Think piece

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Ties that bind: The importance of science and technology to the insurance profession

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Summary

- There are many links between the insurance industry and investment in technology and research and development in the UK. This thinkpiece investigates some of them.
- Science and technology is for example, enhancing the ability of insurance to underwrite diverse risks like climate change, drug trafficking and piracy by providing new and more accurate data streams from which to judge the relative likelihood and impact of various hazards occurring.
- Computational modelling is also changing the way in which insurance brokers operate, with the potential to deliver a "modern version of the classic broker function".
- The UK's current and future comparative advantage lies in the skill to programme computers to maximise their capabilities, and to employ those capabilities to great effect in business.
- For this to occur, government, industry and the scientific community must work together to ensure that technological developments are fully utilised across the industry and for the benefit of society.

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CII Introduction: The rate of technological change in recent years, and particularly with respect to ICT, has been remarkable. Never before has so much information been available to so many people around the world. In this thinkpiece, the Universities and Science Minister, David Willetts MP, discusses the many links between insurance and information technology in the UK[1]. In his view, the UK's comparative advantage is intrinsically linked to industries like financial services building increasingly strong ties with research and development centres and universities which are at the frontiers of developing new technology.

The UK has a world-leading insurance sector and London is the only market in which all of the world's 20 largest reinsurance groups are represented. Too often the City is regarded as shorthand for investment banking but let's be clear: the City covers far more than that and we should be proud of competitive sectors like insurance which matter a great deal for the economy.

For the Government's part, we remain committed to securing the best possible outcome for the UK insurance industry under Solvency II – on the timing of implementation and on the critical detail concerning equivalence and the matching premium.

The UK insurance sector is the third largest in the world – and the biggest in Europe, accounting for seven per cent of global premiums. Employing around 300,000 people in the UK – more than a quarter of all financial services' jobs – it contributes some £10 billion in taxes. It's also a major exporter, with about 30 per cent of its net premium income coming from overseas business. For the Government's part, we remain committed to securing the best possible outcome for the UK insurance industry under Solvency II – on the timing of implementation and on the critical detail concerning equivalence and the matching premium.

There is a wider lesson here for financial services. Insurance has faced its own travails, but it has sorted itself out, reformed its practices and emerged stronger. The controversy surrounding some Lloyd's of London underwriting syndicates was painful and I have constituents who are still living with the consequences of Equitable Life. But the City can learn from unhappy episodes like these, embrace reform and it can bounce back.

Now the UK can celebrate a strong, vigorous insurance industry. There is also, and I am the Minister responsible, a strong university and research sector in the UK – and there are connections between the two. For the rest of this article, I want to investigate these connections – to shed light on the real nature and significance of high-tech growth, and how best to support it.

The first and most obvious function for higher and further education is to produce graduates that business can recruit – and, in the insurance industry, of course, there is a clear need for graduates with maths skills. The good news is at school level, uptake of STEM subjects – that's science, technology, engineering and maths – at GCSE and A-level has been rising steadily over the past few years. We've seen a 42 per cent increase among UK-based students taking a first degree in maths over the past ten years – and an 18 per cent increase among maths PhD entrants. In the Autumn Statement 2011, we announced that we would support a scheme to enable the kite-marking of STEM-related courses which are valued by employers. But the educational role is only one aspect of the relationship. The associations are both broader and deeper.

Windows upon the world

The links between the UK's outstanding science and research base and what the insurance industry does go even further than education. They go right back to the open character of our society. Brokers like Willis, for example, connect the world's risks and the world's insurance capacity. Insurance has always been a global business, as shown by our merchants who sought to insure their cargoes moving across the oceans – originally in the coffee houses of the Square Mile. No doubt they do so again today, thanks to Starbucks and wifi. It's a clear case of history repeating itself, but also a classic example of Britain's reach – and not just in a purely international sense. Nowadays, UK insurers underwrite commercial activities ranging from the deep sea to earth orbit.

