32nd International Symposium on Military Operational Research

RONNIE SHEPHARD MEMORIAL ADDRESS

Dr Frances Saunders CB FREng

When Peter Starkey invited me to give this year's address in memory of Professor Ronnie Shephard I was obviously honoured but also just a bit apprehensive. What would I have to say that would be of interest to this august assembly of defence analytical expertise. I have known Peter for nearly 20 years now, since I was parachuted into his orbit to be Director of the then UK Centre for Defence Analysis and his sage advice was that ideally, I should, and I quote, "present some sort of core message to advise, educate or enthuse the symposium participants, leavened with judicious amounts of humour and anecdote". So now that you know my brief I thought I should start off with an attempt to meet the humour requirement.

This is the one about the physicist, the engineer and the defence analyst who were stranded on a desert island with a few cans of baked beans but no can-opener. So they started discussing how they were going to solve the problem of not starving. The physicist started (after just a bit of gazing at her sandals) well we could light a fire and put a can in the hot embers, the baked beans would get hot, the liquid around them would start to boil and release gas that would build up pressure to a point that it would overcome the structural integrity of the can – and boom the can would explode releasing the hot beans. The engineer scratched his beard and did what he had been told to do in the creativity workshops he had attended and said "Ah YES, AND .... building on your suggestion ... we could surround the can with some kind of structure to catch the beans as they are released and so stop them falling into the fire or being catapulted into the sand. The physicist liked the practical additions presented by the engineer and after a bit more discussion between the two of them they agreed that they had a cunning plan. However, before going on to implementation they thought they should allow their third team member to make a contribution so asked if he had anything to offer in relation to the problem. The defence analyst hummed a bit, stared at the sky and had a bit of a Eureka moment, shouting I've got it. His two

colleagues gathered around him in anticipation – yes, he said, I know where we should start – **Let us first assume a can-opener**.

So what should we learn from this anecdote?

Firstly ... old jokes are not guaranteed to raise a laugh

Secondly ... the collective noun for an assembly of defence analysts – or indeed any kind of analysts or operational researchers - should be an Assumption ... (like “Murder of Crows” – an “Assumption of Analysts” rolls nicely off the tongue)

Thirdly ... as analysts ... it is always particularly important to check that your assumptions are credible within the context of the analysis you are undertaking or the advice you are giving if you are going to have the Impact you desire

Which takes me onto the theme I thought I would focus on for this evening. That is achieving IMPACT.

Now delivering Impact has become something of a craze, or I might say even a bandwagon, in the UK in recent years. Academics cannot prize Grants out of the Research Councils without filling in a clearly thought through statement relating to “**Pathways to Impact**”. This statement is required to **Focus** on potential outcomes from their work; identify and engage relevant users of their research and stakeholders at appropriate stages; and articulate a clear understanding of the context and needs of such users for the outputs of the work.

Two key points here I think:

1. Research Councils have recognises the important difference between doing the work – which is an activity that obviously needs to be done well - the outputs of the work – the new knowledge or understanding created - and the outcomes being sought by users. It is vital to understand what they will use the outputs for as it is only this final stage Impact happens.

2. They have also recognised that Impact has to be built into the earliest thinking about a research project – whether that just be to increase the academic impact of knew knowledge or to deliver additional economic and societal benefits.

NOW. Does any of this sound familiar?? I do recall having rather similar discussions with study leaders in my time at CDA and later in Dstl when reviewing research projects – questions such as ...

> who were the users of the work?
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> were we engaging them early enough in the design of the project,
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> were we keeping them involved and informed as work progressed so if any mid-course correction was required we could do it – rather than getting to the end and discovering that we were at risk of delivering a lemon on which they had no desire suck ?

So designing work - up front - for the potential and the desired Impact is certainly one important element of this theme.

