

PS PUBLIC SERVICE REVIEW

European Science & Technology 16

an independent review

Anne Glover

discusses gender equality in the scientific community

Pär Omling

outlines the importance of research infrastructures

Androulla Vassiliou

on the benefits of educational mobility

Tim de Zeeuw

hails 50 years of progress at the ESO



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Foreword

Ken Guy

Head of the Science and Technology
Policy Division, OECD

Scientific activities and investment in R&D and innovation have always been influenced by three main drivers – curiosity, social need and competition. For many scientists, the quest for knowledge and truth has constituted the strongest driver, with society prepared to satisfy this curiosity as long as excellence is prioritised and mediocrity abhorred.

But society also invests in science when there is a demonstrable social need to which science and scientists can contribute. As long ago as 1675, for example, the Royal Observatory in Greenwich, UK, was set up to perfect the art of navigation, thus facilitating sea-borne exploration and trade and reducing the likelihood of disasters at sea. Increasingly, too, recognition of the link between scientific activity, innovation and economic returns and the societal desire to maximise these returns has been a particularly strong driver of investment in science, technology and innovation.

Complementing these drivers of curiosity and social need has been an insatiable competition between both scientists and nations in terms of comparative scientific achievements and economic performance. In 1830, Charles Babbage wrote that England was in decline compared to France and Germany, and this set in motion a chain of events that led in due course to the allocation of grants for research by the Royal Society in 1850 and the establishment of a government department responsible for science in 1853. Since then, too, depending on one's location, public investment in science and innovation has been hugely influenced by cries such as 'The Russians are coming!', 'The Japanese are coming!', 'The US is ahead!' and, more recently, 'The Chinese are coming!'.

Over the years, these three drivers have frequently acted in opposition to each other and led to strong debates and heated arguments, typically concerning the allocation of scarce resources and the balance between rival demands. Arguments about the balance between civil and military expenditure on R&D often exploit a tension between civil social needs and military rivalry, while arguments about the balance between investment in basic and applied R&D are typically couched in terms of a conflict between

curiosity-driven research and research aimed at satisfying social needs.

Looking to the future, the immense societal challenges that now confront us demand that resource allocation is driven by considerations of social need. The benefits that competition between nations in the economic sphere can have on global levels of prosperity and wellbeing demand that this rivalry drives investment in R&D and innovation. And the need to satiate the intrinsic desire to explore new scientific landscapes demands that resources are allocated to curiosity-oriented research.

But there is no room for these drivers to continue to act in opposition to each other. There is just too much at stake for petty squabbling. It will always be possible to find arguments justifying the existence of pockets of funding that satisfy just one of the drivers, but the key challenge for society, as far as science, technology and innovation are concerned, is to find ways of either funding activities that respond to all the drivers, or to find ways of exploiting synergistic links between activities funded in response to single drivers.

A new factor also has to be taken into account, and that is international collaboration. In one sense, collaboration between the scientists of different nations has always been a characteristic feature of the practice of science, but until recently it has not been a central facet of such activity. Nowadays, however, collaboration on a global scale between scientists and nations is imperative – not only for the solution of many contemporary scientific problems that draw upon multiple disciplines, but also for the solution of many of the most pressing societal challenges that confront us. If life was not difficult enough before, a new complementary equilibrium now has to be sought between the hitherto competing forces of curiosity, social need, competition and collaboration.

A handwritten signature in black ink, appearing to be 'KG' or similar initials, written in a cursive style.



Introduction

Lauren Smith
Editor

A significant group of large businesses expect their investments in research and development to grow by an average of 4% annually over the period 2012 to 2014, the EU Survey on R&D Investment Business Trends has indicated. Although this is slightly down on the 5% growth expected in the previous survey (likely to be a reflection of the current economic context) it highlights the importance that these companies place on R&D as a key factor for future growth and innovation. This is something that needs to be reflected in the public sector and across independent research institutions – with financial incentives and a supportive environment to enable progress.

The appetite for knowledge sharing and debate was evident in abundance when the *Public Service Review* and ScienceOmega.com delegation attended this year's Euroscience Open Forum (ESOF) in Dublin in July. Bringing together world-leading scientists from across the disciplines, as well as policymakers and science communicators, the forum highlighted the diversity encompassed in this community. The mood of ESOF 2012 is captured in this edition's opening special feature, with further interviews from the event included throughout the publication.

