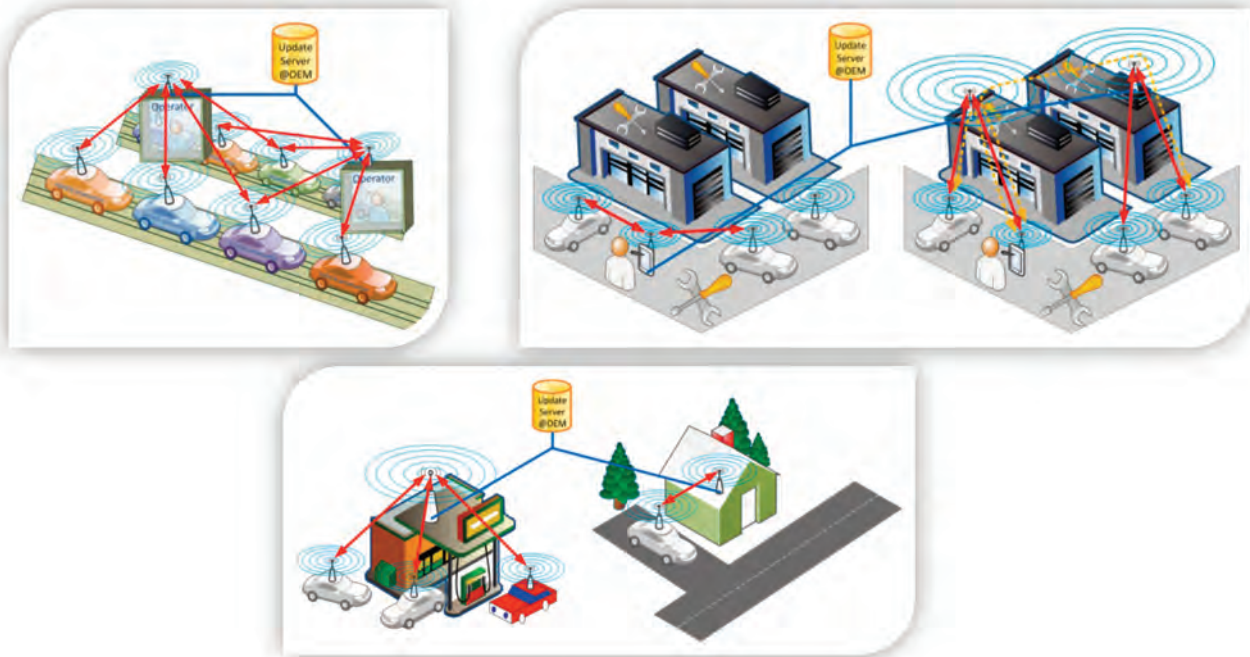
## Challenges of wireless solutions

However, there are specific reasons and factors why wired solutions are still dominant in many areas, services and applications, although things are rapidly improving:

First, there is the comparable low degree of dependability. Dependability, an all-encompassing term that considers reliability, availability, maintainability, safety, as well as integrity, is the ability of a system or a product to deliver its intended level of service to its users, especially in the light of failures or other incidents that impinge on its level of service.







*Figure 2. Wireless update of software for automotive electronic control units in three different scenarios (wireless update in an assembly line, top left; in a workshop, top right; and remote updates and wireless updates at home, bottom), as developed in the DEWI project.*

Second, although security and privacy considerations are not new in the context of information and communication technology, WSN and the IoT provide new and unique security and privacy challenges<sup>1</sup>. Due to the ever increasing amount of devices connected to the IoT, numerous additional entry points for cyber-attacks are generated. Furthermore, since WSN and IoT open up new ways how to collect, analyse and use personal data, people are concerned about surveillance, tracking and other misuse.

And, there is still a lack of interoperability. Current wireless solutions do not have the common reference design and service-oriented architecture needed to build a market environment where competition enables lower prices for the users.

To increase trust of private and professional users in WSN solutions, and thus to accelerate the full market uptake of wireless solutions and of IoT as a whole, all the factors mentioned have to be taken seriously into consideration.

DEWI – Dependable Embedded Wireless Infrastructure<sup>2</sup>, led by the VIRTUAL VEHICLE Research Center in Graz/Austria, is a large pan-European initiative on WSN and wireless communication in the areas of transportation and building automation. It involves 58 key players from 11 EU countries, with a total budget of €40m for 3 years. Since 2014 DEWI is preparing the ground for the broad introduction of dependable wireless systems by a strong symbiosis between industry, research, and education. The focus

of DEWI is clearly on dependability and interoperability, rather than on security and privacy aspects.

DEWI utilises a use-case driven approach with more than 20 use cases from different areas of high relevance to European society and industry. The use cases of DEWI range from telemetry loggers for sounding rockets, active flow control for airplanes, wireless sensors for trucks, monitoring of off-road vehicle operators, wireless automotive software updates, solutions concerning train integrity and composition, as well as freight monitoring, to housing energy optimisation, building security, and facility operation and maintenance. A comprehensive overview on these use cases, highlighting the advantages of dependable wireless solutions in

the automotive, aeronautics, rail and building automation domains and also addressing the related challenges has been issued in May 2016 and is publicly available<sup>3</sup>.

To foster cross-domain reusability, scalability, and interoperability of its solutions, DEWI has developed a standardised multi-domain reference architecture, being fully compliant with the international standard series ISO 29182 – Sensor Network Reference Architecture<sup>4</sup>. This architecture thus will be comprehensively beneficial for all future WSN applications in smart mobility, smart society, smart energy, smart health or smart production.

The future of WSN still faces many challenges. Those developed in one industrial domain will be reusable in others (e.g. automotive, aeronautics, rail, health, or industrial automation), to make better use of economies of scale. Design and development of the security of WSN are currently still quite separated from other areas. However, security may severely affect safety but also reliability, privacy etc. Therefore co-design and co-development of solutions concerning safety, security, reliability or privacy are a must. Furthermore, one has to consider tradeoffs between those parameters as well as costs for certain services and applications, requiring multidimensional optimisation. WSN being fully safe and secure but leading to unacceptable costs or zero data throughput will never be introduced to the market.

Privacy and building trust in products (systems, services or applications) will be the main deciding factors between success and failure in the IoT business. Therefore user's experience has to be taken really seriously and has to follow a user-centered design to put security and privacy really in the hands of the user. Activation and configuration of security and privacy have to be simplified, and a common, internationally recognised accepted metrics for 'measurable security and privacy' still has to be developed.

The IoT or the concept of 'system of systems' can only be realised if WSN are connected to each other and to the cloud (or backbone) using new communication technologies such as 5G to cope with the increased amount of data and real-time requirements (e.g. for automated driving), etc.

VIRTUAL VEHICLE will – together with its large European partner network from industry and academia and as a member of AIOTI, the Alliance for the Internet of Things Innovation<sup>5</sup>, which was launched by the European Commission and today is the largest European IoT ecosystem – further significantly contribute to overcome these challenges. VIRTUAL VEHICLE is currently about to prepare new pan-European activities and projects focusing particularly on security and privacy to make wireless sensor network solutions more secure and trustable to eventually allow the full potential of IoT come true.

### Acknowledgement

The research from DEWI project leading to these results has received funding from the ARTEMIS Joint Undertaking under grant agreement n°621353. The author further acknowledges the financial support of the COMET K2 – Competence Centres for Excellent Technologies Programme of the Austrian Federal Ministry for Transport, Innovation and Technology (BMVIT), the Austrian Federal Ministry of Science, Research and Economy (BMWFW), the Austrian Research Promotion Agency (FFG), the Province of Styria and the Styrian Business Promotion Agency (SFG).

1 The Internet of Things: An Overview. (October 2015). The Internet Society. 50pp.

2 <http://www.dewi-project.eu>

3 [http://www.dewiproject.eu/wp-content/uploads/2016/06/DEWI\\_A5\\_final\\_web.pdf](http://www.dewiproject.eu/wp-content/uploads/2016/06/DEWI_A5_final_web.pdf)

4 ISO/IEC 29182 Information technology – Sensor networks: Sensor Network Reference Architecture (SNRA). 7 parts. (2013-2015). International Organization for Standardization.

5 <http://www.aioti.eu/>



**Dr. Werner Rom**  
**Head of Department Cross Domain**  
VIRTUAL VEHICLE Research Center  
Tel: +43 316 873 9001  
[werner.rom@v2c2.at](mailto:werner.rom@v2c2.at)  
<http://www.v2c2.at>

# Digital economy: Why a brighter future could be in our pocket

The digital economy is here, and growing every day, sometimes in surprising ways. As ministers gather for major meetings in Paris and Cancun, Andy Wyckoff, Director of the Directorate for Science, Technology and Innovation at OECD outlines how government leaders should be in no doubt about the key role they must play in securing the digital economy's future, as a driver of productive and inclusive progress...

**"A**nalysing the impact of electronic commerce in 1997 is about as easy as estimating the impact of the automobile in 1900. Intuitively you know that the impact will be large, but few people know how to drive, roads are of varying quality and gas stations and mechanics are nearly non-existent. With some confidence you can say that there will be a positive impact on supplying industries such as oil, steel, glass and rubber, and direct competitors like horses, oat producers and carriages are likely to suffer, but beyond that it is largely speculation. Who would have predicted that the car would lead to suburbs, air pollution and the geo-political importance of the Middle East? So it is with electronic commerce."<sup>1</sup>.

So I wrote, in a contribution to the OECD Observer magazine in 1997 during the run-up to the first ever OECD ministerial meeting devoted to the digital economy, held in Ottawa, Canada in 1998. How prescient that meeting proved to be: not only was it the year the Internet was colonised (indeed, privatised), albeit by just 2 million domain names (including [www.oecd.org](http://www.oecd.org)), but it was also the year that a firm called Google was incorporated, while barely a year after that, a company calling itself Amazon had an initial public offering.

Nearly decades later, the OECD organised another ministerial meeting, this time in Cancun, Mexico, under the title: "Digital Economy: Innovation, Growth and Social Prosperity." Extending the automobile metaphor, we now drive at speeds more than a thousand times faster than we did on the 1998 "information highway"; we've gone from a mere 180 million "drivers" (about 3% of the world population) to over 3 billion (40%). Seatbelts, let alone airbags, don't exist yet, but GPS is here following us wherever we go and our "cars" now fit in our pocket.