One of the other things I have done since retirement has been involvement in the UK University Research Excellence assessment undertaken last year – REF 2014. For the first time the Impact of research from University Departments accounted for some 20% of their marks – and those marks affect how much money they receive as core funding for their research. This evaluation of Impact was undertaken using case studies that were supposed to demonstrate how Impact from previous research had been delivered – research which might have been started up to nearly 20 years previously. I read nearly 100 case studies of the Impact of different types of Physics research.

By far the easiest Impact to assess was the economic benefit – especially if the case study included some concrete numbers such as turnover, company value, jobs created and so on. It was also relatively easy to follow the trail from research to its use to its impact. Some case studies had clearly had an Impact on Society at large or on People's lives, through diverse routes such as improvements to Healthcare, efficiency of energy production or reduced energy use, weather forecasting and so on. Much more difficult to assess were those case studies claiming Impact on policy – such as Government policies – where the research might just have been one small aspect of the evidence considered – often by a large committee of the great and good ... who gave an opinion which might or might not end up becoming a policy ... which might or might not get turned into law or otherwise implemented by a Government Department. It was often quite difficult to

show unequivocally that research results had fed through into concrete Impact – which left me uneasy that we might be either undervaluing or overvaluing it.

This must be particularly the case where there is controversy or vested interests at play – just think how loud some of the negative voices have been concerning the origins of climate change and its links to human activities and CO2 emissions. Even when strong evidence has been accumulated over many years, having a significant Impact on political decisions to change behaviours or implement policies that may be unpopular with voters ... for the greater good ... may still be a challenge too far ...

So has all the excellent data gathering and modelling actually had any Impact ...or is that Impact illusionary because of the many other factors at play?

Even in the so called third sector – charities and the like – The requirement to demonstrate Impact and explain the difference that the work of the charity is making to people's lives – aligned with the relevant Charitable Objectives of the organisation – is the new bible on best practice. It is no longer sufficient to say that you may have helped several 1000 people – as that is just seen as an input measure – Charities are expected to keep records and try to follow up on outcomes – so did an intervention with an individual make a real difference to their options or their attitudes and did it have a lasting effect or was it just transitory – the purpose being to help learn from what works in terms of outcomes and design interventions to improve the likelihood of having a lasting effect. Not necessarily a discipline that many small charities have expertise or resources to follow fully. But that will be the challenge for them – and that comes from donors as much as the Charity Commission.

So, in the context of tonight's theme - where much of the output of analytical work feeds into Government decisions at various levels, I suppose one question might be "do you have case studies that illustrate the Impact of your work?" Do you regularly follow up to find what was done with the report delivered – or did it just sit in a cupboard somewhere. In any case, how would you define such Impact? Do people make better decisions as a result of your work, or do they just

make better informed decisions? Or are they just ticking the box on the business case that says they must have considered independent analysis when making this recommendation for a particular investment or course of action?

I certainly remember being roughly spoken to by more than one senior military officer whose views of analysis and their results could be summarised as “Either I knew it anyway as it is just common sense and it aligns with my military experience - OR – **It’s wrong** – probably because you have used the wrong assumptions and if I put in different ones I can get the answer I want”. Along with such attitudes also came pressure to do just that and cherry pick the results that aligned with what they wanted to do anyway. At a time when there is significant pressure on budgets, being able to put forward good examples of where work has made a significant difference and had Impact is something for all involved in the production and use of evidence to consider.

However, the degree of Impact achieved from analysis may have little to do with the “excellence” of the underlying analytical techniques employed or the quantity of data delivered – much as the longer term Impact of University research is not directly related to whether it was internationally leading in terms of its academic quality. It is true that there is a quality/quantity threshold below which the analysis is inadequate for its purpose but once above that threshold other factors kick in – such as the level of engagement with the users of the work and clarity around the questions being answered – or often more importantly not being answered. Users of the results of analysis really **DO NOT CARE HOW CLEVER YOU ARE**. Nor do they care how clever or novel the analytical technique was – They are only interested in what the results will do for them.