Following on from *Public Service Review: European Science and Technology 15*, the second part of our interview with Professor Anne Glover sees the Chief Scientific Adviser to the European Commission discuss gender equality and environmental concerns, among other issues. President of the European Science Foundation Pär Omning stresses the importance of research infrastructures, while several European Commissioners such as Janez Potočnik (Environment) and Günther Oettinger (Energy) outline their policies and future ambitions for Europe.

The European Southern Observatory celebrates its 50th anniversary this year, and Director General Tim de Zeeuw sheds light on the organisation's progress, endeavours and hopes for the future in our space sciences focus. In health, meanwhile, we look at the epidemic proportions of the

obesity crisis in modern society, and the accompanying host of major risks for serious conditions and reduced overall quality of life it brings. Expert contributors also stress the role of national policies, economics and personalisation across the health sector.

As steps continue to be made towards the 2014 goal of making the European Research Area (ERA) a single market for research and innovation, the drive for greater research investment and scientific quality to support the development of knowledge-intensive products and services increases. If researchers, institutions and businesses can move, compete and cooperate across borders more successfully, this will help to strengthen the research base in Europe overall and provide a robust foundation for addressing the major societal challenges that we face.

A handwritten signature of Lauren Smith in black ink, written in a cursive style.

CONTENTS

| | |
|---|----------|
| Ken Guy, Head of the Science and Technology Policy Division, OECD. | 3 |
| Lauren Smith, Editor | 4 |
| Reflections from ESOF: European research practice and policy | 9 |

FOREWORD 3

INTRODUCTION 4

ESOF 2012 9

RESEARCH

| | |
|--|-----------|
| The scope to strengthen | 14 |
|--|-----------|

In the second of a two-part special feature, Chief Scientific Adviser for Europe Professor Anne Glover shares her thoughts on gender equality, addressing climate change and her future hopes with Editor Lauren Smith

FEATURE INTERVIEW 14

| | |
|-------------------------------------|-----------|
| Structuring success. | 22 |
|-------------------------------------|-----------|

ESF President Pär Omling highlights to Editor Lauren Smith the need for effective research infrastructures to allow world-class European innovation to prosper

OVERVIEW 22

| | |
|--|-----------|
| An international exchange | 28 |
|--|-----------|

Pawel Rybicki, Chairman of the European Network of Forensic Science Institutes, charts the progress made towards European standardisation in the field

| | |
|---|-----------|
| From potential to policy | 32 |
|---|-----------|

Dominique Ristori, Director-General of the European Commission's Joint Research Centre, advocates the power of science for a smart, sustainable and inclusive economy

| | |
|--|-----------|
| The people's particle | 45 |
|--|-----------|

Professor Paris Sphicas, of CERN and the University of Athens, tells Editor Lauren Smith about the opportunities opened up by the discovery of the Higgs-like boson at the LHC

| | |
|-------------------------------------|-----------|
| A neverending story. | 47 |
|-------------------------------------|-----------|

Professor Paul Hardaker, Chief Executive of the Institute of Physics, explains why research breakthroughs in physics capture the public imagination

| | |
|---------------------------------------|-----------|
| All the small things | 48 |
|---------------------------------------|-----------|

The rise of nanomaterials brings challenges for researchers and policymakers, especially where safety is concerned, as the JRC's Dr Hermann Stamm tells *Public Service Review*

| | |
|--|-----------|
| Economically thinking | 52 |
|--|-----------|

Past President of the European Engineering Industries Association Edward G Krubasik declares that it is time to talk about smart growth and restructuring

| | |
|---------------------------------|-----------|
| A duty of care | 56 |
|---------------------------------|-----------|

Professor Maurizio Martellini, of IWG-LNCV, and Adriaan van der Meer, of ISTC, discuss the need for responsible science management to curb proliferation risks

| | |
|------------------------------------|-----------|
| You do the maths? | 62 |
|------------------------------------|-----------|

Marta Sanz-Solé, President of the European Mathematical Society, explains falling standards and the need for collaboration to *Public Service Review's* Amy Caddick

| | |
|-------------------------------------|-----------|
| A robotics movement. | 66 |
|-------------------------------------|-----------|

Forums such as the European Robotics Technology Platform underline the importance of collaboration in innovation, as *Public Service Review's* Amy Caddick highlights

| | |
|-------------------------------------|-----------|
| The knowledge base | 70 |
|-------------------------------------|-----------|