UK science and research is another international window on the world. Like insurance, it is bound up with Britain's history of exploration and discovery and it's what lies behind our understanding of the cultures and languages of other countries. For anywhere in the world, we're likely to have linguists, anthropologists, historians, sociologists studying it today. There are not many nations who can claim that breadth of expertise. This breadth resides not just in the humanities and social sciences. According to last year's report written by Elsevier, the UK can boast internationally-recognised

[1] This is an abridged version of a speech given by the Minister to Willis in March 2012. It is reproduced within our latest Future Risk report: *How Technology could make or break our world*. Available for download here: http://www.cii.co.uk/media/3691513/future_risk_report_no_4.pdf

research strength in more than 400 fields. That includes strengths in studying the physical and the natural world – biology, geology, geography, hydrography and all those disciplines which joined the Royal Navy and merchant fleet on their circumnavigations. British scientists still fan out across the world and study data collected from above and below it, to understand how our planet works. In February 2012, I visited British Antarctic Survey researchers on the west of the Antarctic Peninsula. The people stationed there are conducting a range of experiments including examining molluscs collected during Captain Scott's expedition with the same species collected by current researchers from the very same location to understand the effects of climate change over time. Very few countries are in a position to carry out this kind of comparative work because they do not have our history of exploration and scientific investigation.

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So the insurance industry has a window on the world. Scientists do too – and their activities are intrinsic to what insurers do. In fact, scientists and insurers must gaze through the same pane of glass. Scientists' raison d'être is understanding nature and insurers also need to understand nature as the prerequisite to judging risk. Insurers and scientists, therefore, share the same need to understand our world.

Earth observation exemplifies that shared mission – and for me, its true importance hit home when I visited the NASA Jet Propulsion Laboratory in Pasadena, where a large screen simultaneously shows missions monitoring the oceans, polar ice, atmospheric pollution and forest fires. It treats the world like a human patient. No one country can take responsibility for all this work, but the UK plays a leading role. In 2012 we chaired the international committee that covers space and major disasters; UK satellites provide vital data in the wake of major natural disasters. In 2012 we celebrated the tenth anniversary of the Envisat satellite – ten years of UK-built technology providing scientists and researchers with quality data to analyse global warming and climate change.

One reason I am so keen to support the UK space sector is that I see our role as a spacefaring nation as a natural follow-on from our role as a seafaring nation. Again, it gives Britain global reach and understanding. Inmarsat, the world's leading maritime communications business is based in London, and we're doing our best to make sure that the business infrastructure is in place to grow the FTSE 100 space companies of tomorrow. That includes changing the Outer Space Act by introducing an upper limit on liability for UK operators, developing the right insurance infrastructure for space activities and investing to open up new markets.

There is another aspect of Government investment in space likely to be of particular interest to the insurance industry. In November 2011, we committed £21 million to assist in the development and launch of the UK's first Synthetic Aperture Radar satellite – better known as NovaSAR. Once NovaSAR is up and running, businesses will be able to use the data in various ways, including maritime surveillance of drug-trafficking, oil spills and piracy. With piracy, the major advantage of NovaSAR is that it has the ability to image at day or night and effectively see through clouds. NovaSAR can also cover vast areas, like the Indian Ocean, in relatively short periods of time – with sufficient resolution to detect small individual ships, their speed and direction. By marrying this information with automatic broadcast messages which identify individual ships, NovaSAR will enable law enforcement agencies to identify and target uncooperative or suspect vessels.

The Government is also investing in other branches of science to help all of us understand the world – and help insurers to underwrite it. The Met Office Hadley Centre is probably the world's leading place for combining weather and climate forecasting. In the past, the Met Office has sat with the Board of Trade and the Ministry of Defence, given its importance in protecting commercial shipping and the UK's armed forces. In 2011, it moved over to BIS and is part of the science family for which we have responsibility.

We have excellent centres of meteorology such as the University of Reading. Meanwhile, the Natural Environment Research Council (NERC) is leading the £2.8million PURE programme on probability, uncertainty and risk in the Environment – improving assessment and quantification in natural hazards by developing new methods and demonstrating their applicability.

The Met Office is continuing to combine its expertise in weather and climate with the UK's researchers in environmental science. It has already brought together several institutions and agencies to form the Natural Hazards Partnership, which provides round-the-clock support to the emergency response services. Now it is extending this concept through the Environmental Science to Service Partnership, which aims to harness the nation's investment in environmental science for the benefit of society, business and government. At the same time, the UK Space Agency is opening up data for researchers and companies at the centre

for Climate and Environment Monitoring from Space (CEMS). We want CEMS to become the leader in satellite data integration and information delivery.