I note that the publication of the Aqua Book by the UK Treasury in March 2015 contains much guidance and best practice for producing quality analysis for government and this may be a step forward in helping ensure that everyone involved in the commissioning, delivery and assurance of analysis is at least on the same page. However I might observe empirically that achieving and recording Impact from analysis activities seems to be almost inversely proportional to the potential impact available. What do I mean by that?

Well analysis that might support strategic level reviews of defence and security priorities, such as the current UK SDSR, have the greatest opportunity to make a difference on the country's whole defence stance and priorities for investment – get it right and it can have a major impact. However, this is precisely the kind of problem space where crystal ball gazing and assumptions on the future are the most difficult to justify – leading to the danger of so called "smuggled assumptions" – or scenarios constructed without an audit trail from value judgements of those in the driving seat. It may be important to try to explore possible futures and trends that might drive the defence and security environment but it is not possible to pick one future state as the winner. Yet at times of austerity, when budgets are under such pressure, it is critical to be able to understand what risks a country is taking by not investing in particular defence capabilities, or by changing its defence stance, or its balance of forces. Not surprisingly this whole area is very political – not just Politician and Votes type political – but also internal faction politics and the potential for what I might call "analysis wars" – I am sure you will have come across situations where people commission pieces of work that they hope will further their own agenda.

This is of course not new. I have been clearing out my loft and came across a CDA report from about 20 years ago called Project Insight that was aiming to provide some structured analysis of the future global defence and security environment out to 2040 - which it was hoped might in turn influence defence policy and capability planning. The output of the work was not to be a prediction of one single future state but to understand how different drivers could influence a range of possible futures and identify any leading indicators that could in principle be watched to give some early warning of problems in the road ahead. With 20 year hindsight, there was much in this work, particularly on drivers, that was basically correct – for example growing populations in poorer countries – particularly of unemployed and disaffected youth threatening civil stability and – or leading to increased migration of said youth – across the Mediterranean. Environmental Change – for example increased desertification and issues over control of water resources, Globalisation of the economic system, breakdown in nation states, more open access to knowledge – though of course they did not know of the social media and twitter effects at that stage. So I would say the work

was very good at identifying many of the drivers and some of the potential consequences that have come to pass so far -not necessarily in the detail, but in broad areas where they have affected the world security environment.

So what happened to this clever piece of work? Did it have any Impact? The Honest answer is that it probably had very little impact – despite trying to engage politicians and senior strategic thinkers with the material – Why? **Because who was going to be the real user of such a thought provoking piece of work and over not just a 20 year but a 40 year period**. Who was going to keep it fresh and watch for indications that some of the drivers were indeed taking us towards one of the predicted world states?

Again, back to my original thesis, where potential for Impact is greatest it is hardest to achieve – political and institutional timeframes and the long term ownership of the problem space just do not work in our kind of democracy – other than reverting to a national despot or a, yet to be invented, international institution that sits outside political cycles I do not see that changing.

So, in summary, for long term strategic analysis I would say again, that it is always going to be hard to deliver any lasting Impact. Analytical support to the next level down of defence reviews such as SDSR are likely to more impactful at helping people at least to explore options and lay them out with some underlying logic. But even here the danger of smuggled assumptions can render the analysis less valuable as the tugs of war go on between the factions on different views of the basis on which they wish to plan their future priorities. Analysis wars can be fun – especially if different groups or firms of analysts are employed by different factions -but can damage the overall view of analytical worth – if you can get any answer you want if you ask the question in the right way – hence the need for someone to own the overall analysis strategy and agree the portfolio of studies that will contribute – **the owner of the analysis strategy then becomes one of the most powerful players in the review ...**

Let us go somewhere more comfortable. At the other end of the impact spectrum are the short, sharp pieces of work undertaken by deployed analysts on Military Operations or in Headquarters. I was fortunate to visit analysts working in both Iraq and Afghanistan to get a feel for how closely they worked with the military team, how valuable their contributions could be and their Impact on improving operational outcomes and indeed on saving lives. The analysis was not necessarily the most sophisticated – and I am reminded of the wise words of one of my Dstl colleagues (David Oxenham?) that “you could do a lot of good analysis on the back of an envelope – though with complex problems you might need to write rather small and have quite a big envelope”. The impacts were of course local and time-bound – but even here I am not sure that we always captured the contribution that we had made – too modest – and by the time we may have to deploy in such a way again the corporate memory in the military around how they used analysis and analysts will probably have been promoted or retired – so it is worth capturing these key lessons as to what worked and why before it is too late.