Like the suburbs, digital technologies have sprawled into nearly every part of the economy and society: 80% of OECD citizens have broadband subscriptions with the majority accessing the more than 300 million web sites via a smartphone. Some 95% of 16-24 year olds in the OECD use the internet and on average a 15-year-old spends three hours a day online, while about half of OECD citizens now engage in e-commerce.

**"Another challenge is productivity growth. True, this has slowed in recent years and many people still refer to Robert Solow's 1987 remark that computers are everywhere except in the productivity statistics."**

Clearly, the goal at Ottawa to "realise the potential" has been achieved—the digital platform is well deployed across most of the OECD and quite a bit beyond too, while applications extend into every facet of the economy and society, disrupting and enhancing many sectors along the way and unleashing innovation, productivity growth and (as yet unmeasured) social benefits. Newspapers, music, finance and travel agents have been transformed, in some ways as predicted, though Facebook, Twitter, smartphones and the "sharing economy" have perhaps surpassed people's expectations, even disrupting established structures and economic arrangements. Many innovations were simply beyond our imagination: who could have guessed that we'd be experimenting with automated vehicles in 2016?

Some pundits say the big economic impact of information and communication technologies (ICT) may have already passed as we harvested the low-hanging fruit of computerisation in the second-half of the 1990s.





Others think that we are just at the beginning of another wave, characterised by ubiquitous computing as epitomised by the smartphone, which is both a platform and a linked device par excellence. It is the harbinger of the Internet of Things, expected to encompass between 20 and 50 billion devices connected to the Internet by 2020, throwing off torrents of data and supporting our daily routines. Already, more data are now being generated every week than in the last millennia, as our chart shows.

Crucially, the ability to analyse this data and extract strategic insights has made huge advances, with new data analysis techniques making it possible to automate decision making (e.g. high-speed trading) and edge towards artificial intelligence (AI). All of the major Internet platforms as of 2016, including Google, Amazon, Microsoft, Facebook, Apple, etc, now see AI as the next big service that users will demand and already have applications, such as face and voice recognition. Many, including this author, think that we are just entering a significant period of ICT induced structural change that

will simply transform the economy and society for the better. We have seen nothing yet.

**“Some 95% of 16-24 year olds in the OECD use the internet and on average a 15-year-old spends three hours a day online, while about half of OECD citizens now engage in e-commerce.”**

But this techno-optimism needs to be tempered with a reality check, that not all these advancements are universally welcomed. Some people worry about technology taking our jobs, others about privacy and data issues, while there is a more widespread erosion of trust fuelled by security breaches, including the Snowden revelations and abuse of the Internet by the “dark side” (terrorists and criminals). Policy makers must take these concerns seriously and develop policies to mitigate the risks and unleash the benefits.

### **Productivity’s macro-puzzle**

Another challenge is productivity growth. True, this has

slowed in recent years and many people still refer to Robert Solow's 1987 remark that computers are everywhere except in the productivity statistics. But 3 decades on, and the data we have been gathering on quite a number of firms and industries clearly show that the digital economy does indeed benefit productivity via several channels: by generating new innovative enterprises and clearing out old, badly performing, ones in a process of creative destruction; by allowing smarter, more efficient use of labour and capital to generate so-called multi-factor productivity growth, whereby even older firms can raise their game; by introducing new opportunities and services among people previously removed from the global economy, such as farmers, and local manufacturers and public services; by enhancing information efficiencies to improve stock management and shipping, for instance; the list goes on. Why all these "micro" increases in productivity do not add up to faster productivity growth at the "macro" level is a puzzle that the OECD is working to solve.

Clearly the online world is at another inflection point, and it could go in more than one direction. That is why stakeholders—from government, business, labour, civil society and the technical community—must not only take stock, but take a step back and assess the big picture. Where is the digital economy going, and how can policy help it deliver on even greater promise in the years ahead?

The Cancun conference comes at a time when no one is in doubt about the transformative role of ICT. It is neither an infant in need of protection, nor a teenager that needs oversight, but a young adult who needs to shoulder responsibilities and take its rightful place in the world. The agenda's 4 main themes therefore reflect what is needed to plot the way ahead: Internet Openness and Innovation; Building Global Connectivity; Trust in the Digital Economy; and Jobs and Skills in the Digital Economy.

**“Some pundits say the big economic impact of information and communication technologies (ICT) may have already passed as we harvested the low-hanging fruit of computerisation in the second-half of the 1990s.”**

The digital economy has proven itself to be a powerful catalyst, so much so that improving our future relies on harnessing the opportunities and minimising the risks. It has become a driver of inclusiveness, by linking communities to each other in a sort of global village, sharing information, ideas and products, and allowing countries to rise up the value chain. It must be allowed to grow, by allowing our “young adults” to sow economic and social opportunities for a greater number of our citizens. For two days in June, Cancun became the centre of this global village and, we hope, opened a new chapter in the collective future for the digital economy. ■

<sup>1</sup> Wyckoff, Andy (1997), “Imagining the impact of electronic commerce” in OECD Observer No 5, May, available at [www.oecd-ilibrary.org](http://www.oecd-ilibrary.org), at <http://oe.cd/1ln>

Visit [www.oecd.org/sti/innovation-imperative.htm](http://www.oecd.org/sti/innovation-imperative.htm)

Ministerial: [www.oecd.org/internet/ministerial](http://www.oecd.org/internet/ministerial)

This article originally appeared in ©OECD Yearbook 2016 – <http://www.oecd.org/forum/oecdyearbook/digital-economy-a-brighter-future-could-be-in-our-pocket.htm>

.....  
**Andy Wyckoff**  
**Director – Directorate for Science,**  
**Technology and Innovation**  
OECD  
[www.oecd.org](http://www.oecd.org)



## Digitalising services to strengthen communities

Dave Langhorn, Head of Regional Business and Regional Public Sector at Vodafone UK discusses how communities can be strengthened by digitalising services...

**W**hat makes a strong community? A recent Perspectives report by Vodafone UK, which surveyed local government, health and social care leaders, found that there are 3 essential components: a healthy population, community trust in public services and an efficient local government.

Yet challenges arise when it comes to trust: just one in 5 public sector leaders believe that their local community has full trust in public services. This is compounded by continued austerity measures as announced by George Osborne in the spring budget in March. Local and central government remain under constant pressure to find ways to deliver public services more efficiently.

One way to build trust and drive efficiencies is through the use of technology. Vodafone's Perspectives report, 'Strengthening Communities', shows that only half of the public sector is reaping the benefits of using technology, due to almost two-thirds (62%) having an internal resistance to change and 57% struggling to adopt technology in the absence of a clear strategy.

There is also a need to encourage the 'digital by default' initiative: where people intuitively access the internet as a first port of call to pay council tax or book a doctor's appointment, for example. But how do government organisations get to this point? Here are some tips of how to engage with and serve local



communities with the help of technology, which in turn will help to engender greater trust in local public services and ultimately build stronger communities as a result.

### Don't overlook the basics

According to the ONS, over 86% of households in the UK have access to the internet and this, combined with the proliferation of mobile internet connectivity, means that a large proportion of society is constantly connected online, making it a simple and cost effective medium to reach individuals and communities. As face-to-face or one to one interaction isn't always an option and is costly to deliver, digital channels such as social media and websites are a great way to interact with and serve the public.

Government websites are set to be the most popular channel in terms of investment as, according to the Vodafone UK Perspectives report, 65% of organisations plan to invest in and increase the public's use of their website over the next 2 years. As the majority of the population is connected to the internet, websites are an easy way to reach almost anyone in the community. Making a website user-friendly and informative should be high on the priority list for local government organisations looking to improve digital communications.

### Get social

Investment in social media comes a close second to websites, according to the Vodafone's research, as 58% of public sector organisations said they would increase investment in social media over the next 2 years.

Facebook claims 1 billion people across the world use its site every single day, demonstrating its power and influence as a means to communicate and interact with local communities. Social media channels offer organisations a way of reaching and interacting with large numbers of people quickly and cost effectively. For example, many local police forces now have a twitter page, often used to notify the community when they are searching for witnesses of a crime, or simply warning people of traffic delays due to an accident.

### Hire tech-savvy employees

The transition to 'digital by default' can be a slow process if organisations are starting from scratch. Tech-savvy employees with digital skills already ingrained in their DNA can play a vital role in making digital by

default a reality, however, recruiting and retaining these employees can be a challenge.

When looking for new tech-savvy staff, particularly millennials, organisations need to make sure the vacancy is seen in the right places. Vodafone's Here Come the Millennials report showed that the majority (64%) of 'millennials', those born between the early 1980s and 2000, use an internet search to find a job, and 31% use LinkedIn. Therefore, rather than register with traditional recruitment agencies, it is worthwhile spending the time looking at digital channels when it comes to recruitment.

### Invest in long-term rewards

The primary driver behind digital by default is efficiency and cost savings, however this also requires some investment to reap the long-term benefits. Securing a budget can be tricky, as shown by the Perspectives report which found that 73% of public sector organisations felt they had a lack of budget for introducing new technologies.

Public sector organisations ideally need to identify the long-term cost savings which will result from adopting the 'digital by default' initiative and use these to build a strong argument for the initial investment. With annual cost savings of going digital by default estimated to be at least £1.7bn, securing the investment will be well worth it.

Overall, there is no escaping the digital future. Through embracing the digital world, central and local public sector organisations will be able to make more effective use of employees' time as they enable more services to be delivered and information to be shared online. This in turn will encourage an efficient public sector that the public has trust in. Crucially, trust in public services is seen as a key characteristic of a strong community meaning technology clearly has a greater role to play than solely driving vital efficiencies. ■

.....  
**Dave Langhorn**  
**Head of Regional Business and**  
**Regional Public Sector**

Vodafone UK  
[www.vodafone.co.uk](http://www.vodafone.co.uk)



# Creative solutions for forward thinking local governments

Darren Hunt, Director of Public Sector at SAP, examines how technology is transforming local government and services...

