Resilience

In 2021 resilience became a subject that was much talked about. Our blogs joined in the conversations.

Resilience – a "black swan" strategy

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The major shock of the pandemic highlights how successfully or otherwise different organisations are coping. We can also see how previous shocks/"black swans" have been dealt with more or less well. Several commentators have noted how organisations have increasingly been focussed on "efficiency", with the result that there was less slack in the system to cope when shocks hit – less resilience. To what extent is sacrificing short term profitability for long term success worthwhile?

The Boston Consultancy Group in their excellent blog "Becoming an All-Weather Company" argue that long-run performance is disproportionately determined by performance in crisis periods. They produced a very valuable set of "design principles" to enhance resilience.

EXHIBIT 7 | Design Principles to Increase Resilience

Source: BCG Henderson Institute analysis.
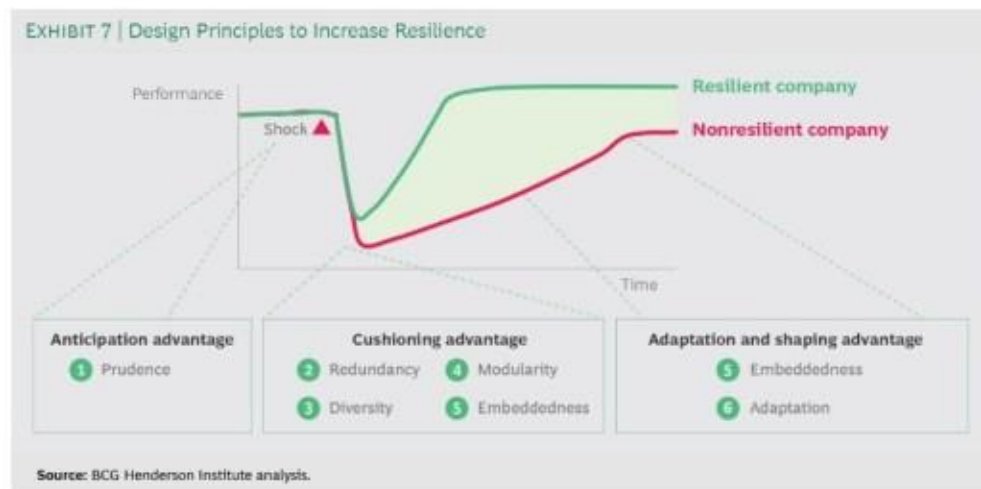
Anticipation

Being sensitive to possible alternative futures is clearly a pre-requisite of resilience. This is the area that SAMI tends to focus on, helping clients build scenarios of the future. Companies first identify long-term shifts, major drivers of change or "megatrends". They then build contingency plans for the different potential situations, and ideally war-game them to test how well they work. Good organisations then adapt their plans: the Government's response to the pandemic wargame ("Project Cygnus") failed to pick up on the deficiencies identified. The final element is to introduce a strong early-warning monitoring system to trigger responses and implement (and adapt) the contingency plans.

The area that BCG call "cushioning" has a number of elements.

Redundancy

An anathema to "efficiency", having spare resources is essential to resilience. These may be extra stocks to cope with disruption to supply chains (the antithesis of "just in time"), or extra staff available to be drafted into "surge" responses (or reservists that can be called upon). Or they may be financial reserves such as an above average cash/operating cost ratio.

Diversity

Organisations should identify the options to switch to different revenue sources: having different products, customers or regions reduces exposure to shocks. Clearly, an over-reliance on a single, narrow market makes you vulnerable. Equally, over-reliance on single suppliers, production sites or processes creates an exposure to risk. Interestingly, BCG didn't identify diversity in its cultural sense as a strength – in

SAMI we always seek to get a diversity of views into strategy development, as it reduces the risk of group-think.

Modularity
B
y this BCG mean building systems which reduce inter-dependencies between elements, so that if one fails it doesn't bring down the whole operation. Modularity can be built into production processes and into supply chains. There is also the issue of financial separation, where the failure of one division doesn't bankrupt the whole company.