A world in flux

Understanding the physical world is all the more necessary because of the speed at which the natural environment is altering. Natural disasters caused £100 billion of damage in 2011 and it was the costliest year in the insurance market's 323-year history. Scientists and insurers are both urgently scrutinising a world in flux.

The Iceland volcano, flash floods in Pakistan, the earthquake in Haiti, wildfires in Russia, scientists recorded 960 loss-relevant events in 2010, a world record. More than ever, insurers are reliant on Earth observation data for exposure control, damage assessment and then loss quantification. When a catastrophe happens, the insurance industry is only a few steps behind the emergency responders.

There were fewer than 400 natural catastrophes in 1980, compared to almost 1,000 in 2010 – with a significant rise in meteorological and hydrological events, and a measurable increase in climatological ones.

As the climate changes, so we expect more energy in the climate system to lead to more extreme weather events. But, of course, while we can make this general point on a probabilistic basis, individual events cannot necessarily be attributed to climate change. The past may be no guide to the future – hence the enormous value of scientific modelling to a world where there is more of value to destroy – more buildings, ships and wealth than ever before.

More of these natural events are insured in the London market than anywhere else – meaning record pay-outs. But there has not been a crisis in the London market. There have been quite a few stories about financial services in recent years, some of them pretty dreadful, but they haven't focused on the London insurance market. One reason for that is its continuous engagement with the scientific community to make sure it has the best possible understanding of the world around us.

The Government's position on climate change

As a coalition government, we are informed by the available scientific evidence: evidence from temperature records in England dating back to 1659 and proxy measurements from ice cores going back thousands of years; evidence from the sophisticated models designed by NASA and the Met Office, projecting future climate under a range of emissions scenarios. The evidence is overwhelming, validated by the vast majority of scientists, and points in one direction. The earth's surface has warmed by more than 0.75 degrees centigrade since around 1900, with much of this warming occurring in the past 50 years.

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The Fourth Assessment Report of the Intergovernmental Panel on Climate Change in 2007 concluded that – with a probability of more than 90 per cent – most of the observed global warming since the mid-20th century is attributable to the observed increase in human-caused greenhouse gas concentrations. We are currently annually emitting more than 30 billion tonnes of CO_2 globally by burning fossil fuels. Putting all this together, average global temperatures may rise between 1.1°C and 6.4°C above 1990 levels by the end of this century.

Of course there are many uncertainties involved here – discontinuities or tipping points, for example, and the scientific community is focusing huge efforts on examining these. But as science minister, I operate purely from the available evidence.

One reason why climate change is so important is the potential burden our generation may bequeath. When Margaret Thatcher opened the Hadley Centre in May 1990, she observed that "Man's activities are already adding greenhouse gases to the Earth at an unprecedented rate, with inevitable consequences for our future climate" – and that "The problems do not lie in the future—they are here and now—and it is our children and grandchildren, who are already growing up, who will be affected." This relates to the central theme of my book, 'The Pinch – fairness between generations'.

According to a DEFRA climate change risk assessment published in January 2012, for example, annual damage to properties in England and Wales from river and sea flooding is projected to rise to between £2 billion and £12 billion annually by the 2080s – against a current cost of around £1.3 billion. While premature deaths due to cold winters are projected to decrease significantly, premature deaths due to hotter summers are likely to increase – by up to around 4,000 by the 2050s. From a scientific perspective, uncertainties around tipping points, and the potentially incalculable costs that these could impose on our descendants, are rather big bets to place on the future when there are sound arguments –

and good business opportunities – for moving towards a low carbon economy now.

The modelled world

Thus far, this thinkpiece has illustrated the significance of the links between the work of scientists studying climate change and the natural world, and the work of the insurance industry. But that is not the end of the story, for there is another connection besides. It is not only what we research that matters, but how we do it. The sheer volume of data is currently one of the biggest challenges facing science. Analysing all that data for scientific discovery is one of our great challenges.

One of the classic ways in which we handle these large volumes of data is through algorithms. And this year, in June, we marked the centenary of the birth of the great British scientist who, more than anyone else, linked the maths of algorithms to modern computing: Alan Turing. Handling large datasets is a key skill in financial services, in advanced manufacturing, and in scientific research too. That is why the Government is investing £165 million in e-infrastructure. And in March 2012 I co-chaired, with Professor Dominic Tildesley, the first meeting of the e-infrastructure leadership council that is going to ensure the UK maintains its global lead in this discipline.