Local government is many things to many people. It provides services to citizens, protects the public, runs transportation systems, supports education, collects taxes and promotes economic growth. It also has to manage its internal operations, finances and human capital while facing the ever increasing pressure to do more with less.

These requirements will not change, but with the explosion in digital innovation the means of delivering them will. New technologies are leading to better decision making through more accurate and telling insights, and new efficiencies are delivering operational benefits. Perhaps most significant is the radical shift in the expectations of digitally savvy citizens who now expect their interactions with local government to mirror the intuitive and friction-free experiences they have in their daily lives.

For better or for worse, people expect that renewing your parking permit should be as easy as buying a book on Amazon. Technology is the means of achieving this.

This is leading to some significant changes in how services are delivered. Rather than being a provider of services, local governments are increasingly being seen as an enabler – facilitating, brokering and orchestrating delivery for its connected citizens rather than simply being the provider.

But for this to work effectively, local governments must focus on understanding their citizens in the same way that businesses invest in understanding their customers. Local governments need real time insights and a 360 degree view of how people are interacting with them.

To show what this all means, I have outlined case studies of local governments in the UK that are using technology to achieve greater value for citizens. These are local governments that are starting out on their path of digital transformation. But the bold moves they are taking to look at innovative solutions to the challenges they face, will I hope act as an inspiration of what can be achieved.

### **Improving the way citizens and businesses interact with government – Cardiff Council**

Cardiff is the fastest growing city in the UK outside of London and is expected to expand by 26% within the next 20 years. With over 40,000 students, it is also Europe's youngest capital and it attracts nearly 80,000 commuters on a daily basis. These trends have placed ever-increasing demands on services in the city.

With the Council facing budget cuts of £124m over the next 3 years, it sees technology solutions as an important component in its efforts to manage costs, reduce expenditure and meet the needs of a growing, youthful population.

Using SAP's Cloud for Customer solutions together with the HANA Cloud Platform, Cardiff Council has created a digital self-service portal that enables residents to interact online rather than in-person, greatly reducing administrative costs. This appeals to the increasingly young population in Cardiff, with an intuitive user interface that mirrors the modern, e-commerce experiences of daily life. Self-service and more efficient call handling is critical in helping the Council to meet local government directives, while improving customer satisfaction.

### **Working together to build a powerhouse of knowledge and achieve economies of scale – Salford and Liverpool City Councils**

As with most other public sector bodies, Liverpool and Salford City Councils are seeking ways to deliver technology innovation across their IT infrastructure and digital services but are faced with budget limitations which on their own, would make it nearly impossible to migrate to next generation solutions. Both councils have made great use of their legacy ERP systems but in order to future-proof their operations, they needed to move ahead with technology which can give them real-time data and a full view of their services and internal operations.

The councils have begun to collaborate on a single technology platform – giving them both access to best of class digital solutions while sharing the costs of implementation and maintenance. The collaboration

will allow both councils to streamline their operations, reduce costs and provide more efficient and effective services for their citizens. There is also scope for other authorities to join in the collaboration to gain richer services and lower operating costs.

### **An engaged workforce to improved productivity – Essex Fire and Rescue Service**

Protecting the lives, property, and environment of 1.74 million people; the Essex Fire and Rescue Service has a lot on its shoulders. One of the largest county fire services in the United Kingdom, its service area contains every conceivable high risk from oil and gas terminals to a power station, 2 airports, docks, and many more. So maintaining current and accurate information about staff, stations, and training is crucial.

By transferring their system to a unified IT platform, Essex Fire and Rescue was better able to manage training, events, scheduling, payroll, and personnel records. Centralised data and self-service tools helped staff manage personal information and get their jobs done more quickly. The implementation resulted in major savings of more than £1m year over a year. The final result is less HR paperwork for everyone, leaving more time to focus on keeping the people of Essex safe and secure.

What is consistent across each of these examples is the need for local government to find ways of doing more with less while also flexing to the expectations and needs of citizens and businesses. By reimagining traditional models in innovative ways, local governments can do just this – improving services and building stronger communities often by fostering new partnerships and collaborations. ■

.....  
**Darren Hunt**

**Director of Public Sector**

SAP

<http://go.sap.com/index.html>

[www.twitter.com/SAP](http://www.twitter.com/SAP)





# Holding down the public sector fort

Gerry Kelliher, EMEAR Sales Director, Kodak Alaris outlines how digitisation is transforming the public sector and lifting the paper weight its been carrying...

**T**he public sector is inherently weighed down by paper. From internal government processes to medical records (which costs the UK government millions annually) and benefit management, paperwork is an intrinsic part of public sector services. However, as the world moves in a digital direction, paper is becoming a less practical and more costly medium for government. The need to store an ever-growing amount of data, provide information quickly and efficiently, while on a budget, is resulting in an increasing need to go paper-free.

The sector is well aware of the need to revolutionise. To start, the public sector has been focusing on redesigning its services using digital advancements to transform the delivery of vital services as part of a government-led digital transformation initiative.

This digitisation has created a public that expects all of these services to move seamlessly – in real-time. They

want convenience, flexibility, manageability and customised experiences. To deal with this, many public sector organisations are looking to move to 'digital by default'. For example, the NHS is working towards a deadline to be paper-free by 2018, in order to make savings of £44bn.

The whole sector, not just healthcare, is looking to enhance citizen experiences – all the while improving staff productivity and reducing operating costs. These are just some of the many motivators for public sector organisations to make the move to digital documentation by using computerised forms and tablets instead of physical paper.

## **Pesky paper weights**

Although the public sector is embracing the benefits going digital will bring, it still faces many challenges in removing these pesky paper weights from their vital services:

### Existing systems

The structure of existing processes within the public sector is itself a challenge to overcome. Organisations and services need to truly understand how these pre-existing arrangements actually operate, in order to take steps to fix them. In the UK, many were quick to criticise the government's 'Connecting for Health' initiative for neglecting to understand current systems ahead of creating new ones.

### Budget

Spending within the public sector does not come without scrutiny. By May 2016, the current public sector deficit, excluding public sector banks, was £7.84m<sup>1</sup> – the pressure is on for these agencies to cost-effectively drive change, while also facing future budget cuts. This impacts all aspects of the digitisation process and can be a challenge in implementing new, costly technology.

### Security

With security breaches becoming increasingly common, it is important now more than ever to ensure data is as secure as it can be. In 2015, an East Sussex woman<sup>2</sup> found the details of Conquest Hospital patients on a USB behind the hospital. Thinking it was someone's precious holiday photos or important information, she was shocked to discover this was patients' private data records. Once this data is digitalised, keeping it as secure as possible is a top priority through methods such as passwords, digital signatures and encryption.

Although these may seem like huge hurdles, they are certainly not insurmountable. For much of the public sector, the solution lies in applying suitable document management. Traditionally speaking, document management services are about reforming processes, removing paperwork and improving communication and data flow. There are many other additional benefits in terms of digitisation and budget.

### Time to lift those weights

For the public sector, the document management solution implemented must be able to capture, organise, share and store billions of pieces of paperwork that already exist. Breaking this daunting process down to 2 simple steps can make this a more manageable weight to lift:

### Document entry

Digitising paper documents as easily and speedy as possible is the top goal for digital document entry. Manual data entry is inclined to error as people are likely to make mistakes along the way, resulting in poor data quality. It is key for the public sector to automate where possible and ensure that its trusts and agencies are utilising the proper solutions by either centralising or distributing scanning solutions.

### Software support

To accompany the digitisation process, it is important to have a solid software solution to support the back-end. With smart solutions that can intelligently sort and direct information correctly, the public sector can capitalise on this, both in terms of time and money.

Digitisation brings huge benefits to the public sector beyond increased efficiency and cost savings estimated to be over \$1 trillion<sup>3</sup>. These vast amounts of data can, such as for the NHS, shed light on problems before they occur and ensure both educational and medicinal remedies are prepared in a timely manner.

The greatest challenge the public sector will face is avoiding becoming lost in the mountains of data as a result of going paper-free, and utilising this to the public's advantage. With document management solutions available that allow for quick, efficient and on-budget productivity, the public sector can take another step in the right digital direction. ■

<sup>1</sup> <https://www.ons.gov.uk/economy/governmentpublicsectorandtaxes/publicsectorfinance>

<sup>2</sup> <http://www.eastbourneherald.co.uk/news/local/east-sussex-patient-details-found-on-usb-stick-1-6802861>

<sup>3</sup> <http://economicgrowthdc.org/work/assets/McKinsey-Public-Sector-Digitization-The-Trillion-Dollar-Challenge.pdf>

.....  
**Gerry Kelliher**

**EMEAR Sales Director**

Kodak Alaris

[www.kodakalaris.com/b2b](http://www.kodakalaris.com/b2b)



# IT fighting the good fight

Mav Turner of SolarWinds highlights how far IT security has come and how nearly 40% of UK companies are more secure than a year ago...

Things are looking up in the world of IT security. As high-profile hacks and lesson-worthy leaks hit the headlines, people are taking their security situation seriously. A [recent survey by SolarWinds](#) found that there has been significant improvements in IT security preparedness and effectiveness among UK public and private sector organisations. More than a third (39%) of organisations are less vulnerable than they were a year ago, compared to the 27% who fear they are more vulnerable. Increased security is also speeding up response times; with almost half (42%) of respondents revealing the time it takes to detect a threat has decreased since 2015.

**“With better security technologies and training principles, public and private organisations are ensuring they are better protected for the future.”**

So where are these improvements in security posture coming from? Among those who said their organisations are now less vulnerable than they were a year ago, the top 5 reasons reported were:

## 1. Improved patch management

Acquiring, testing, and installing multiple patches can be tricky. To get the best from patch management, organisations are relying on software that notifies of newly available patches. Good patch management also means good documentation; document the entire process following every successful deployment – this will simplify and streamline subsequent patches. Automated tools can speed up deployment, saving time by simplifying patch management on servers/workstations.

