OFFICE OF THE PRIME MINISTER'S CHIEF SCIENCE ADVISOR

Professor Sir Peter Gluckman, ONZ KNZM FRSNZ FMedSci FRS
Chief Science Advisor

6 April 2018

Knowledge brokerage in an age of rapid technological change

Sir Peter Gluckman Speech at Public Communication of Science and Technology Conference 2018, held in Dunedin, NZ 3-6 April 2018

Last week my Office released a report about the NZ criminal justice system. It reviewed the evidence that suggests that a dominant focus on retribution is driving up prison costs and doing little to address the fundamental drivers of crime – it is a result of two decades of the politicians showing they are being tough on crime in response to public and media fuelled demand. The report argued that the evidence suggests it is a time for a rethink. The immediate responses were predictable. Some questioned how you can use data to show crime is falling when they know they are in the middle of a crime epidemic – what we have is an epidemic of crime reporting, not of crime itself; some who clearly commented even before they had access to the full report merely stated that we need to be tough on crime and others, both scientists and the public, engaged constructively in the issue. But it will take far more than one report to change the debate to one which is more constructive.

So why do I start here. Because the issues of social innovation and technological innovation have great similarities. Both require social license for innovation to be accepted – both involve consideration of personal cost and benefit, risk and precaution. And when it comes to risk, a startling figure in our report was that the majority of NZ-ers think the crime rate is rising when it is clearly falling – clearly a function of where our media has taken the debate. The density of crime stories leading on our front pages and on the TV channels is extraordinary and has risen rapidly as mainstream media use shock and horror to maintain an audience against newer platforms. Moving a discussion from instant kneejerk responses on complex issues, where science and values intersect will never be easy, yet it is this I want to focus on today.

The list of disruptive science-driven technologies is growing – artifical intelligence, machine learning and big data, robotics, internet of things, autonomous vehicles, nanotechnology, gene editing, brain enhancement drugs, meiotic gene driven, bioelectronic implants, synthetic biology and geoengineering are some of the most obvious. Each of these technologies has the potential to both advance the planetary and human condition or to harm it and different stakeholders will have very different perceptions and understandings. And public policy is a matter of making choices between different options that affect different stakeholders in different ways. There is always some trade-off to be made. Many activists and lobbyists will take a complex issue and try and reduce it to a singular and simple decision – yet the trade-offs matter – they are real, they impact in different ways, they impact stakeholders in different ways they can be anticipated and unanticipated and policy making must take all of this into account.

Mail: PO Box 108-117, Symonds Street, Auckland 1150, New Zealand
Physical: Ground Floor, Boyle Building (505), 85 Park Road, Grafton, Auckland 1023
Telephone: +64 9 923 6318 Email: csa@pmcsa.org.nz Website: www.pmcsa.org.nz

I have spent most of the last nine years being a broker between the science community and the policy community. And these are very different cultures. All governments have the challenge of choosing between the impact on different stakeholders when they make policy choices. And they are torn between managing short-term electoral risk and promoting longer- term strategy. Importantly science does not make the policy, it can only inform policy. Democracy relies on decision-making informed by many other values-laden considerations: public opinion, political ideology, electoral contract, fiscal considerations, diplomatic considerations, etc. Policy making is not the neat cycle it is sometimes suggested to be, rather it is a messy process involving formal and informal actors.

But these issues are not simply for science and the policy community. As technologies play a greater part in our future, we will need both the policy community and society to be continually engaged with the scientific discussion. And this will not happen if complex discussions are reduced to political point scoring, 280 character tweets or 10 second sound bites. More mature and multidimensional discussion will be needed but this is increasingly difficult with the echo chamber of social media, and the decline in trust in institutions, in the media and experts. The post-expert and post-truth world make many important decisions that much harder and threaten the nature of democracy itself. Science and science communication have important roles in being bastions against that threat.

As my introductory anecdote reminds us, people have very different and deeply held worldviews reflecting their culture, tradition, past experience, persona and context. People interpret data and evidence through lenses shaped by their cognitive biases, the views of their peer group and their own world views. Science alone will not resolve different worldviews; rather it can actually make them more divergent as we have seen in a number of experiments.

Ultimately the choice that society makes about any innovation is about perceptions of relative risk and of cost (and to whom) and benefit (and to whom). And while the pace of innovation is now much faster, it is nothing new. All said and done it is embedded in our evolved capacities to innovate and learn. The progressive evolution of our cognitive and manual skills has meant that most human societies have been in a constant phase of innovation since we first emerged as a species. But the pace of innovation is now rising exponentially, and what is relatively new is the ability of democratic society to have some say in how technologies evolve, and how they are used and controlled.