Computational modelling, as I have already suggested, is well developed for predicting the natural world, but there is huge potential in combining high performance computing and analytics to improve existing models: the better the model, the better the business decision. The UK has great strengths in modelling and simulation software, but we also need the mathematics knowhow to exploit future architectures, combine methodologies in solving complex problems and handle the associated storage and data analysis issues. A recent international review rated the UK as excellent in the mathematical sciences, with world-leading researchers in every subfield. I know that some of our mathematicians are worried that the importance of maths research is being overlooked. I take their concern very seriously – and so does the Engineering and Physical Sciences Research Council. In response to the review's recommendations, the EPSRC published an action plan in November 2011. In fact, the EPSRC tell me that they will be increasing the total amount of resources going into maths through their wider work on societal challenges over the period covered by the spending review.

So far as the City is concerned, the Government have pledged support for a doctoral training centre in financial computing at University College, London. The £20 million centre – for £7.5 million from the Research Councils leveraged the remaining investment – has a particular interest in algorithmic risk simulation.

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This is where insurance fits in – presumably hoping clients will place their business with them. For example, through a market match algorithm, insurance brokers can harness new technology to deliver a modern version of the classic broker function. The customer wins thanks to better information about the market, which drives competition. Business wins thanks to better access to more customers. The UK wins by insurers being at the forefront of innovation and also based in the UK. In fact, a range of major UK firms and sectors are essentially in the algorithm business. Autonomy is one, of course, but they are not alone. WPP may be thought of as a services company, and its R&D budget is officially small, but sophisticated sentiment analysis is crucial to its business. And what about Tesco, who rely on Clubcards and algorithms to achieve smart customer segmentation and targeting? Algorithms seek out and discover new relationships and business opportunities that would otherwise be invisible and unexploited.

Our comparative advantage is different. It is the skill to programme those computers to maximise their capabilities, and employ those capabilities to great effect in business. It is also to develop new market opportunities in, for example, low energy use computing.

I am not saying that the UK will have the world's biggest or fastest computers, though we do need to be there or thereabouts. Our comparative advantage is different. It is the skill to programme those computers to maximise their capabilities, and employ those capabilities to great effect in business. It is also to develop new market opportunities in, for example, low energy use computing. In 2012 I opened the world's most energy efficient high performance computer in Edinburgh. BlueGene/Q can carry something like 800 million million calculations a second, yet requires only the electricity needed to run a light bulb.

So we have seen several connections between what insurers do and the UK's scientific activities. UK insurance and UK science share a need to understand the world around us and

to understand how it is changing. We've seen how both rely on sophisticated maths-based models.

Let me finally take a step back and connect all this to the wider argument about the Government's growth strategy.

Defining and supporting high-tech industry

Earlier in 2012 I set out the Coalition's commitment to high-tech growth – not just as a nice idea but as something we should actively pursue through the right mix of policies backing science, research and innovation. One challenge to my speech was that high tech may sound sexy but it just isn't big enough to matter today; in the future, perhaps, but not now.

It is true that official statistics record high-tech businesses as a small part of our GDP. The OECD definition of a high-tech industry is one with a R&D-to-output ratio of more than 4 per cent. By this measure, high tech does indeed look small in the UK. Indeed, measured in this way, high tech invariably comprises a small part of any advanced economy. But we need to look behind that definition, because it's a bad guide to policy. It completely fails to account for the way in which scientific knowledge flows into industries. Many low-tech activities, such as timber products or warehousing, have important scientific inputs. Therefore, general purpose technologies permeate the economy – with an impact extending way beyond so-called high-tech sectors.

By the OECD definition, insurance is not officially a high-tech industry. Even though it's classed as "knowledge intensive" – with more than one third of its workforce qualified to degree level – insurance is considered to do little by way of R&D. I very much doubt that any insurance company spends anything like four per cent of its turnover on R&D.

But, as I have argued in this thinkpiece, insurers actually depend to a considerable degree on high-tech science and research. Insurers' excellent global performance depends in part on access to world-class science which does not show up in figures measuring insurance activity.

So high tech matters far more than official figures suggest, and that challenge to my January speech – that high tech remains relatively unimportant – is misguided. Even apparently low-tech industries may depend on high-tech investment and research. Currently, the UK has high-tech industries flying under the radar and – once we recognise them – it becomes clear how crucially important high-tech capability really is. That's why the UK's high-tech strategy is so central – why investment in general purpose technologies like high-performance computing and our commitment to scientific research are so necessary to rebalancing the UK economy.