## 2. Implementation of configuration change management, alerting and approval tools

By managing an NCCM solution, organisations are able to avoid mistakes and other incidents that could have easily been prevented with the right technological tools. In the past, network changes and configuration practices required distinct knowledge of network devices, command line interface (CLI) scripting and long hours of often-tedious work. By adding this the tool kit, network changes and configurations can be nearly effortless in terms of deployment and upkeep.





passwords. This allows IT pros to take the burden off the user and keep the system secure.

With better security technologies and training principles, public and private organisations are ensuring they are better protected for the future. Seeing higher adoption of these tools into your security program is a positive sign the industry is moving in the right direction. However, it's important for IT professionals to never get too confident in their organisations' security posture, as this can potentially result in overestimating one's defences.

**“A recent survey by SolarWinds found that there has been significant improvements in IT security preparedness and effectiveness among UK public and private sector organisations. More than a third (39%) of organisations are less vulnerable than they were a year ago, compared to the 27% who fear they are more vulnerable. Increased security is also speeding up response times; with almost half (42%) of respondents revealing the time it takes to detect a threat has decreased since 2015.”**

After all, the findings illustrate how high the stakes are – while less than one-third of UK organisations experienced a security breach in 2015, of those, 77% store potentially sensitive customer data. The IT team needs to ensure it is applying the best principles, tools and training initiatives to protect its organisation and its data. Through a strong IT security posture, both the public and private sectors can reduce the likelihood of organisations becoming victim to a headline grabbing security threat. ■

.....  
**Mav Turner**  
**Head Geek**

SolarWinds  
[www.solarwinds.com](http://www.solarwinds.com)  
[www.twitter.com/solarwinds](https://www.twitter.com/solarwinds)

### 3. Adoption of intrusion detection and prevention systems

Knowing what is happening within your organisation is key to staying on top of your security. Intrusion detection and prevention systems (IDS / IPS) that monitor network and/or system activities for malicious activity can help to identify and stop malicious activity.

### 4. Implementation of security analytics solutions, such as security information and event management (SIEM) tools

Monitoring and log analysis tools are also key to knowing what is happening within your organisation's security posture. SIEM tools provide real-time analysis of network hardware and applications which correlate to actionable events.

### 5. Implementation or improvements to an identity management system

Identity management systems can help IT pros know who has authorisation and access to their systems and networks to better control security and manage a central database without needing a long list of system

# Harnessing new technologies for the defence sector

Professor Neil Stansfield, Quantum Programme Strategic Lead at The Defence Science and Technology Laboratory, explains how new technologies such as cryogenics are making game-changing impacts in the Defence sector...

**T**raditional cryogenics has long had an important role in defence and security. A wide range of instruments for remote sensing require cryogenic cooling, for instance in forward looking infra-red cameras and sensors. Nuclear Magnetic Resonance spectroscopy, used for the understanding and identification of materials, relies on superconducting magnets cooled by liquid helium. Cryogenic fuels (especially liquid hydrogen and oxygen) are commonly used propellants for space vehicles to launch satellites into orbit and liquid nitrogen is used in the transport of large quantities of food to regions like areas requiring humanitarian aid.

Whilst these interests remain, a new area of harnessing the “super-cold” has opened up, with significant implications for our defence and security capability based on quantum technology: “cold atoms”.

Within the Ministry of Defence we put a significant focus on assessing how new technologies are expected to have game-changing impacts for UK defence and security. The potential to use quantum technologies was identified a number of years ago as having the possibility to open up entirely new capabilities for defence and security in a range of areas, including timing, navigation, and sensing. This could be the second ‘quantum revolution’ - following that from the first half of the 20th century, which eventually produced technologies such as miniature integrated circuits in computers and application specific chips, superconductors, lasers, nuclear energy, thermal imagers and digital cameras.

Many of these new quantum technologies are based around ultra-cold atoms cooled with lasers. By confining a small number of atoms in a magneto-optical or optical dipole trap and scattering laser light off the trapped

atoms, detuned from an optical resonance in the atom, we can almost eliminate their momentum in the rest frame of the trap resulting in clouds of atoms at a temperature of tens to hundreds of micro-Kelvin. A new way of super-cooling. The original work on cold atoms resulted in the 1997 Nobel Prize in physics. Once atoms are cooled to these temperatures, interactions of these ultra-cold atoms with their environment can be interpreted using quantum physics to make possible some brand new capabilities.

At their lowest energies the atoms become the coldest known bodies in the universe and move extremely slowly, a few millimetres per second compared to about 1.9 km/sec for H<sub>2</sub> at room temperature. Therefore they are highly sensitive to changes in the local magnetic and gravitational field. Their lack of movement also makes them ideal for atomic clocks, which utilise the ultra-regular absorption and release of radiation by their electrons during energy shifts, as a highly accurate pendulum. Current atomic clocks are limited by the occasional collision of atoms within the clock. Laser cooling the atoms until they are nearly stationary significantly reduces this effect.

Since this early identification of the possibilities of quantum technologies, the Ministry of Defence has built a significant exploitation programme to harness the UK’s world leading capability in quantum technologies, with a specific focus on cold atoms.

An investment of £270m in quantum science by the UK government was announced in the 2013 [Autumn Statement](#) to support significant UK research activity. The launch of 4 [Quantum Technology Hubs](#) at UK universities was announced to explore the properties of quantum mechanics and how they can be harnessed for use in technology. In May 2014, the Defence Science

“Within the Ministry of Defence we put a significant focus on assessing how new technologies are expected to have game-changing impacts for UK defence and security.”



and Technology Laboratory (Dstl) and the [National Physical Laboratory](#) showcased some of the [new quantum technologies](#), which are expected to give greater resilience and better performance in positioning, navigation and timing than traditional alternatives such as GPS or conventional inertial navigation systems. Now in 2016 we have a national UK quantum technology programme of around £350m over 5 years, 10% of which is invested from the Ministry of Defence's research programme.

Whilst there are some significant obstacles, it's exciting to see how well placed the UK is on the global stage to address the significant technical and systematic challenges that remain in commercialising quantum technologies and accelerating exploitation.

The potential impact of quantum technology on military activities could be significant – bringing the accuracy of a submarine's navigation under the oceans (denied of GPS signals) from kilometres to hectometres, allowing individual soldiers underground or in buildings to know where they are to within centimetres or to use electric field or gravitational sensing to look underground or through walls to identify hidden adversaries or subterranean tunnels.

Currently, Dstl is conducting research with university and industry partners focussing on increasing optimal performance, investigating miniaturisation procedures and looking at the potential use of new technologies. With the first prototypes due to be demonstrated over the next few years, this could provide new options for the conduct of defence operations in the future.

The defence industry often acts as a pioneer in the development of new technologies and the UK is bringing about a new technological revolution in timing, navigation and sensing that could revolutionise military, defence and civilian operations. ■



**Professor Neil Stansfield**  
**Quantum Programme Strategic Lead**

Defence Science and Technology Laboratory (Dstl)  
[www.gov.uk/dstl](http://www.gov.uk/dstl)  
[www.twitter.com/dstlmod](https://twitter.com/dstlmod)



# Cryogenic technologies for precision tactical and space applications

Peter Iredale, Engineering Lead at Honeywell Hymatic

**H**oneywell Hymatic has been at the forefront of cooling technology for infrared and sensing applications for over 50 years. Operating in some of the most demanding environments, Honeywell technology increases reliability and efficiency, whilst enabling missiles, satellites, fighting vehicles, underwater weapons and submarines to more effectively and accurately complete their missions.

Through our expertise in Joule-Thomson cryogenic coolers, linear Stirling cycle cryocoolers and compressors and extensive knowledge of long life stored energy technologies, Honeywell offers customers an integrated solution for their cooling requirements. From our dedicated cryogenic facility, we provide a bespoke manufacturing service and a responsive aftercare infrastructure to support through the lifecycle of the product.

## Joule-Thomson Cryogenic Coolers and Stored Energy Gas Systems

Joule-Thomson (J-T) coolers remain the simplest, lightest and easiest technology for cryogenic cooling across a wide range of IR sensor applications, employed in numerous global missile programmes such as, Javelin, StormShadow and ASRAAM. They provide rapid, accurate cooling, within tight space envelopes.

We offer a variety of J-T coolers that can optimise gas consumption, resulting



*Joule-Thomson Cryogenic Coolers and Stored Energy Gas Systems*

in more efficient operation. Complementary to this are our stored energy products that provide fuel for the J-T coolers and can utilise a variety of gas species, dependant on requirement, throughout their typically extensive 25 year life cycle. These gas systems can often include various gas management ancillaries that control flow rates under varying ambient pressures (altitudes), temperatures and other complex environmental requirements often akin to tactical/airborne applications.

What this ultimately provides is a complete solution for cooling, gas supply and management of gases for the intended application regardless of the environmental complexities customers are often faced with.

## Linear Stirling cycle cryocoolers

Designed for use in high duty applications for continuous use as a replacement for legacy cooling systems, the Linear Cryocooler offers a significantly

extended life and enhanced levels of performance.

Honeywell's Linear Cryocoolers incorporate unique, patented technology from the development and industrialisation of an Oxford University design concept. This patented technology, born out of the need for extremely high reliability for space applications, offers superior durability to traditional tactical Linear Cryocoolers.

Designed to 'fit and forget' standards, the system uses a non-contact dynamic sealing of the internal working gas, coupled with a high reliability linear electric drive, which has been proven to deliver over 120,000 hours of constant, maintenance-free operation.