At ESOF 2012, ERC President Helga Nowotny called on science and scientists to help Europe regain its confidence, as *Public Service Review* reports

| | |
|--|-----------|
| Innovation in preparation | 74 |
|--|-----------|

Science and technology can make a huge difference in building resilience against natural disasters, as UNESCO's Badaoui Rouhban elucidates

| | |
|---------------------------------------|-----------|
| Information overload | 76 |
|---------------------------------------|-----------|

Professor Dr Renato Pajarola, of the University of Zürich, sheds light on what is needed to effectively process the ever-expanding datasets created by advances in hardware

| | |
|--|-----------|
| Facing change together. | 78 |
|--|-----------|

European research has to move with the times, and collaboration has become more important than ever, explains the SNSF's Dieter Imboden to Editor Lauren Smith

| | |
|---|-----------|
| Ending Spain's research pain | 87 |
|---|-----------|

Spanish R&D has been badly hit by the economic crisis, and fresh approaches to research and funding systems are vital, urges COSCE President Carlos Andradadas

| | |
|--|-----------|
| Bordering on excellence | 93 |
|--|-----------|

Jens Christian Djurhuus, Chair of the Danish Council for Independent Research, provides an overview of the country's progress in international collaboration

NATIONAL PERSPECTIVES 78

| | |
|---|------------|
| Competition starts at home | 95 |
| <i>Public Service Review</i> explores how regional policies in higher education and research are contributing to German scientific successes | |
| A question of discipline | 106 |
| 'Interdisciplinary' research is highly prized today, and Professor Jochen Brüning, of Hermann von Helmholtz-Zentrum für Kulturtechnik, considers how to define the term | |

EDUCATION AND SKILLS

| | |
|---|------------|
| Charting the Erasmus course | 108 |
| Androulla Vassiliou, European Commissioner for Education, Culture, Multilingualism and Youth, celebrates the scheme's 25 years of success in changing lives | |
| Work both ways | 112 |
| Chief Executive of the Science Council Diana Garnham turns the spotlight onto gender equality in UK science employment and the measures that can secure it | |
| The earliest opportunities | 114 |
| Marja Vauras, Dean of the University of Turku's Faculty of Education, highlights the value of combining equity and quality in education | |

ENVIRONMENT AND ENERGY

116 SPECIAL FEATURE

| | |
|--|------------|
| Rio's grand challenges | 116 |
| Plenty of positives emerged from the Rio20+ conference, says European Commissioner for the Environment Janez Potočnik, but it is time to deliver results | |

121 ENVIRONMENT

| | |
|---|------------|
| Emissions controlled? | 121 |
| European Environment Agency's Climate Change Analyst Ricardo Fernandez provides insight into the changing levels of greenhouse gas emissions in the EU | |
| Developing ambitions | 126 |
| EU climate and energy targets can go even further through collaboration with developing nations, states Wendel Trio, Director of Climate Action Network Europe | |
| Deutsch courage | 128 |
| Germany's commitment to environmental protection is strong, but Federal Minister Peter Altmaier has stressed that it cannot act alone, as <i>Public Service Review</i> explores | |
| A period of transition | 132 |
| Research on transition zones between ecological systems could have a major impact on environmental policy, says the University of Koblenz-Landau's Professor Dr Andreas Lorke | |
| Austria's renewable vows | 134 |
| <i>Public Service Review's</i> Amy Caddick reflects on the ambitions of Environment Minister Nikolaus Berlakovich to turn Austria into a sustainable, energy-autonomous nation | |

138 ENERGY

| | |
|---|------------|
| Got the energy? | 138 |
| European Commissioner for Energy Günther H Oettinger provides insight into how the Energy Roadmap 2050 hopes to balance security of supply with decarbonisation | |
| The three power peaks | 142 |
| Joan McNaughton, of the World Energy Council 'Assessment of country energy and climate policies', advocates dialogue as the means to overcome the energy 'trilemma' | |
| Big green country | 144 |
| Danish Minister for Climate, Energy and Building Martin Lidegaard champions the nation's path to a sustainable future through investment in renewables | |

148 GEOSCIENCES

| | |
|--|------------|
| What's on Earth? | 148 |
| EGU's President of the Earth and Space Science Informatics Division Stefano Nativi outlines geoinformatics' role in providing and processing environmental information | |