If you have any questions or comments about this Thinkpiece, and/or would like to be added to a mailing list to receive new articles by email, please contact us: thinkpiece@cii.co.uk or by telephone: +44 (0)20 7417 4783

David Willetts is Minister of State for Universities and Science. He looks at strategic priorities accross all departmental business including; higher education, science and research, life sciences, innovation and cyber security. He is also responsible for the Technology Strategy Board, Energy Technologies Institute, the National Measurement Office, the UK Accreditation Service, the British Standards Institution and space policy.

David has been a Member of Parliament for Havant since 1992. He has worked at HM Treasury, the Number 10 Policy Unit, served as Paymaster General in the last Conservative Government and then in the Shadow Cabinet. He was a Visiting Fellow and Nuffield College, Oxford, is a Governor of the Ditchley Foundation and a member of the Council of the Institute for Fiscal Studies. He has written widely on economic and social policy. His book, '*The Pinch: How the baby boomers took their children's future – and why they should give it back*' was published earlier this year.

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Recent amd relevant articles in the series:

No.86: **The Power of Networking in the New Economy**, by Sue Carette (10 August).

Getting a march on the competition is difficult during the best of times, let alone when conditions are as testing as they are now. Access to the right network of support and contacts can be the difference between success and failure. The author examines how networking is changing with the advent of new technologies and how it can be of value to you professionally and personally.

No.85: **Road to the White House: what's at stake in the US election**, by Ana Catalano Weeks (20 July).

The world will be watching as Americans go to the polls on 6 November. The battle between present incumbent, Barack Obama and challenger, Mitt Romney promises to be close. Whatever the result, the consequences will be felt all over the world and not just in the US. In this Thinkpiece, Ana Catalano Weeks (Harvard University) considers some of the policy topics that will play an important role in deciding the winner and that will be of global significance to those in insurance and financial services.

No.84: **Perceived and Actual Risk in Financial Markets: Insights from Emotional Finance**, Nick Bullman and Richard Fairchild (13 July).

Traditional approaches explaining human choices in financial services have done little other than reveal our limited understanding of this subject. More recently, researchers have come to realise that emotions have a more powerful part to play in the decisions of casual consumers and professional investors alike. This article explore some of these new theories and their implications to understanding financial markets.

No.80: **Climate Change: Implications for the UK and the Rest of the World**, Professor Sir John Beddington (June 2012).

The UK Government's Chief Scientific Adviser discusses the potential implications of a two-degree warming of the climate. Possible negative consequences include; a rise in sea levels, increase in prevalence of heat waves and an increase in the number of extreme weather events such as storms and droughts. There is also the possibility of breaching tipping points in the climate system which if crossed could result in irreversible climate change.

No.76: **Is the Renminbi the New Dollar? Chinese Monetary Policy and the Global Reserve Currency System**, by Andrew Leung (14 May).

The author focuses on monetary policy in China and its potential implications, arguing that any drastic appreciation of the Renminbi (RMB) is likely to cause catastrophic job losses and social instability in the country. As a consequence, Leung argues that China must retain an independent RMB exchange rate, allowing for only gradual and measured appreciation.

No. 71: **The Challenge of Age: Global Longevity Trends and Economic and Social Implications**, by George Magnus (23 March).

George Magnus ("the man who predicted the financial crisis") argues that the current economic turmoil is colluding with rising longevity to severely depress returns for the elderly. Governments, societies and industries must take robust action now in order to ensure that rising longevity is celebrated rather than feared over the decades to come.

CPD Reflective Questions

Reading this Thinkpiece with respect to the learning outcomes below can count towards *Structured CPD* under the CII CPD Scheme. The questions are designed to help you reflect on the issues raised in the article in relation to these learning outcomes. Please note that the answers to the questions are not meant for CPD records purposes.

Learning Outcomes

- To understand the links that exist between science and technology and the insurance profession
- To understand how some of these links are being developed and supported by government

1. The author talks about insurers having “a window on the world” – how has he come to this conclusion? Do you agree with this observation? What factors help form your opinion?
2. Do you recognise the links between insurance and science? Do you believe they are strong enough? If not, how might they be improved? How might this help the industry in the future?
3. Can you think of other examples of links that exist between insurance and science?