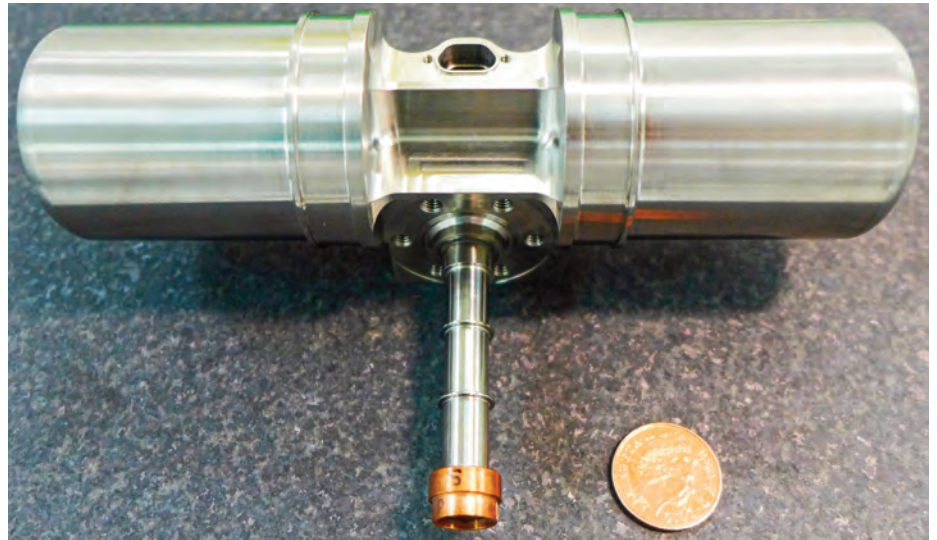
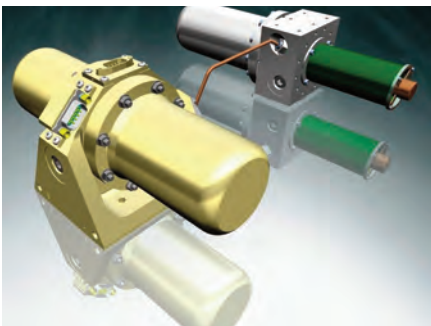
Due to their durability, reliability and military-grade performance, 85% of US long life flexure bearing Linear Cryocoolers in orbit on satellites today contain Honeywell Hymatic hardware. Other potential applications include:

## PROFILE

- Extended operation cryogenic sensor cooling requirements;
- High efficiency compressors for space applications;
- High reliability/durability sensor cooling – radio isotope detection systems;
- Power generation for forward outposts.

### **Future developments and forging relationships**

Under a General Support Technology Program (GSTP), funding from the European Space Agency (ESA), a consortium of Honeywell Hymatic, Rutherford Appleton Laboratory (RAL) and Thales Alenia Space UK are now working on the next generation of long life Linear Space Cryocoolers for Europe. Cryocoolers such as these are critical to future Earth observation missions where the need for high resolution IR sensing needs to be balanced carefully against the satellite payload size, weight and efficiency. ESA identified the need to push technology of Cryocoolers with respect to size, weight and efficiency after benchmarking US Space Cryocoolers as world leading, including those supplied by Honeywell. The program, currently at its mid-point of a 3 year schedule, promises to deliver engineering qualified units to ESA that will be market leading within Europe, with respect to low mass/size and high efficiency, whilst maintaining the long life heritage required for said applications.



Our relationship with RAL is yielding further development of products for tactical/commercial applications. The Cryogenics team at RAL has a long established heritage in the field of long life Space Cryocoolers, working with ESA and the UK Space Agency. Recently RAL have been developing a Small Scale Cryocooler for use in miniature space satellites, pushing the space envelope ever smaller. Honeywell Hymatic, seeing an opportunity with this design, has taken the technology and is applying our manufacturing techniques to ensure a version can be produced for tactical and commercial IR applications without the high costs traditionally associated with space applications. However this does present an opportunity for space applications in the respect that a Cryocooler may be taken from a standard production run, and with a minimal increase in testing and quality control, supplied to a space customer for a much reduced cost over traditional Space Cryocoolers. The key with this philosophy is sustainability of source product and their manufacturers. The space market represents very low quantities of product per annum, whereas the volumes for tactical/commercial coolers are far greater and often the technology cannot read from one

to the other. This is a dichotomy that Honeywell Hymatic is working to break with the Small Scale Cooler.

Honeywell Hymatic employs a dedicated team of specialised engineers and technicians with a combined experience of more than 300 years in cryogenic products. We continue to invest in developing leading-edge technology, working in partnership with our customers, to offer effective solutions based on our mission proven expertise.

For more information on our full product range, please visit our website: <https://Aerospace.honeywell.com/cryogenic-cooling>

To speak to one of our sales or engineering team, please feel free to contact us on the details below.

# Honeywell

**Peter Iredale**  
**Engineering Lead**  
Honeywell Hymatic  
Tel: +44 (0)1527 64931  
[Redditch.Sales@Honeywell.com](mailto:Redditch.Sales@Honeywell.com)

# Advancing technology – keeping our airports safe

With the amount of terror attacks taking place globally in recent months, it is safe to say that the importance of effective aviation security is at an all-time high. Here, James Kelly, Chief Executive of the British Security Industry Association (BSIA), discusses some of the key elements involved in protecting our airports...

Perhaps one of the most important aspects of airport security is detecting illegal or dangerous substances in bags, freight and people. While 9/11 resulted in a much more heightened level of security for passenger planes, the cargo plane bomb plot back in 2010, in which Al Qaeda had planted bombs disguised as printer cartridges on board US cargo planes, including one which was departing from East Midlands airport, also called for far more stringent measures in freight security as well. Nowadays, x-ray systems are not just used on baggage, but also on people and vehicles. New x-ray technology means that vehicles can be inspected for illegal goods including weapons, drugs and even bombs, without having to be manually searched. This technology has found its place at seaports as well, helping to keep a close eye on freight moving in and out of the country.

In terms of people, full body x-ray systems have also been introduced to airports around the globe in recent years. Unlike metal detectors, these scanners can detect non-metal objects and provide security guards with a comprehensive full body screening, without the need for physical contact. That being said, manual searches, when carried out properly, are still an effective aspect of airport security, particularly in helping identify illegal or dangerous items. Noting the sensitivity and importance of maintaining professionalism during a search, last year the BSIA's Police and Public Services Section created a 'Code of Practice for Security Searches'. The code, while not compulsory, provides good practice recommendations for the conducting of searches by personnel employed to ensure the security and safety of property and persons, to prevent entry into an area of restricted items and to locate prohibited and dangerous items. The code places emphasis on the importance of addressing concerns of safety whilst



**James Kelly**  
**Chief Executive**

maintaining the respect of individuals, something that is essential in a busy airport environment.

## UAVs – an emerging threat

One aspect of modern day technology that can compromise an airport's security is that of Unmanned Aerial Vehicles (UAVs), commonly known as drones. Faraz Nasir, Head of Intelligence and Advisory Services for BSIA member G4S Risk Consulting, explains: "the evolving capabilities and functions of UAVs have resulted in a series of incidents over the past year, ranging from hostile reconnaissance to endangering commercial flights" and "the rise in UAV ownership and competitive costs have opened up the potential for hostile uses." Drones are used by a range of people, including the military, media and hobbyists and can pose serious threats to aircrafts, being more dangerous than a bird strike. Their small size and manoeuvrability, along with their HD camera capabilities, mean that they could be employed for hostile reconnaissance or could even carry dangerous explosive devices. As such, it is vital that airports employ effective perimeter security in order to detect these drones as early as possible. Perimeter security is often seen as the first line of defence, whether it is physical in terms of fences and barriers, or electronic, such as





of sensors and audio visuals. At present new technology is being created and tested in order to specifically target the emerging threat of UAVs.

### The importance of development

Another feature of security that has continued to develop and improve is that of CCTV. Over time, important lessons have been learned about the capabilities of CCTV and their accompanying video analytics, helping to better manage end user expectations and deliver positive results. The wide scope of Video Content Analytics (VCA), which theoretically allows any action that can be seen and accurately defined on a video image to then be automatically identified by a VCA system, has led to its deployment in a range of applications including intruder detection, people counting and smoke and fire detection. With regards to airport security, one function that is extremely useful is 'object left/object removed.' Object left refers to the identification of an unattended item, which left in an airport could pose a serious threat. It is therefore crucial for security professionals to make the assertion as to whether there is an innocent explanation or if the

item is indeed suspicious, resulting in an evacuation of the immediate area near the article. Object removed allows CCTV operators to be notified regarding the offending object, allowing for its removal and the restoration of public order.

With the landscape of airport security ever changing, and technology continuing to evolve, one thing remains paramount – the importance of quality. It is absolutely essential that airports are sourcing their products and services from a reliable supplier who meets with the relevant British and European standards. Members of the BSIA are all inspected to these standards and offer a reputable service, to find out more visit <http://www.bsia.co.uk/> . ■

---

### James Kelly Chief Executive

British Security Industry Association (BSIA)  
<http://www.bsia.co.uk/>

# The Customs X-Ray Simulator

## A new platform for cargo X-ray image interpretation training

The development of transportation and information technology has advanced the interconnectedness of global markets. With this global economic integration, new trade partners, shipping and transport routes emerge. The weight of goods carried by heavy goods vehicles (HGVs) to or from the UK alone amounted to 1.63 billion tonnes between October 2014 and September 2015 (UK Department for Transport, 2016). The number of main freight units handled by major ports rose to 12.8 million units (UK Department for Transport, 2015). Similar growths in freight units are being reported by other European transport hubs.

The growing cargo traffic requires efficient inspection procedures. Hence, shipments passing checkpoints are risk profiled by the Customs Administrations to identify inconsistencies between declared and transported goods, illegal material, and threats to society.

For this reason, the Center for Adaptive Security Research and Applications (CASRA) has developed a new platform for cargo X-ray image interpretation training, called the Customs X-Ray Simulator. This test and training system was specifically designed for cargo X-ray screening officers by computer scientists, psychologists and security experts of CASRA in close collaboration with customs organisa-

tions funded by the EU 7<sup>th</sup> Framework project ACXIS.

This article explores aspects of the daily work routines of cargo X-ray screeners, identifies the challenges in the process and explains how training with the Customs X-Ray Simulator may improve the screening competency of customs officers. Besides the practical implications, the subchapters ahead also provide an inside look into the scientific research behind computer-based training, the ACXIS project and the Customs X-Ray Simulator.