SPACE

160 SPECIAL FEATURE

| | |
|--|------------|
| Aiming for the stars | 160 |
| Director General of the European Southern Observatory Professor Tim de Zeeuw explains to Editor Lauren Smith the role of his organisation in global space endeavours | |
| Another giant leap | 163 |
| Alvaro Giménez Cañete, Director of Science and Robotic Exploration at the European Space Agency, highlights the continent's role in ongoing space exploration | |

Paws for thought 169

IFAH-Europe's Declan O'Brien reflects on the impact of animals on people, in more ways than one, and why innovation is crucial in safeguarding the health of both

The specialist effect 171

Progress in veterinary medicine has seen a rise in demand for anaesthetic and analgesic specialists, says the University of Veterinary Medicine's Professor Dr Yves P S Moens

HEALTH

Bigger but not better 173

Escalating on a global scale, obesity affects virtually all age and socioeconomic groups, bringing with it a wide variety of associated major risks for serious conditions – including diabetes, cardiovascular disease, hypertension and stroke, and certain forms of cancer – as well as reducing overall quality of life. Three experts from across Europe highlight issues around childhood obesity, the role of the food industry and the importance of satiety innovation

SPECIAL FEATURE: OBESITY 173

Taking medical to the maximum 177

European Commissioner for Health and Consumer Policy John Dalli plans to use technology and innovation to transform the healthcare landscape, writes *Public Service Review*

OVERVIEW 177

Helping to find the balance 180

Dr Stephanie Stock, of the University Hospital of Cologne, champions health economics as a key player in the sustainability drive of European healthcare systems

A molecular formula for success? 182

Professor Mika Lindén, of the University of Ulm, Germany, details developments in nanomedicine that could bring huge benefits to modern day healthcare

Honing Holland's healthcare 185

Edith Schippers is the minister tasked with improving the Netherlands' healthcare system in the face of an efficiency drive, as *Public Service Review* reports

Pathways to personalised medicine 189

Work is under way to introduce personalised medicine on a wide scale, say the ESF's Dr Kirsten Steinhausen, Dr Stephane Berghmans and Professor Liselotte Højgaard

The hopes and the hypes 194

The European Society of Human Genetics' Professor Martina C Cornel outlines current priorities and challenges in human and medical genetics

An ever-expanding ministry 196

Danish Health Minister Astrid Krag is well aware that national health priorities are rarely unaffected by global issues, as *Public Service Review* explores

Quality and qualification 200

Marianne Hedlund, Dean of the Faculty of Health and Social Studies at Telemark University College, details standards and education in health and social care professions

An appetite for change 202

Salutogenic research provides fresh perspectives on healthful eating, reveal Wageningen University Professors Dr Laura Bouwman and Dr Maria Koelen, and Dr Emily Swan

AD-justing the answers 206

Professor Walter E Müller, of Goethe University Frankfurt, looks at the role of mitochondrial dysfunction as a cause and therapeutic target in Alzheimer's disease

Belgian self-betterment 208

Minister for Social Affairs and Health Laurette Onkelinx is spearheading reforms to further refine Belgium's already high-quality healthcare, writes *Public Service Review*

Revolution in the head 214

Exciting developments are under way in basic neuroscience, but wider research and awareness are key, FENS President Professor Marian Joëls tells Editor Lauren Smith

NEUROSCIENCE 214

Translating into action 218

Professor Armin Curt, Chairman of the University of Zurich's Spinal Cord Injury Center, examines the 'valley of death' of translational research in neuroscience

| | | |
|-----|---------------|---|
| 220 | ENDOCRINOLOGY | Comparatively speaking 220 The ESCE's Dan Larhammar, Horst-Werner Korf and Elisabeth Eppler highlight the impact of new approaches in genetics and genomics on comparative endocrinology |
| 224 | OPHTHALMOLOGY | All eyes on innovation 224 <i>Public Service Review's</i> Amy Caddick asks Royal College of Ophthalmologists President Professor Harminder Dua about the advances being made in ophthalmology research |
| 228 | ONCOLOGY | The part of smart drugs 228 Odense University Hospital's Professor Poul F Høilund-Carlsen and the University of Southern Denmark's Professor Jan Mollenhauer discuss future hopes for cancer treatment |
| 230 | DENTISTRY | The tooth of the matter 230 President of the Council of European Dentists Dr Wolfgang Doneus turns the spotlight onto dentistry and oral health practice in Europe |
| 234 | GLOBAL HEALTH | Hope, scope and isotopes 234 Dr Tony Lahoutte, Head of the Nuclear Medicine Division at UZ Brussels, Belgium, tells <i>Public Service Review's</i> Amy Caddick why nuclear medicine is so important |