Sat somewhere in the middle is the analytical support to development and procurement of defence capability. Looking at defence budgets, one of the key areas for Impact must be an increased focus on the affordability of capability – not just the equipment but the trained people who will make use of it. I remember visiting an industrial supplier of Command and Control equipment for the Navy who rather proudly announced that they had delivered their equipment with a significant stretch capability – less than 50% of the functionality in its specified requirement was turned on yet because the Navy did not have enough money to train the operators in those functions. Now part of me could understand the potential value of a stretch capability – but the other part of me thought that the Navy had paid handsomely for functionality it was never going to use and whether that extra functionality actually provided any additional military advantage – presumably not or they would have turned it on.

This just illustrates how important analysis can be when exploring the intersection between performance (or functionality) and effectiveness (or impact on military value). Particularly when looking at cost effectiveness

of advances in performance of equipment – where they may not actually deliver any additional military benefit. Capturing case studies where analysis has helped save money would I am sure be worth doing.

It is also potentially an area where there is greatest pressure to build and use models at different levels of system representation and system of system complexity. I remember a colleague from industry postulating that now we had such vast computing power available we could see ourselves having multi-level linked models where we could model everything from the electron transport in the new design of diodes on the radar receiver to the performance of the system on the battlefield. I think my response was something like – I am sure you could – but why would you want to?

I am very suspicious of analysts that reach for models as a first step – rather than thinking through the questions they are trying to answer – I am also a bit suspicious of models that link together without an air –gap – the purpose of the air gap being that people get involved in thinking about the data coming from one level of model and how it relates to what is important at the next level up. Of course availability of cheap computing power does allow a greater volume of the problem space to be explored quickly and economically – but I feel it should not be a replacement for thinking how best to structure the problem.

Interestingly, the link between performance and effectiveness is an area of thinking that I have also been promoting more recently to those engaged with technology transfer from University research to industry. Too often the researchers just push technical performance without any understanding of the users' needs, or markets for their technology. This is not that surprising as it is often the case that what drives the academic individual is technological advance – having a world leading academic result in the lab. Whereas what industry needs is something that will deliver a competitive advantage in terms of features that their customers will value and at a price they are willing to pay – and at minimum risk in manufacturing. The, so called, Valley of Death between research prototypes at low Technology Readiness Level and fully engineered prototype products is often deeper because of the inability to communicate and have shared mental models of what areas of performance are important in terms of Impact on the customer or end

user. With the reduction in the number of applied central research labs in industry and the public sector, the number of people who understand such translational research has fallen and really needs to be rebuilt – I would argue that analysis and modelling are key parts of that translational capability.

So let me draw this to a close. My theme for this address has been one of the importance of thinking about the true Impact of analysis and the difference it can make. I think I would highlight three takeaway thoughts.

1. Think about maximising Impact at the design stage of any piece of analysis – particularly talking to the users about their expectations as well as the problem space – managing their expectations of what analysis will and will not be able to do for them.

2. Look at whether it is worth capturing case studies of where analysis has had a demonstrable impact. Follow up with users and commissioners of work as to what was done with the work – is there an audit trail of where it really helped with difficult choices or saved money – was there any concrete outcome and whether there was anything that could have been done differently to increase the impact.

3. Remember analysis is a contact sport – it will only have impact if users are fully engaged – it is not best delivered by specialists sat in rooms throwing multisided dice or by running ever more complex models that only analysts understand. Take a nice big envelope into your meetings with the users and learn to write small.