Social licence was a concept originally developed to allow industries with manufacturing plants to have on-going approval from the local community and other stakeholders. But the concept has been more broadly adopted to include the acceptance of technological innovations by society. It is a complex topic involving different perceptions of risk and benefit, and different views of different stakeholders. It varies for different types of technology. Depending on the technology and the societal response, it may involve regulators and formal processes, it engages politicians or it is driven by the market place.

Mail: PO Box 108-117, Symonds Street, Auckland 1150, New Zealand
Physical: Ground Floor, Boyle Building (505), 85 Park Road, Grafton, Auckland 1023
Telephone: +64 9 923 6318 Email: csa@pmcsa.org.nz Website: www.pmcsa.org.nz

There is always a tension in any society between the stability of what we know now and the novelty of the future and of new innovations. Underneath there is conflict that arises because fundamentally most people are comfortable with what they've got, what they know, and generally they fear the unknown unless the benefit to them is immediate and obvious. This tension is exacerbated by many other issues; the positioning and power of incumbent technologies and the associated path dependencies, perceptions of risk, costs and benefits of new technology and who receives or bears them, differing world views and so forth. And there can be strong economic interests on either side of such debates. That partisan politics might aggravate such complex discussions is thus almost inevitable. Social licence in this broader context is about when the socio-political environment allows the technology to be used.

Central to technological acceptance, or not, is the relationship between science and society and science communication here has a critical role to play. There is the issue of the state of the evidence and the claims around it: this can be the source of real or apparent debate. But underneath is a set of deeper issues; is there trust in the actors, is there trust in the science? We now hear a lot of the term 'post-trust' society: a key strategy for groups who take a strong position is to undermine the credibility of those actors who take an alternate position or even to undermine trust in the regulator. In turn the regulator must earn and strive to maintain trust.

In general people accept a new innovation more readily if they can see direct benefit from it, for instance the smartphone, and are less likely to accept a new technology if they think that they're going to pay the cost and take the risk while some other entity like a large pharma is going to gain the benefit. In all of this there are many different vested interests of different stakeholders. There's also a set of cultural factors that are particularly relevant to biotechnology but I think are now emerging in relation to digital technologies. Some challenge spiritual beliefs. Another is fear of impacts on the way of life.

Societal consensus must be achieved within the frame of the diversity of values and worldviews that we value within a democracy. At the heart of social licence are issues around the assessment of risk. And risk means different things to different people. Many scientists are used to presenting risk in an actuarial sense. But, most people have much more subjective perceptions. And closely related are considerations of gain and losses, benefits and burdens. You have a different sense of risk if you think you're going to benefit from a particular technology, compared to if you think you're going to lose in some way, even if in either case there is uncertainty in the actual risk-benefit equation. And in a democracy, we need to remember that politicians have a very different driver of their perception of risk; it's what happens in the ballot box in 1, 2 or 3 years' time.

Related to this is our understanding of precaution. The precautionary principle was never intended to say you can't do something unless it's absolutely proven to be safe. The nature of the scientific method means that one can never absolutely prove anything to be completely safe. And no innovation is possible without some acceptance of uncertainty. But there can be pressure to take an extreme interpretation of the precautionary principle and reverse the concepts of science and proof; that is to say unless you can prove safety, you can't do anything at all. This is an illogical concept: but some lobbyists for a particular position push to that extreme.

Mail: PO Box 108-117, Symonds Street, Auckland 1150, New Zealand
Physical: Ground Floor, Boyle Building (505), 85 Park Road, Grafton, Auckland 1023
Telephone: +64 9 923 6318 Email: csa@pmcsa.org.nz Website: www.pmcsa.org.nz

It is useful to understand why the relationship between science and the rest of society has changed in the last 30 years. Science has changed dramatically. The result of computational development on one hand (including the emergence now of big data) and the molecular sciences on the other have changed what science is possible. An increasing amount of science, is now framed within systems thinking which moves us from certainty to probabilistic approaches. As a result of these changes we are also moving from what's been called normal to post-normal science, where the science is complex and where there is a high values component that is often in dispute. So let us look at two technologies.

About 20 years ago NZ took the position of effectively banning the non-medical use of the gene modification technologies – a rather extreme interpretation of the precautionary principle was taken. Despite the rapid pace of change and growing understanding of it uses and potential, the technology itself, rather than the use of the technology, was regulated. Perhaps understandable in context of the times but increasingly seen globally as an illogical approach to technological regulation. And was it logical for a country that is built on biology? Yet despite an overwhelming amount of scientific evidence of the safety and value of such technologies, social license to do so does not exist.