GETTING TO KNOW

| |
|---|
| Getting to know... Dr Gernot Groemer 238 |
| Contending with massively varying temperatures, toxic atmospheres and potential radiation, the Austrian Space Forum's Dr Gernot Groemer plays a vital role in the development of advanced spacesuits in preparation for future human expeditions to Mars. Here, he discusses with Editor Lauren Smith his passion for exploration, the importance of scientific outreach and his ambitions for the future |

Index **242**

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An international exchange

Pawel Rybicki, Chairman of the European Network of Forensic Science Institutes, charts the progress made towards European standardisation in the field...

Forensic science, which supports law enforcement and justice activities primarily in the investigation and evidential phase, has expanded its role through becoming involved in crime prevention processes. Moreover, this is also accompanied by the need for geographical expansion.

The cross-border character of criminality requires close collaboration between the law enforcement and judiciary systems of different countries, and an increasing number of criminal cases with this dimension have entailed an intensified exchange of forensic data and evidence. This should lead to the situation in which evidence originating from a different country is more frequently used in court; however, a number of criminal proceedings concerning international crime are carried out simultaneously in all affected countries. This is a great disadvantage from many perspectives, although from one of pure economy, it would be far better if the proceedings were carried out in one member state only. Obviously, the lack of common forensic standards does not improve the situation.

All of these issues contributed to the need for common standards on forensic processes to be established for use across Europe, which has recently assumed a more realistic shape due to the efforts of forensic stakeholders.

Current international developments

Recently, there have been a number of significant documents, from the forensic practice perspective, which constitute important steps in the process of applying uniform rules regarding various aspects of forensic work. The Council Decision 2008/615/JHA of 23th June 2008 'on the stepping up of cross-border cooperation, particularly in combating terrorism and cross-border crime', provides all countries involved with the tool to enable effective exchange of the data from nationally run forensic databases in order to assist unchallenged identification of the suspect in another country. In particular, the decision defines the way that specific forensic data, such as DNA profiles and dactyloscopic data, can be exchanged between EU member states.

In order to ensure the reliability and interoperability of data to be internationally exchanged under the Council Decision 2008/615/JHA, there was a need to draw up relevant legal instrument. Council Framework Decision 2009/905/JHA of 30th November 2009 on Accreditation of forensic service providers carrying out laboratory

activities regulates the issues relating to quality standards in obtaining DNA-profiles and dactyloscopic data through the process of laboratory analysis.

The decision seeks to ensure that the results of laboratory activities carried out by those accredited to EN ISO/IEC 17025 forensic service providers in one member state are recognised as being equally reliable as the results of examination of the laboratory accredited accordingly within any other member state. Under this decision, all member states shall take the necessary steps to comply with the provisions laid down therein.¹ However, these decisions, important as they are, deal with quite technical aspects of selected forensic processes. Although they tackle two main directions regarding standardisation in forensic science – interoperability and quality respectively – there was still a gap in the area of forensic standards that were internationally recognised and applicable to all forensic related activities.

Polish forensic initiative

The need to develop comprehensive forensic standards has been explicitly highlighted in the so-called Polish Forensic Initiative, approved as the 'Council conclusions on the vision for European Forensic Science 2020, including the creation of a European Forensic Science Area and the development of forensic science infrastructure in Europe'.²

The document brings together various forensic processes starting from the scene of crime to the delivery of forensic results by formulating a vision for forensic science in Europe based on the following key areas:

- Accreditation of forensic science institutes and laboratories;
- Respect for minimum competence criteria for forensic science personnel;
- Establishing common best practice manuals and their application in daily work of forensic laboratories and institutes;
- Conducting proficiency tests/collaborative exercises in forensic science activities at international level;
- Application of minimum quality standards for scene-of-crime investigations and evidence management from crime scene to court room;



The need for common standards on forensic processes to be established for use across Europe has recently assumed a more realistic shape due to the efforts of forensic stakeholders, explains Rybicki

- Recognition of equivalence of law enforcement forensic activities with a view to avoiding duplication of effort through cancellation of evidence owing to technical and qualitative differences, and achieving significant reductions in the time taken to process crimes with a cross-border component;
- Identification of optimal and shared ways to create, update and use forensic databases;
- Use of advances in forensic science in the fight against terrorism, organised crime and other criminal activities;
- Forensic awareness, in particular through appropriate education and training of the law enforcement and justice community;
- Research and development projects to promote further development of the forensic science infrastructure.