### **The customs X-ray screening process**

Most borders and ports now use X-ray screening for unit load devices (ULDs) and containers to identify smuggled items and security threats. This technology is particularly useful as it provides an image of the shipped content without the need for physical interference. The truck is being sent through an X-ray scanner, after which the scanned image is analysed by the operator. Only if a further investigation is needed, the shipment is put aside for manual inspection. Taking the decision whether the freight carrier is clear or not is a difficult task since the inspected ULD can be rather large in scale while the prohibited items can be comparably small (e.g. pills, bricks of cocaine and (chemical) precursors to drugs). Adding to the matter of differences in scale, there are additional

elements that need to be taken into consideration: The variety in texture and composition of the goods themselves, the packaging of the products, the types of vehicles used to transport the freight. Each of the following freight categories poses these unique challenges to the screening process:

- Liquid bulk: Such as oil and liquefied gas.
- Dry bulk: Such as agricultural products, minerals and coal.
- General cargo: Includes common trade goods as well as forestry, iron and steel products.
- Ro-Ro traffic: A term for roll-on, roll-off cargo which is driven on and off the vessel by a motorised vehicle.
- Lo-Lo traffic: A term for lift-on, lift-off shipping containers, craned on and off the vessel.

Another key aspect in the screening process is identifying whether the load matches the information on the waybill. Differences in the types of goods, as well as the amount of goods listed must be compared to the actual shipment, as inconsistencies may have an impact on the taxation.

For all these reasons, investigating cargo goods may take anywhere from minutes to a few hours. On that

account, how do customs officers cope when faced with such challenging tasks? What influences their screening performance?

### **Two important detection performance factors**

Knowledge-based and image-based factors have a large impact on human detection performance (Schwaninger, Hardmeier and Hofer, 2005). Knowledge based factors relate to knowing which items are prohibited or not and/or match the waybill, what they look like in X-ray images and how they can be distinguished visually. They are especially relevant for objects that are rarely seen in everyday life and that look quite different in an X-ray image (e.g. contraband goods and Improvised Explosive Devices, so called IEDs). Image-based factors refer to characteristics of X-ray images. Objects are more difficult to recognise if depicted from an unusual viewpoint, when superimposed by other objects or if the load is heterogeneous and complex.

### **Mastering cargo X-ray screening by adopting airport security training**

Adaptive, computer-based training (CBT), which contains training levels based on the user's individual detection performance and learning progress, has shown to be very effective in strengthening X-ray image interpretation performance in cabin and hold baggage screening at airports. The abilities to cope with effects of viewpoint, superposition and image complexity are also important in cargo X-ray screening and may be

taken into account when recruiting officers.

### **A study on the competency of cargo X-ray screeners**

As an example of training evaluation in the domain of cargo X-ray screening, a study investigated whether a customised CBT can improve the X-ray image interpretation competency of cargo screeners (Michel, Mendes, de Ruiter, Koomer and Schwanninger, 2014). The X-Ray Tutor (XRT) training system, developed by CASRA, was adapted to fit the needs of cargo X-ray screening for the study. The results of the study revealed significant increases in detection performance for screeners having trained weekly using the C-XRT (a test version of the Customs X-Ray Simulator). In addition, a decrease in the average inspection time per image was revealed for the second measurement of the C-XRT group as a result of training.

### **The EU funded ACXIS project**

As important as frequent training, is the creation of a platform where information can be shared nationwide with other customs sites. Because of that, standardising X-ray images recorded from different models of X-ray machines is crucial.

ACXIS (Automated Comparison of X-ray images for cargo scanning) is a research project funded by the European Union, under the 7<sup>th</sup> framework Program. The aim of the project is to promote scientific research and development by combining different partners with complementary expertise

for improving cargo X-ray screening. ACXIS researchers, including CASRA, work on establishing a unified X-ray image standard. X-ray data that has been converted into a standardised format can be stored in a database which may be shared with other sites. This manufacturer independent reference database is filled with over 30,000 X-ray scans from a large variety of containers and trucks provided by custom organisations and processed by CASRA.

ACXIS also develops Assisted Target Recognition (ATR) methods to automatically detect regular and illicit goods through dedicated algorithms. The impact of the ATR method, as well as the impact of a systematic computer-based training for cargo officers on their performance, is assessed through a validation study. Final results and publications are expected by early 2017.

### **The Customs X-Ray Simulator**

Combining scientific results from the CBT studies and the algorithms used to unify X-ray images for ACXIS, CASRA has developed a training system called the Customs X-Ray Simulator. This new platform can be used for training purposes and/or evaluating the X-ray image interpretation competency of cargo customs officers by simulating operational reality.

The navigation on the software suite requires no prior knowledge. Due to the high degree of individualisation, new procedures may be integrated into test units quickly and comfortably.



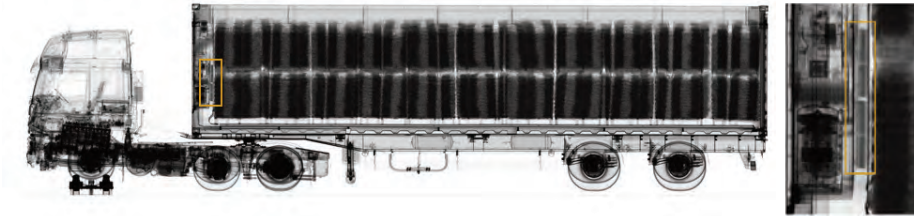


Figure 1: A user interface of the Customs X-Ray Simulator showing an X-ray image of a container with smuggled drugs hidden behind the cooler, marked by the object-specific assist frame

### Creation of own content

The Customs X-Ray Simulator is divided into libraries, modules and series. The content manager is able to create customised image libraries by uploading their own material, e.g. X-ray images, scans of waybills and/or manually added information from the waybill. These libraries may be used to create test and training modules that can be bundled into series and assigned to certain persons or groups of personnel, with the option to allow access for a designated period of time.

For example, series A contains objects hidden between pallets in the container, whereas series B contains objects attached to the walls and the cooler of the ULD (Fig. 1). If an increase in frequency of one of the two smuggling methods is being registered at a specific border, series A or B can be assigned to the staff of the affected checkpoint for training purposes. New cases can also be uploaded to the library and allocated to the corresponding module. The images and case specific information may be exchanged with other national customs agencies on a centralised database.

Furthermore, it is possible to create individual information slides or slide

blocks to launch or conclude a simulation and provide theoretical background knowledge (Fig. 2).

### Simulator for computer-based training

During training, it is important to expose users to a broad variety of X-ray images depicting prohibited objects from different angles in order to improve their image interpretation competency and object recognition. The interface of the Customs X-Ray Simulator features a variety of supportive functions. In addition to the zoom function, the object-specific assist frame (Fig. 2) is designed to

draw attention to possible smuggling goods inside the cargo. Also available to the test user is the button “Waybill”, which displays a list of additional information and/or a scanned copy of the waybill documents. Along with this, integrated are following image enhancements to mimic real-work-conditions:

- NEG: Creates a “negative” of the image;
- SEN: “Super Enhancement”, increases the contours;
- LOW LUM: “Low Luminosity”, reduces the brightness;
- HIGH LUM: “High Luminosity”, increases the brightness;
- B/W: “Black/White”, displays the image in grey scales;
- PSEUDO COLOURS: Colours the image, 4 available colour schemes.

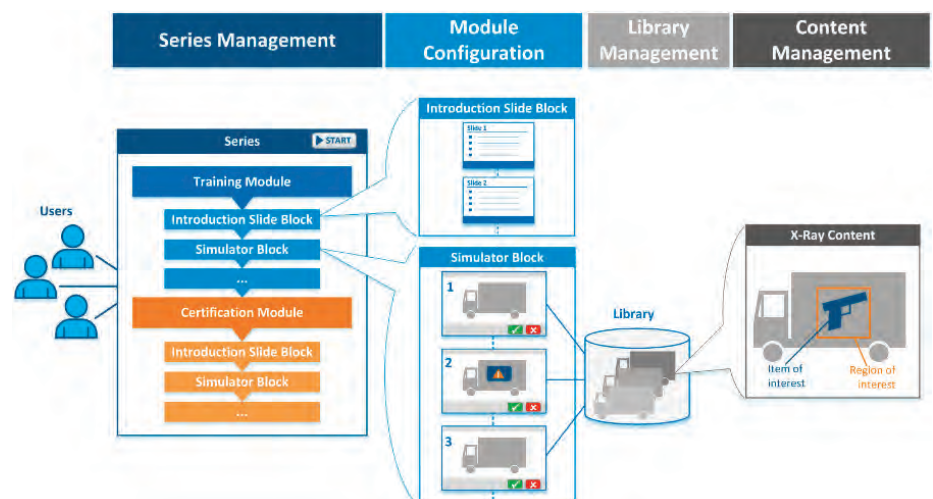


Figure 2: A content management overview of the Customs X-Ray Simulator software

## Immediate feedback

When a screener correctly reports that an X-ray image contains an item that does not match the waybill and/or is prohibited, the response is counted as a hit. If an incorrect answer has been given, the response is categorised as a false alarm. The customs screening officer is presented with trial feedback after each image and a block feedback after he or she completes a training session. In the trial feedback window the photograph, X-ray image, the training time and further details of the simulated scenario can be examined (Fig. 3).

## Administration and reporting functions

Thanks to the administration functions, users can be monitored and managed easily. New user accounts can be swiftly imported via templates and organised in user groups. The reporting functions provide the administrator with overviews of each user's training, test behaviour, and results. Reports may be exported for further data analysis.

## Centralised database

X-ray images, information from the waybill, registration documents, and customised tags can be uploaded on to the shared database. The application architecture supports fully web-based clients by using HTML5 and AngularJS. The software can be used on-premises, by installing it on a server, located on the customs administration's premises. In this case, the configuration data and the user's results are stored on a local centralised database. This option enables



Figure 3: Display of the feedback feature on the interface of the Customs X-Ray Simulator training program

the nationwide review and exchange of images and information between different customs sites.

In the future, Customs Administrations from different nations will be able to extend their knowledge worldwide by operating on a shared database of valid, standardised, high quality images.

As shown throughout this article, scientific results have demonstrated that there is large potential for improvement in cargo X-ray screening. The use of a computer-based training, such as the Customs X-Ray Simulator, can significantly improve the detection performance of customs screening officers. Not only allows this new platform the exchange of knowledge, experiences and information relevant for successful image interpretation, but it also positively impacts the real, day-to-day work of customs

officers by enhancing their visual knowledge of X-ray images.

