Techniques

This collection of blogs explores some of the futures techniques we use in our projects.

Hype and rates of Technology Adoption

Image by Gerd Altmann from Pixabay

Technology advances at a remarkable rate, but even more dramatic claims are made for some innovations which never in the end deliver. Some are just a ridiculous idea in the first place; others end up in narrower niches and at smaller scale than initially thought. At the weirdness end of the range, this year's Consumer Electronics Show gave us a smart toilet paper holder, and soft toys that nibble your fingers.

One well-established model that describes this evolution is the Gartner Hype cycle.

This describes how early high expectations are tempered by reality until second-or third-generation products find an appropriate application.

One example of this could be delivery drones. Ten years ago, back in 2013, Jeff Bezos announced that Amazon was testing delivery by drones. The press became very excited. However, little has been heard of the concept over the years as practical problems were encountered. Nonetheless, delivery drones have already found specialist medical applications – eg in Rwanda, blood supplies have been delivered by drone to rural areas since 2016; in Denmark, defibrillators can be sent to scenes of cardiac emergencies. Admittedly, in 2022 Amazon announced it was trying again, as the FAA had granted some waivers – but it's hard to see this succeeding at scale.

The limitation of this model is that it is descriptive, rather than predictive. It is clear that a small number of developments such as smartphones sweep to global success. How can we tell which ones they will be?

Other technology diffusion theories focus on different types of customer – eg early adopters. These are seen as typically being more technology aware, richer, better educated and experimental. In the social media age they can also be "influencers".

NASA approached the issue from the technology end, defining different levels of technology readiness for use in the space industry. This approach has been gaining ground in other industries but there remains some scepticism as to its usefulness. We use Technology Readiness Levels (TRLs) extensively in our Sustainability Innovation Pathway Framework.

Sometimes, adoption depends on the simultaneous development of technologies in adjoining fields. For example, video-on-demand services came about because of the coincident arrival of low-cost disc storage, higher bandwidth broadband and improved processing. The nexus of Internet of Things, Big Data analysis and Machine Learning similarly allows leaps forward. Potentially, AI and biotechnology together will accelerate innovation.

Barriers to adoption are often not about the technology itself, but more about the economics and the wider societal eco-system. Some seminal examples are:

- ***Videophones*** – the development of videotelephony as a subscription service started in the latter half of the 1920s, but it never became a generally widespread product, as the costs (both of equipment and comms links) were high and telecoms companies regarded it as a premium product that they could charge more for. Despite featuring in sci-fi programmes such as Star Trek, real-life products were not appearing. Advances in broadband, and innovative software fundamentally changed the business model. Skype offered video-communication free and the equipment needed was already generally available. The Covid pandemic finally wiped away residual barriers and Zoom calls/meetings are now standard.
- ***Electric vehicles:*** although once widely used for milk delivery, where speed was not an issue, electric vehicles failed to take hold until the recent Green Agenda. (Milk delivery also featured environmentally favourable reusable bottles!). The Sinclair C5 was a complete flop, yet now would sit in an easy niche between electric cars and e-bikes, e-scooters etc.
- ***Flying cars:*** another staple of sci-fi since the Jetsons in the 1960's, or earlier. But the technological challenges of widespread use of flying cars are dwarfed by the logistical issues of traffic control, safety and landing sites. The 1997 film "*The Fifth Element*" showed some of the problems – with a lead character falling into a flying taxi.

Some of the wider considerations affecting adoption can be categorised as:

- ***Ease of use***. This includes integration with other existing technologies and established ways of working. Changing behaviours is a barrier. Oddly, the original SMS system was very difficult to use – needing three key depressions for some letters – yet was successful because of the price. So, more generally, we look at
- ***Price vs utility:*** clearly a fundamental consideration. This can also depend on the general economic environment – today's "cost of living" crisis is not a time to introduce "nice to have" services.
- ***Comparison with alternatives:*** smartphones overtook Personal Digital Assistants and Filofax
- ***Infrastructure requirements***: typically infrastructure takes longer to develop than devices, but can eventually offer economies of scale. The telecoms/internet industry battles between the "Edge" and the "Cloud" are an example of this tension. Hyperloop faces similar challenges.
- ***Regulatory issues***: air traffic control was mentioned above – similar considerations apply to drones (privacy, safety); labour market rules are beginning to challenge Uber approaches to employment; Concorde was to a degree stymied by sonic boom issues (though politics and economics also played a role).
- ***Business eco-system:*** often linked developments are needed between, for example devices and content with the whole package being necessary –

Betamax/VHS being a classic example. TV streaming services are a similar dynamic as Netflix etc move into content creation.