Embeddedness

I found this concept one of the more innovative – the extent to which the organisation's goals are in alignment with the social systems of the markets it serves. Highly embedded organisations can rely on a good degree of social capital that can be drawn upon in times of crisis. Local companies tend to be better at this – eg restaurants' clienteles being willing to buy take-aways to keep them company alive. In larger organisations, Corporate Social Responsibility programmes should be aiming to achieve the same result – but probably rarely do.

BCG's next area was **Adaptation.**

This has two elements. First, the capacity and capability for experimentation, being willing and able to try new approaches, new products, new markets to see whether they offer relief from the crisis, and if not move on to something else. ""Fail fast" is the mantra of this approach. The second is "Agility", typically created by decentralised decision-making and collective action. Oddly, BCG seem to think algorithmic decision-making helps with this – it may speed up decision-making, but I would be surprised if was innovative enough to cope with radical change.

Finally, we come to **Shaping.**

Change and crises are not all about risk – they create opportunities too. Intelligent organisations can identify how the shock has changed the system, and spot the new markets, products or processes that can now emerge. The ability to be the first to respond to these new opportunities will differentiate the organisation from its rivals.

Being BCG, they typically claim to be able to quantify the benefits of being a resilient company. Personally, I find these analyses somewhat spurious, but if you are needing to persuade your Board of the value of being resilient, BCG suggest you could claim "that resilience in unfavorable periods accounts for nearly 30% of long-term outperformance" and "15% of companies displayed general resilience by

outperforming their industries in more than 80% of the crisis quarters they faced over the 25-year study period."

There is also a discussion to be had around which industries are intrinsically less resilient and how they should manage that lack of resilience. There is an interesting dichotomy between which organisations are seen as financially resilient – long-term infrastructure companies such as telecoms networks and extractive industries are less vulnerable to everyday shocks – and those which are agile – FMCG, software – which can pick up on new trends rapidly. The longer it takes you to react to change, the further ahead you need to be looking, and the more sophisticated scenarios you should be building.

There are interesting echoes in BCG's analysis of Nassim Taleb's "anti-fragile" concept. Instead of "durability", Taleb (of "black swan" fame) argues that organisations should aim to become stronger when damaged, like the mythical Hydra growing two heads when one is cut off. The resilient resists shocks and stays the same; the anti-fragile gets better and better. Only BCG's "Shaping" element comes close to this. Nonetheless, I'm sure that most organisations would settle for durable, and outperforming their competitors.

SAMI Consulting can help you become more resilient, making "robust decisions in uncertain times", and building alternative scenarios of the future from which sound contingency plans and capabilities can be created.

Written by Huw Williams, SAMI Principal, Published 17 March 2021

Thinking the unthinkable

Image by Patty Jansen from Pixabay

A recent EC Joint Research Council paper, "Thinking the unthinkable", explored the question of whether technological accidents caused by natural hazards (Natech accidents) are real "Black Swans". A "Black Swan" is a concept introduced by Nassim Taleb in his 2010 book where he uses it to mean an unpredictable and hence unpreventable event. Though the paper focusses on accidents caused by natural hazards, many of the issues can be applied more widely to other catastrophic events, such as the Deep Water Horizon explosion or the Grenfell Tower fire.

The author, Elisabeth Krausmann, concludes that *"government and industry are using the term Black Swan too liberally in the wake of disaster as an excuse for poor planning"* and that there is an "Act-of-God" mindset that needs to be challenged.

She cites two studies that examined major technological accidents (56 in one study, 50 in the other), which both concluded that the vast majority, if not all, could have been foreseen and prevented using available information and knowledge. The Fukishima nuclear power station accident could likely have been prevented if information on large historical tsunamis on that coastline had been heeded and the power plant had been constructed elsewhere or on higher ground.

The paper is full of examples of similar catastrophic events that in retrospect seem like they could have been avoided.