European Forensic Science Area

The aim of the initiative is to create by 2020 a European Forensic Science Area, where the forensic processes for the collection, processing, use and delivery of forensic data are based on equivalent minimum forensic science standards.

These conclusions, in addition to determining a range of issues to be dealt with, define the role of main stakeholders within this field. One of the tasks for member states and the Commission as envisaged in the conclusions is to cooperate with the European Network of Forensic Science Institutes (ENFSI) in developing a detailed action plan to implement the vision for European Forensic Science 2020.³

All of the issues point to the undisputable fact that forensic standards in Europe need to be developed. Therefore, on 24th May 2012, the European Committee for Standardization (CEN) created its new Project Committee, 'TC 419 – Project Committee – Forensic science services' following a proposal from the Polish Committee for Standardization. CEN is the only recognised European organisation according to Directive

98/34/EC for the planning, drafting and adoption of European Standards and major provider thereof. Shortly after the establishment of the Project Committee, ENFSI has been approached by CEN to consider the possibility of active participation in this initiative.

Involvement in global discussion

The creation of common European standards to forensic practice is currently ongoing. The importance of the process can be considered from different perspectives. On an international level, it will help to avoid, for example, judicial misunderstandings, rejections and appeals. Moreover, standardisation in this area will have a positive impact on cooperation among forensic science laboratories based on so-called mutual trust, and this rule seems to be crucial for the future of cooperation between judicial and law enforcement authorities. It is also important from an economical point of view as it will reduce the cost of criminal proceedings and avoid duplication efforts.

The forensic standardisation arena in Europe deserves a more comprehensive, consistent and strategic approach, especially considering the fact that relevant standards are already being developed in other parts of the world. The initiatives described should enable the European forensic stakeholders to become coherently involved in a global discussion on forensic standardisation.

¹ In relation to DNA-profiles by 30th November 2013 and the fingerprints by 30th November 2015

² Council conclusions approved at 3135th Justice and Home Affairs Council meeting, Brussels, 13th and 14th December 2011

³ To be presented by June 2013



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The future of forensics

The challenges...

The forensic sector is going through a disruptive transition. For example, the number of investigations handled by the Netherlands Forensic Institute (NFI) has increased sixfold in the past decade alone. Since the start of the 21st Century, the number of employees at the NFI has almost tripled, rising from 200 to 600. Innovations in areas such as information technology, molecular biology, and analytical chemistry have given rise to new types of forensic investigations. The role being played by forensic science has increased in scale and impact, and scrutiny by clients, press and the public has intensified.

At the same time, many governmental and intergovernmental agencies outside the field of criminal justice have discovered the value of forensic investigations. Today, the NFI has dozens of clients outside the criminal justice system, and even outside the Netherlands. Forensic science and technology is not bound by national borders, and it is unrealistic to assume that each institute will be able to do everything that is requested by the clients. As the field continues to develop and innovate, different forensic service providers will develop their own special capabilities, creating an irresistible driver for the cross-border exchange of forensic products and services. Fuelling this trend will be innovations from different domains (domain transfer) – for example, from healthcare, the computer industry, and the biotechnology sector. These can be developed into powerful forensic tools. In this way, we will be able to get more information from more trace classes, at a higher speed and at lower costs.

These aforementioned trends are changing forensic science from a relatively small and closed field of specialists, cast in a supporting role, to a dynamic international sector of products and services with high added value and based on state-of-the-art science and technology. This change is not restricted to the Netherlands or the NFI, but can and will be seen all over the world. It is ‘forensic science 2.0’, and it is coming fast.

Traditional forensics

Forensics used to be – and still is in part – a sector of skilled craftsmen, each with their own ‘shop’. The scientific base is relatively weak. As is often the case in sectors of skilled craftsmen, the forensic sector is also stovepiped. Deep interdisciplinary cooperation or R&D to create new (interdisciplinary) services is unusual. Also, the forensic sector was, and still is, fragmented and local. Most forensic labs only serve the geographical jurisdiction of their main client. This means that forensic institutes either become state-of-the-art in all disciplines – which is clearly impossible – or customers of forensic institutes have to settle for what is available in their jurisdiction. Last but not least, most forensic labs were and are only active in the context of criminal investigations. In many cases, the police and/or prosecution and judges are the only clients. All this is changing.