But sometimes it is just the technology itself. ***Nuclear fusion*** has been the "coming" energy revolution since the original concepts in the 1930s. Its green credentials make it very attractive. Recent announcements about a breakthrough, where more energy was produced than used, launched another hype wave. But even its developers admit that timescales are long: "a few decades of research could put us in a position to build a power plant". It most certainly is not an answer to the current climate crisis.

Looking forward what can we say about two major areas of development?

Crypto-currencies and Blockchain

Is there widespread utility for crypto-currencies? Are there economic or social advantages? Are they (or will they) be subject to restrictive regulation? The signs are not good, and personally I would suggest that this is one for the "plateau".

Blockchain more generally has some clear applications and utility, even social benefits when applied to land rights for women in sub-Saharan Africa. But again, applications seem limited and a plateau would be my forecast.

Artificial Intelligence

This is now such a wide field, with myriad applications, that it is hard to generalise. The "Singularity" of self-replicating AI outstripping human intelligence is discussed less these days. Many leading scientists, including Stephen Hawking were concerned for the future of the human race. Ray Kurzweil's 2005 book *The Singularity is Near*, predicted singularity by 2045.

Specific applications of AI are taking hold rapidly, though not uniformly.

- ***Voice assistants:*** Amazon's Alexa seems to be losing its appeal – the division lost $3 billion in just the first quarter of 2022. New users discover half the features they'll ever use within three hours of activation and 15% to 25% were not using the virtual assistant in the second week. The recently launched ChatGPT is creating a new hype wave about AI capabilities. Despite its many strengths, it has been described as ""like an undergraduate confidently answering a question for which it didn't attend any lectures. It looks like a confident bullshitter that can write very convincing nonsense."
- ***Legal applications:*** automation of many standard legal tasks – surveying etc – is now very feasible, raising concerns about automation of more junior roles.

- ***Medical applications:*** a wide range of medical applications of AI are emerging, from radiography to vaccine design. Interestingly, in this field, AI is seen as supporting the professionals.
- ***Art:*** AI systems are capable of imitating grand masters. Many art design projects could be delivered by AI. But the real challenge of "grand masters" is not imitating them, but moving beyond to new creations. AI art has been described as "competent but dull" – but then so is much human-created art.

So where do we see AI on the hype cycle? It is undoubtedly valuable in many fields, with many applications not yet envisaged. But – perhaps thankfully – there seem to be limitations due to the content on which systems are trained, and true "intelligence" (whatever that is) may be a step too far. Perhaps it is finding many different plateaus.

Predicting the take-up of new technologies is, like most prediction, not a definitive science. When a newly hyped product emerges, however, it probably pays to consider how it fits into the wider socio-economic environment, rather than simply enjoying the thrill of the innovative technology. Futurists can help here – we live in the future enough to understand not only its possibilities, but how concepts like TRLs and the Hype Cycle can affect the way multiple futures may pan out.

Written by Huw Williams, SAMI Principal
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Adaptive Plans – a dynamic approach to putting scenarios into action

Image by Gerd Altmann from Pixabay

How do you plan in a world that is so uncertain? How do you prepare when so many different futures could emerge? The experience of the last few years has made it clear that just expecting a "business as usual" future is a fantasy.

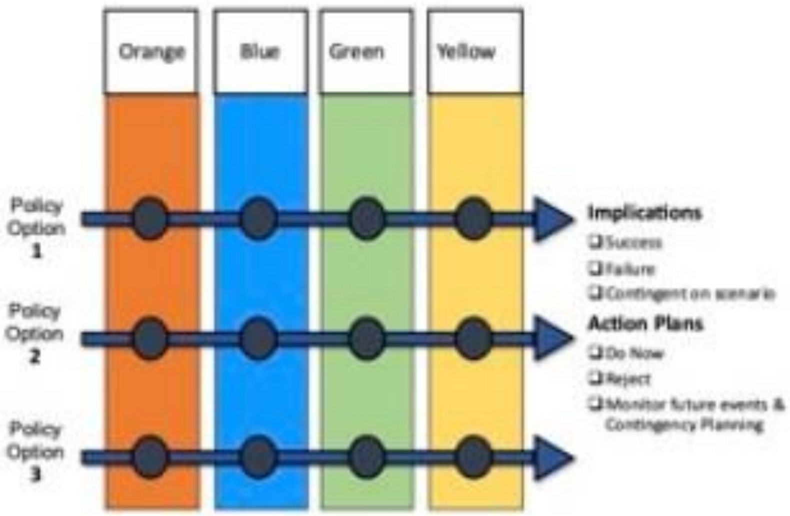
You could give up on the idea of planning altogether and instead focus on improving your capability to react, your resilience. We discussed this in a Working Paper. We worked recently with one client where the Chair asked the CEO to come up with a plan of how to cope with a 25% fall in revenues – not from any specific risk, but just as a defence against random threats.