UK Department of Transport. (2016). *Road Freight Statistics: United Kingdom October 2014 – September 2015*. Retrieved from [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/522637/road-freight-statistics-oct-2014-sep-2015.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/522637/road-freight-statistics-oct-2014-sep-2015.pdf)

UK Department of Transport. (2015). *UK Port Freight Statistics: 2014*. Retrieved from [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/465439/port-freight-statistics-2014.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/465439/port-freight-statistics-2014.pdf)

Schwaninger, A., Hardmeier, D., & Hofer, F. (2005). Aviation security screeners' visual abilities and visual knowledge measurement. *IEEE Aerospace and Electronic Systems*, 20(6), 29-35.

Michel, S., Mendes, M., de Ruiter, J., Koomen, G., & Schwaninger, A. (2014). Increasing X-ray image interpretation competency of cargo security screeners. *International Journal of Industrial Ergonomics*, 44, 551-560.



## Alexander Flisch Project Coordinator

Empa – Swiss Federal Laboratories for  
Materials Science and Technology  
Tel: +41 58 765 4567  
[alexander.flisch@empa.ch](mailto:alexander.flisch@empa.ch)  
[www.empa.ch](http://www.empa.ch)  
[www.acxis.eu](http://www.acxis.eu)

## Diana Hardmeier Director

CASRA – Center for Adaptive Security  
Research and Applications  
Tel: +41 43 363 0101  
[info@casra.ch](mailto:info@casra.ch)  
[www.casra.ch](http://www.casra.ch)



Image Courtesy of Swiss Federal Customs Administration (FCA)

# Automated Comparison of X-ray Images for cargo Scanning (ACXIS)

[www.acxis.eu](http://www.acxis.eu)

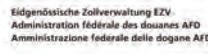
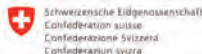
## Improving border inspection procedures for cargo transports

The increasing volume of trade combined to a broad variety of risks brings the necessity to improve the inspection procedures. In cargo inspection, the X-ray screening plays an important role and in this framework the ACXIS project aims to increase the performance in terms of detection but also in terms of throughput, for existing and future facilities or mobile scanners. New automated analysis algorithms and a manufacturer independent reference database are the core of the developments of this project. Combined with a new training platform for screening officers, these developments will contribute to a quantifiable progress in the performance of the screening process.

### Contact:

Alexander Flisch  
Project Coordinator  
Empa – Swiss Federal Laboratories for  
Materials Science and Technology  
[alexander.flisch@empa.ch](mailto:alexander.flisch@empa.ch)

Marius Costin  
Dissemination Manager  
CEA LIST – French Alternative Energies  
and Atomic Energy Commission  
[marius.costin@cea.fr](mailto:marius.costin@cea.fr)





# A European response to terrorism

Ard van der Steur, Minister of Security and Justice in the Netherlands outlines how Member States are coming together to work as one, in order to prevent terrorist attacks...

The ISIS-attacks in Paris (November 2015) and Brussels (March 2016) show the vulnerability of European countries to relatively large scale terrorist attacks and illustrate difficulties in detecting terrorist networks and their travel movements on time. The Member States of the EU are faced with a challenge that may not be new, but that is urgent nevertheless: terrorism is not stopped by borders, as preparations to a terrorist attack may very well take place in a country different from the one in which the attack will actually be carried out. To counter this kind of threat, the exchange of information between law-enforcement agencies and intelligence services within Europe is essential.

Under the Netherlands EU Presidency the priority has been to improve the European exchange of information, especially in the field of counter-terrorism, commitment on improving the sharing of information and improving the quality and usability of information and systems. The starting point was a change from need to know to need to share. To get there we have launched new initiatives and strengthened existing ones.

## Threats

The threat of new terrorist attacks in Europe remains a very real one, with various actors (ranging from transnational terrorist organisations to lone actors) and possibilities for both small and large scale attacks. Attacks such as those in Paris and Brussels demonstrate a significant ability of terrorist organisations like ISIS to conduct attacks against the West. The majority of the perpetrators of these specific attacks were most likely trained in Syria. There are a number of indications that ISIS might very order terrorist attacks in Europe again. Other violent jihadist groups that have flourished in the recent instability of the Middle East and Northern Africa, may also be pursuing an international agenda, which increases the threat they pose to Western

interests. Meanwhile, lone actor terrorism – whether it is inspired by violent jihadist or by right or left wing extremism – also remains a current threat to European countries. These are some of the main conclusions of the National Terrorist Threat Assessment for the Netherlands (DTN), which is drawn up by the National Coordinator for Security and Counterterrorism.

**“Europol has played a central role in the European response to terrorist threats. For example, Europol has set up the Counter Terrorism Centre as an enhanced information hub enhanced central information through which the Member States can increase information sharing and operational coordination.”**

## Ambitions

Given the international nature of the terrorist threat it is not enough that our national intelligence – and police-services are functioning efficiently and effectively. Our national security also depends on information from other countries, in particular the EU Member States. This signifies a shift from national security to European security cooperation.

This means that each Member State must find a way to facilitate the sharing of reports of radicalisation and extremism with the police and intelligence-services. Subsequently, there is a need for a system of follow-up in each country, resulting in a tailor-made approach to individual cases of extremism, ranging from preventive care to repressive measures if laws are violated. For the international exchange of information, data needs to be validated and verified and other contexts in which these data could be relevant need to be looked at as well.

Therefore we have strived to realise a further increase



*Ard van der Steur, Minister of Security and Justice in the Netherlands*

in the quality and usability of information and European information-sharing systems, both existing and new ones. Moreover, we are trying to move towards a model in which the performance of Member States concerning information sharing and the use of European and international systems is monitored.

**“The threat of new terrorist attacks in Europe remains a very real one, with various actors (ranging from transnational terrorist organisations to lone actors) and possibilities for both small and large scale attacks.”**

### **Roadmap**

During the Justice and Home Affairs Council of June 2016, all Member States and the European institutions endorsed a roadmap to improve information exchange and use of information, including solutions for interoperability of data systems in the JHA area. This roadmap proposes measures to improve the quality and usability of data and European and international systems

including police, public prosecution services and services responsible for border control.

During the JHA Councils and a number of high official meetings under the Dutch Presidency, we have laid the groundwork by discussing the legal, practical and cultural problems on the one hand, whilst proposing solutions on the other hand. These discussions were followed by deliberations between the Member States and European institutions to discuss the package of agreements. With the endorsement of the roadmap the Member States and EU institutions showed strong commitment to ensure that:

1. All relevant information is shared, unless there are serious legal or operational reasons not to do so; if relevant information is not shared, an explicit explanation should be given. This is monitored by the Council itself, through the Committee on operational cooperation on internal security (COSI) with contributions from the EU Counterterrorism Coordinator and the European Commission;

2. We work on the basis of established principles such as full respect of fundamental rights and data protection rules, the focus on quality and availability of information and the focus on the end user;

3. A number of actions is implemented to further improve cooperation and the quality and usability of data and systems. Such actions include the development of criteria for entering a person suspected of terrorism related activity in the Schengen Information System, the application of a 'marker' for such a person in the Schengen Information System, the strengthening of the Single Points of Contact for the exchange of police-information and the strengthening of the information position of Europol.

### ECTC

Europol has played a central role in the European response to terrorist threats. For example, Europol has set up the Counter Terrorism Centre as an enhanced information hub enhanced central information through which the Member States can increase information sharing and operational coordination. After the Paris and Brussels attacks, a number of countries set up the task force 'Fraternité' within Europol and joint investigation teams to investigate the attacks. Almost 4 terabytes of information have been shared, leading to thousands of notifications and (financial) leads.

### CTG

Finally, the Counter Terrorism Group (CTG) has also played a major role. The CTG is an intelligence-sharing forum between various European states (including Norway and Switzerland), which specifically focuses on counter terrorism intelligence. The security services in the Counter Terrorism Group have set up a platform and database for real time sharing and analysis of operational intelligence, particularly on foreign terrorist fighters. This is a big step. Officers from most European intelligence services are physically co-located in one building and use the same database to share operational intelligence and find connections between

cases. During the last JHA council it was decided that the CTG will be present at future JHA councils if counter terrorism is on the agenda.

**“Given the international nature of the terrorist threat it is not enough that our national intelligence – and police-services are functioning efficiently and effectively. Our national security also depends on information from other countries, in particular the EU Member States. This signifies a shift from national security to European security cooperation.”**

### Conclusion

Good international cooperation in the fight against terrorism naturally begins with a comprehensive national approach. Each individual country in Europe after all has to deal with its own nationals and residents in an appropriate manner. With the adaptation of the Roadmap and the initiatives of Europol and the CTG, we have taken steps to strengthen the political commitment to share all relevant information, monitoring of performance by Member States and improve the quality and usability of data and systems. I firmly believe that this will benefit operational investigations as it allows swift and timely provision of high-quality information to police officers, border guards and immigration officers and other front-line practitioners. I also firmly believe that as a result the security of our all of our citizens will be enhanced. ■

.....  
**Ard van der Steur**

**Minister of Security and Justice**

Ministry of Security and Justice

Government of the Netherlands

<https://www.government.nl/ministries/ministry-of-security-and-justice>





## THE CUSTOMS X-RAY SIMULATOR

A new platform for cargo X-Ray image interpretation training

The development of transportation and information technology has advanced the interconnectedness of global markets. With this global economic integration, new trade partners, shipping and transport routes emerge. In the United Kingdom alone, the weight of goods carried by heavy goods vehicles (HGVs) to or from the UK amounted to 1.63 billion tonnes between October 2014 and September 2015 (UK Department for Transport, 2016). The number of main freight units handled by major ports rose to 12.8 million units (UK Department for Transport, 2015). Similar growths in freight units are being reported by other European transport hubs.

The growing cargo traffic requires efficient inspection procedures. Hence, shipments passing checkpoints are risk profiled by the Customs Administrations to identify

inconsistencies between declared and transported goods, illegal material, and threats to society.