Contrast this with the digital revolution. It emerged at about the same time but benefit in the form of internet, smart phones, email, and then social media and Amazon outweighed any consideration of threat to human values such as privacy, autonomy and agency. Governments feared regulation might inhibit innovation. Only now with the implications of their impact on democracy, the power of the nation state and the growing power of the platform companies becoming apparent, has the policy community started to express alarm. The public remains uncertain – still seeing the manifest benefits of Amazon and Uber and perhaps not recognising yet the magnitude of societal, community and social change that the technology is bringing. Yet the social license for these technologies, while shaky, remains.

These are but two extreme examples: science and technology will be throwing up more and more complex issues that need social input. But, how do we constructively engage in such issues? For at least the last 10,000 years we have all by definition lived in 'experimental societies'. Humans evolved with skills that makes progressive innovation inevitable. Innovation is both sociological and technological. Our societies and concomitant technological innovation have always co-evolved with iterative interactions between them. 1,000 years ago, the pace and diffusion of innovation was relatively slow, society adapted to it and the impact of society on the innovation was again very slow. Now we have very rapid and diffusible innovation that can have direct and large effects on society. But conversely modern societies are much more diverse: within populations, there are multiple empowered communities with multiple viewpoints, in turn resulting in multiple but uneven influences on technological development.

So what drives the acceptance of some technologies and the rejection of others?

First trust in the actors is really important. Of course the technology has to be useful. Secondly, the response to the pre-existing technologies and associated vested interests matters. Thirdly, it takes

Mail: PO Box 108-117, Symonds Street, Auckland 1150, New Zealand
Physical: Ground Floor, Boyle Building (505), 85 Park Road, Grafton, Auckland 1023
Telephone: +64 9 923 6318 Email: csa@pmcsa.org.nz Website: www.pmcsa.org.nz

time. It took 100 years for margarine to be accepted. And technologies do not evolve in isolation – there is an iterative process of both societal and technological adaptation that has to occur. A progressive understanding of costs and benefits will evolve as the technology diffuses. With experience, the empirical understandings of risk become clearer. The feared effects of GM foods on health have been shown to be non-existent, and GM ingredients and foods are now widespread. This however does not provide social licence, for there can be many other objections than simply safety.

Social licence involves early and continuous engagement of the science community with society at all levels and in all areas. It requires a deep understanding of underlying impacts and concerns. Social licence is much more likely if we engage better in the concept of co-design, co-production and extended peer-review within science. This ultimately means our young scientists need to be better prepared at university by training in the civic areas of science such as the philosophy of science, and science engagement. The need for social licence requires better acknowledgement of uncertainty, and a better skill set in explaining risks and benefits. We have to work out how to be more transparent and engage the community as a whole from the earliest stages, and to do so in ways that sustain and maintain trust. And society has to be open to constructive conversation.

We have societal choices ahead of us that are hard – where environment, economics, societal and industry interests all intersect. There are decisions that science alone must not make. And the decisions we make today may differ from those we will make tomorrow when newer technologies emerge. We will use some technologies and likely choose not to use others, but what is certain is that the technological weaponry we will be using in a decade's time will differ from what we now use. The challenge is how to have the conversations and what should be the regulatory regimes that allow for rapid technological change.

This is where enhancing the public understanding of the scientific processes themselves are critical. But citizen science in whatever form is not enough. We need to take lessons from the language and scholarship of post-normal science: the answer must lie in concepts like extended peer review, co-design and co-production. These are critical but complex and controversial concepts but they will be a large part of the future of science. It will require major changes in how science is managed and funded, how our research institutions act and how researchers are incentivised. The scientific enterprise is inherently conservative and this will not be an easy road.

Ultimately science and many new technologies will be essential to enhancing our condition, but that science will mean nothing without much better national conversations, getting beyond political or interest group point scoring and ensuring that conversations engage the public, NGOs, the private sector, academia and the policy community. Science can make a difference but science communication in all its forms will be critical to do so.

Mail: PO Box 108-117, Symonds Street, Auckland 1150, New Zealand
Physical: Ground Floor, Boyle Building (505), 85 Park Road, Grafton, Auckland 1023
Telephone: +64 9 923 6318 Email: csa@pmcsa.org.nz Website: www.pmcsa.org.nz