Improving resilience is fine, but not planning at all is just abandoning yourself to outrageous fortune *and* the sea of troubles. Stakeholders tend to expect some kind of plan. And not to have one is throwing away things that we do know about the future.
There are major long-term trends we can identify – we covered these Drivers of Change in a series of blogs during 2022. We may not know exactly how quickly these trends will develop, or exactly in what direction, but they do give some insight into the possible shape

of the future. Technology Readiness Levels enable us to put – estimated – bounds on when new technology could have an impact.

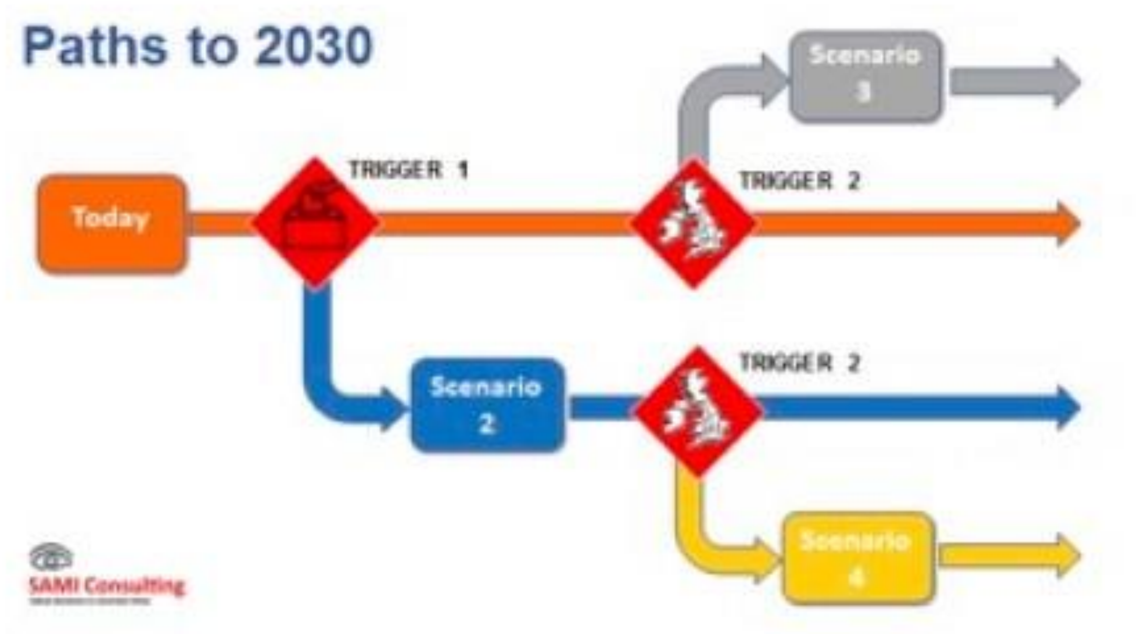
When there is a high degree of uncertainty, the best thing to do is consider the "what-ifs". You can develop these simply by brainstorming a list of risks and opportunities, by looking at a base case plus/minus 10% or by more structured scenario analysis methods such as a scenario cross. But the point is to recognise that there a number of quite different possible futures that could come about, and to think through what each means for you.

For each of these possible futures you can develop a plan. And you can test how robust those plans are by seeing how well they work in other futures. We call this approach "wind-tunnelling". (The generic example below is based on a scenario cross method, but the same principle applies however you generated your futures).



Policies or plans that work well in all scenarios should be put into a base case plan. Risks and opportunities that appear in each should also be addressed in a base case. The rest of the base case plan should be the set of policies suitable to the scenario in which you find yourself today. The other policies can then be worked up into contingency plans.

This is the basis of an Adaptive Plan – a base case and a set of contingency plans. To put them together, you need to identify triggers or key developments which indicate whether one of the alternative futures is starting to come about. By putting in place an ongoing monitoring function that looks specifically for these triggers you add a dynamic element to your planning.



It is quite likely that the future that is emerging is not exactly like the scenario you envisaged. So when dusting off the contingency plan it is important to review it first rather than just blindly implementing it.
An Adaptive Plan is a practical and manageable tool that helps you respond rapidly to emerging events and is a useful way of building futures thinking into your organisation's process.

That futures orientation is what we do (all of the examples I've included here are from actual work with clients) – because it is one thing to understand what the future may be, but another to prepare for it, and another again to understand what to do when it happens. All of those elements are key parts of a fully formed futures practice – which is where we come in. Our tagline reads "robust decisions in uncertain times" –being to adapt and flex to those uncertainties makes an organisation, and its decision making, more robust. We'd be happy to show you how.