The future of forensics

At the NFI, we have identified several emerging trends that are changing the organisation and the field around us. The first trend is strong growth, fuelled by an increasing reliance on forensics by customers and an increasing rate of innovation. Forensics is changing into a modern, hi-tech sector with a stronger customer focus.

Growth

One of the clearest and most important trends in forensics is its strong growth. The disciplines that drive this growth are mainly hi-tech biometrics, including forensic DNA analyses, forensic information technology and forensic chemistry.

The growth in forensics is caused mainly by four factors:

- New technologies have been introduced that make new types of highly valuable forensic investigations possible. Examples are forensic DNA and forensic IT;
- Forensics is relatively low-cost and adds high value compared to more traditional (labour intensive) investigative methods;

- The evidential value of forensics is relatively high;
- Awareness of the value of forensics is increasing rapidly.

As new technologies come to the market and new forensic investigation techniques are developed, the demand will further increase. This is similar to the healthcare sector; if a certain new treatment becomes available, there will be a high pressure to apply it. New science and technology create their own market. We therefore project that the growth will continue, even though the rate of growth will probably go down.

Forensic techniques will also become available at the crime scene. Police investigators are increasingly aware of the value of science and technology. Once the awareness is there and investigative processes become reliant on forensics, customers increasingly push forensic service providers for more information and faster delivery. This will partly shift forensics directly to the crime scene. Technology makes it possible to do forensic research at the crime scene itself. Miniaturisation and lab-on-a-chip technologies will enter the crime scene in the next five years.

Reliance on forensics means that forensic institutes will be increasing pressure to deliver faster. This has certainly been the case in the Netherlands. Using process redesign and new technology, in a comprehensive programme, the NFI has been able to decrease its delivery times by 90% in five years' time. Moreover, due to the application of new technology, forensics will yield more and more information.

Broader customer base

The second trend in the forensic field is a broadening of the customer base. Demand for forensic services is not limited to the criminal justice system. More and more customers – mostly government agencies or inter-governmental organisations – find that forensic science can provide

answers to their problems. Ministries of Defense, intelligence services, customs, naturalisation services, anti-fraud agencies, anti-terrorism authorities, competition authorities, etc., are all discovering what forensic institutes can offer.

Forensic science is not intrinsically limited by national boundaries. However, different countries have different systems to regulate forensics. This causes artificial silos that are not in the interest of the development of the field as a whole. For example, forensic institutes that only service the criminal justice system in one jurisdiction tend to be too small to be able to finance expensive R&D programmes, or to capture economies of scale and scope. At present, there are initiatives to create a European forensic area in which there is a free flow of forensic products and services. The NFI strongly supports these initiatives. One important element of the common area would be common quality standards that are accepted by all member countries.

Domain spin-in and innovation

Other more mature and dynamic technology domains also have a great deal to offer for the forensic community. The transfer of the technology, processes and business models from these domains will have a big impact on forensics. This will ultimately lead to more powerful forensic products and services, and a more professional market for these products and services.

The NFI is actively involved in promoting public/private partnerships with companies and with academia in order to stimulate R&D and domain transfer. The NFI has created an ecosystem of companies in sectors like IT, the gaming industry, aerospace, microbiology and healthcare. We have seen clear advantages in terms of developed technology and products – but less tangible are the real benefits of learning from the dynamics and maturity of other businesses. The 'CSI



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The Hague' project is an example of this. As part of a consortium of more than 15 private companies, the NFI is developing the crime scene technology of the future, which will detect and collect minimal traces undetectable to the human senses.

In conclusion

The field of forensics is developing fast. Not only is there strong growth, fuelled by new technologies, but forensics is also relatively reliable and cheap. Furthermore, the forensic capabilities of existing providers are being discovered by new customers – mostly government agencies and intergovernmental organisations. In Europe, initiatives are being pursued that will create a European forensic area in which there is a free flow of forensic products and services based on common quality standards and regulations. This will have a huge positive impact on the field of forensics, as it will create European Centres of Excellence, more economies of scale, and more R&D.



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