For this reason, the Center for Adaptive Security Research and Applications (CASRA) has developed a new platform for cargo X-ray image interpretation training, called the Customs X-Ray Simulator. This test and training system was specifically designed for cargo X-ray screening officers by computer scientists, psychologists and security experts of CASRA in close collaboration with customs organizations funded by the EU 7th Framework project ACXIS.



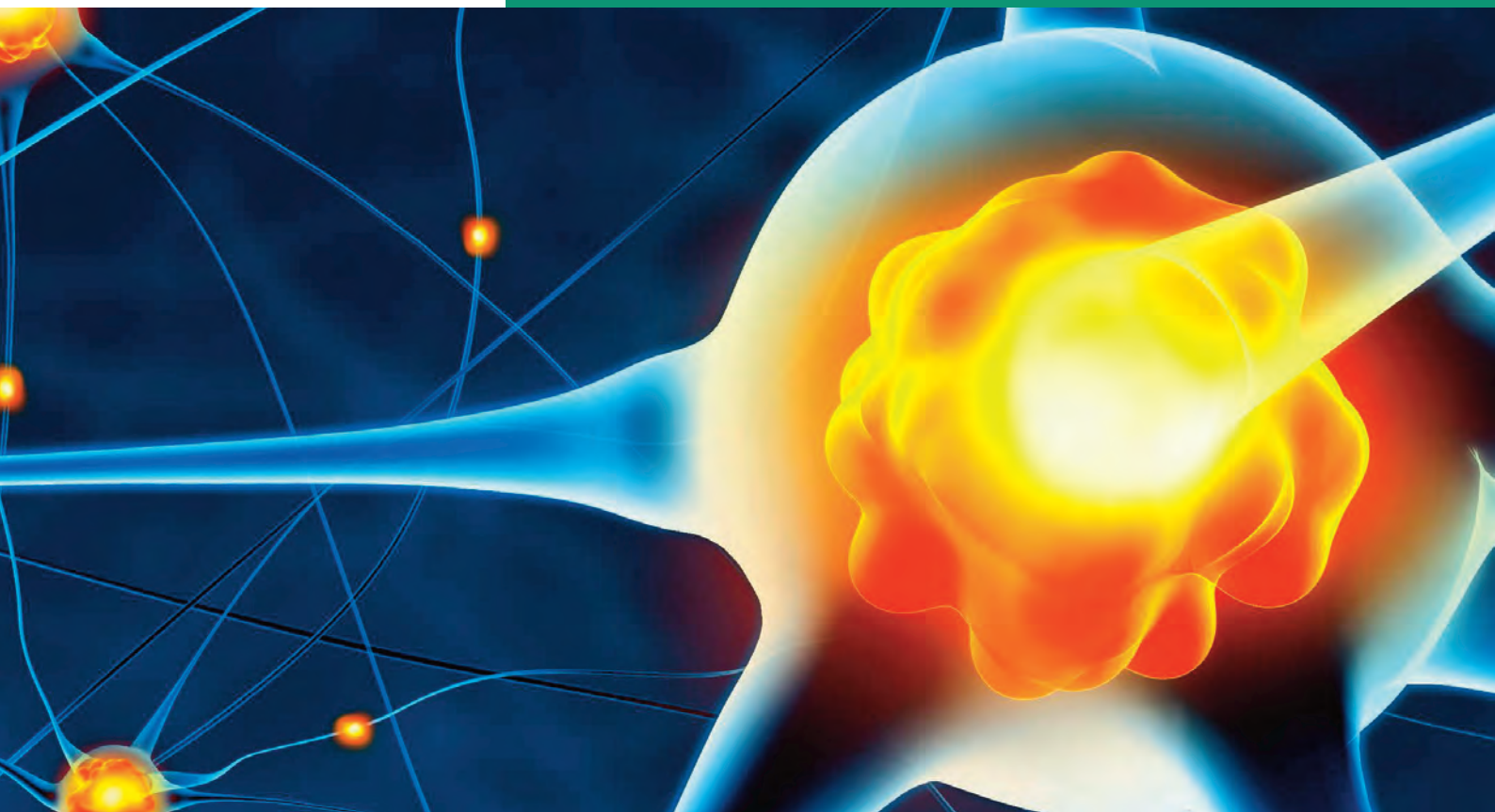


To read the digital ebook

# INDEX

Atomic Information Systems Corp .....	26-27	Life-Edesia Project .....	95-96
BAFE .....	207, 215	LMU Munich, Institut fur Agyptologie und Koptologie .....	93-94
Basque Culinary Center, SiforAGE Project .....	14-15	National Physical Laboratory, EURAMET Project .....	142-143
Biological Control of Pests Research .....	270-271	National Physical Laboratory, METROSION Project .....	144-145
Brock University, Faculty of Social Sciences .....	176-179, 194-195, OBC	National Research Council of Italy, Institute of Atmospheric Pollution Research .....	228-229
Centre for Research Computing, University of Notre Dame .....	158-159	National Research Council, Institute of Clinical Physiology, Gioconda Project .....	84-85
Chalmers University of Technology .....	283-284	National Soil Dynamics Laboratory .....	266-267
Child Memory Lab, Department of Psychology, Wilfrid Laurier University .....	170-171	Nordic Built Active Roof & Facades .....	208-209
Clearbox Ltd .....	221-223	Norwegian Polar Institute .....	230-231
Climate Service Center .....	238-239	Oslo University Hospital .....	76-77
Deltares .....	226-227	Pfalzklunkum fur Psychiatrie und Neurologie Ador .....	42-43
Department of Anatomy and Cell Biology, University of Saskatchewan .....	166-167	Plant Pathology Department, Institute of Agriculture & Natural Resources .....	276-277
Department of Biological Chemistry, The Hebrew University of Jerusalem .....	124-125	Power on Connections Ltd .....	298-299
Department of Chemical and Biological Engineering, University of Sheffield .....	138-139	Professor Colin J Suckling, University of Strathclyde .....	55-57
Department of Emergency Medicine, BRIPPED Project .....	18-19	QuantlC .....	134-135
Department of Geomatics Sciences, Laval University .....	200-201	Recyctec Holding AB .....	246-247
Department of Geosciences, University of Fribourg .....	232-233	Renaissance Computing Institute, University of North Carolina at Chapel Hill .....	236-237
Department of Linguistics, McGill University .....	164-165	School of Social Sciences, The University of Manchester .....	154-155
Department of Molecular Biosciences, The Wenner-Gren Institute .....	64-65	South Karelia District of Social & Health Services .....	82
Department of Nursing & Indigenous Studies, Cape Breton University .....	182-183	The City of Varberg .....	IFC, 216-217
Department of Orthopaedics, Balgrist University Hospital .....	22-23	The Lin Brain Lab, University of Kentucky .....	36-37
Department of Paediatrics, University of Illinois at Chicago, College of Medicine .....	78-79	The Rolls Royce University Technology Centre, College of Engineering .....	136-137
Department of Psychology, University Du Quebec at Trois-Rivières .....	162-163	The University of Texas Health, Science Center at Houston .....	68-69
DEWI Project .....	316-318	UCB .....	34-35, 88-89, IBC
Dr Kevin J Flint .....	192-193	UCL Institute of Child Health .....	152-153
Dublin City University .....	99-100	UERRA Project, SMHI .....	285-286
E3 Modelling .....	294-295	Universidade Católica Portuguesa .....	117-118
EMPA-ACXIS Project .....	336-340, 344-345	Universite Lille .....	121-122
ETH ZURICH .....	204-205	University of Alberta .....	72-73
EUREX Project .....	103-104	University of Kassel, Faculty of Organic Agricultural Sciences .....	260-261
EuroEspes Biomedical Research Center .....	32-33	University of Zurich, Institute of Education .....	190-191
European Commission, Directorate, General Joint Research Centre .....	262-263	Vector Biology and Population Genetics Laboratory .....	62-63
European Healthcare Fraud & Corruption Network .....	46-47	Vernon G James Research and Extension Center .....	278-279
Health Consumer Powerhouse .....	16-17	Washington University School of Medicine .....	70-71
Honeywell Hymatic .....	332-333	York University, Department of Sociology .....	257-258
Hygiena International LTD .....	53-54	Znapz BV .....	306-307
Institut Scientifique de Santé Publique de Bruxelles .....	86-87		
Istituto Nazionale di Astrofisica (DARKLIGHT Project) .....	128-129		
Istituto Nazionale di Geofisica e Vulcanologia .....	255-256		
KTH Royal Institute of Technology, Production and Engineering Management .....	108-109		





## Developing a “mechanism-based taxonomy” of Alzheimer’s and Parkinson’s Disease.

Currently, the established disease classification systems such as ICD (international classification of disease) make use of phenotypes measured clinically or using standard laboratory and imaging techniques to establish major types and subtypes of diseases.

In contrast to the established disease classification systems, a “mechanism-based taxonomy” is based upon the knowledge about the biological pathways involved in the aetiology of a disease to guide the classification of disease classes and subclasses.

A specific challenge we face in the course of the AETIONOMY project lies in the fact that for most neurodegenerative diseases the dysfunctional biological pathways underlying the disease are not well understood.

## Contact

### **Prof. Duncan McHale**

Vicepresident, Head of Global Exploratory Development.  
UCB S.A.

-> [Send E-Mail](#)

### **Prof. Dr. Martin Hofmann-Apitius**

Head of Department for Bioinformatics.  
Fraunhofer Institute for Algorithms and Scientific Computing SCAI.

-> [Send E-Mail](#)



# Department of Child & Youth Studies

**Child and Youth Studies (CHYS)** is one of the most popular programs at Brock. Students learn from a broad-based approach that considers the individual child or youth within the context of the family, school, peer group and community. With interdisciplinary roots in psychology, education, sociology, cultural studies and criminology, the degree gives academic background to pursue a wide variety of careers or to pursue further studies in a Master's program and the new transdisciplinary PhD program.

CHYS will be hosting a multidisciplinary conference on conceptualizing children and youth October 11-13, 2017.

Watch the CHYS website for more details:

<https://brocku.ca/social-sciences/departments-and-centres/child-and-youth-studies>