Written by Huw Williams, SAMI Principal

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Limits to modelling

Image by Marcus Friedrich from Pixabay

September 2023 was the hottest September on record, following the hottest August and the hottest July. It wasn't just a bit hotter – it was fully 0.5˚˚C hotter, a massive leap, the largest jump in temperature ever seen. It was 1.8˚C hotter than pre-industrial levels. In the UK, there were seven consecutive days with temperatures over 30˚C for the first time ever.

Scientists were shocked. "September was, in my professional opinion as a climate scientist, absolutely gobsmackingly bananas," said Zeke Hausfather, at the Berkeley Earth climate data project. Others commented: "struggling to comprehend how a single year can jump so much"; "unprecedented"; "extraordinary".

But hundreds of scientists have been working very hard for years trying to forecast global warming, so what happened? The IPCC does seriously in-depth modelling, with lots of probability assessments so why did it not anticipate this increase? Their central estimate of global surface air temperature (GSAT) crossing the 1.5°C threshold lies in the early 2030. By 2030, GSAT in any individual year could exceed 1.5°C relative to 1850–1900 with a likelihood between 40% and 60%.

The IPCC recognises that modelling is not an exact science – which is why it runs lots of probability models – and that forecasts for any individual month may easily be wide of the mark. There were some factors in September that made the temperature leap higher. We are in part of the sporadic El Niño climate pattern where heat is released from the oceans. There is an uptick in the 11-year solar cycle; a volcanic eruption in Tonga released a large amount of water vapour, which traps heat; and, perversely, the cuts in sun-blocking sulphur emissions from shipping and industry don't help either. Nonetheless, scientists were still surprised at the scale of increase.

There are two fundamental challenges with climate modelling –the system and the data. Fully modelling all the interactions within the climate system is virtually impossible, and all the models have to rely on assumptions. The system itself is unstable and very sensitive to initial conditions. So it also virtually impossible to get accurate enough data, from all around the world, both about the current state of the system and the geographic factors (eg ocean currents) affecting the dynamics.

In addition there are multiple feedback loops, both positive and negative. For example, melting of polar ice caps means the earth is darker and so absorbs more of the sun's heat, driving further melting. Scientists have long fretted over climate tipping points, where non-linear dynamics lead to run-away global warming.

The climate has long been regarded as a classic example of chaos theory and the butterfly effect. Although it is assumed that the system is deterministic, the non-linearity and sensitivity to initial conditions makes modelling impossible.

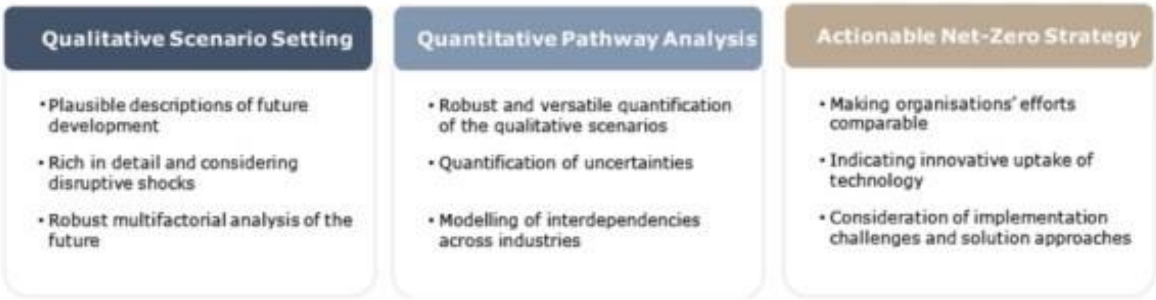
So, should we give up on modelling? And if all we can say is that there is an x% probability of passing a global warming threshold, does that help us at all?

The IPCC models are good enough to give justifiable predictions of overall global warming and to demonstrate that greenhouse gas emissions are clearly a significant cause. This means we can move the debate on to how reduce the. In that sense they have served a purpose, and extreme examples like September can add further to the pressure to act.

But knowing there is a 10% chance of life-threatening change is not especially helpful. We really need to know what to do in such circumstances – to build scenarios for action, and develop resilience to the extremes.

This problem will apply to many other systems if they are sufficiently complex. Certainly any system including the actions of people within it – political, economic and social dynamics, even the pace and directions of technology development – is going to be effectively indeterminate. In nearly all our scenario building work we view the rate of climate change and society's reaction to it as critical uncertainties.

One example of that is our work on Sustainability Innovation Pathways. By combining qualitative scenarios with quantitative analysis, the SIP Framework is able to account for the richness of the many possible future net zero worlds while considering alternative approaches and therefore avoiding the danger of single point forecasts.



This ensures that a wide range of futures is considered, whilst providing the quantitative reassurance that companies, investors and governments like to see when determining funding strategy.

Written by Huw Williams, SAMI Principal

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