Krausmann explores three types of event which are often called Black Swans

- Events completely unknown to science ("unknown unknowns", e.g. due to novel chemistry or technology);
- Events unknown according to a person's present knowledge ("unknown knowns", e.g. safety practices known in one company but unknown in another);
- Events that are known but judged to have negligible probability (e.g. scenarios removed from risk analysis below a specific cut-off value).

Taleb had argued that a Black Swan is a subjective phenomenon that is unexpected for a particular observer only, but not necessarily for others. Krausmann suggests that only "unknown unknowns" are true Black Swans: "unknown knowns" represent a failure of research or failing to learn; high-impact low probability accidents are errors of probability assessment or a high level of risk appetite.

The paper goes on to explore the nature of these events and how they occur. I have grouped comments together into a few themes that seem to me to be pertinent.

COST/ INCENTIVES

Economic considerations are a powerful driver in decision making which can lead to bad safety decisions. Despite protestations to the contrary, in reality safety considerations often are traded off against costs and operational efficiency. Industry is generally reluctant to make investments in events are presumed to be extremely unlikely and to possibly never materialize at all.

Preparing for rare or unexpected events can be costly and inevitably a balance needs to be struck between the prudence recommended by science and budget constraints. When there are a wide range of risks, cost challenges can be reduced by building generic rather than threat-specific responses. This is the approach hospitals take to respond to disasters – whether natural hazards, technology failure or terrorist attack.

In some cases the trade-off is readily apparent: after a BP Texas City refinery fire in 2005, an analysis showed that under BP's system of executive incentives, 70% of executive bonus accounted for financial performance while a mere 15% were attributed to attained safety targets.

POOR MESSAGING

False alarms cause major problems. Not all possible warning signs can or should be responded to with the same priority. Prioritising signals is a challenge – learning from "near misses" and other situations is key.

False alarms also create a fear of incurring costs for no reason – and a reluctance to report issues. This can extend into downright denial so that information is not communicated or that the potential severity of a situation is not believed at the decision-making level. Overly hierarchical organisations limit the communication of problems to the extent it seems that senior management simply don't *want to hear bad news.*

There is also an element of **who** is doing the signalling. Junior staff are often ignored. Residents at Grenfell Tower had flagged concerns about fire safety many times – had it been a luxury block occupied by influential people would the messages have been taken more seriously?

LACK OF FOCUS – DRIFT

A remarkably common issue is complacency. Organizations tend to drift to a higher risk state, relaxing safeguards and controls as they try to accommodate conflicting business goals and tradeoffs. if nothing happens for long stretches of time the view becomes that nothing will continue to happen in the future. COVID-19 is just another example of our tendency to use the past as a basis for our future expectations, of assuming that if the worst did not happen before, it will also not happen in the future ("it's just like swine flu"). Krausmann refers to a disaster "incubation" period, where a system moves closer to the edge of its safety envelope until it fails.

There are also difficulties with retaining information from previous incidents, poor knowledge sharing, failure to use available knowledge, and corporate memory loss due to changes in staff and management, frequent ownership changes, and instability in business continuity.

A major accident may well generate media attention and enquiries. However, once media attention fades, stakeholder interest fades, and a risk might no longer be considered a threat. This is usually accompanied by a redefinition of priorities and a drop in resources made available for mitigating the risk.

PERCEPTION

Another aspect exposed by the pandemic is that it seems that human minds tend to linear thinking. Exponential growth – where things potter along at a lowish level and then rapidly explode – is not a simple concept to get to grips with. Similarly, rare events with complex causal relationships are hard to grasp.

A range of cognitive biases explain why events may be referred to as Black Swans:

- Confirmation bias: we look for evidence that confirms our beliefs but ignore facts that would refute them.
- Narrative fallacy: we construct simplified stories out of sequential facts to make sense of the world. Taleb himself referred to the turkey illusion, in which the well-fed and cared-for bird could not imagine that the good life would come to a sudden and catastrophic end
- Silent evidence: a sampling bias where only evidence that catches the eye is considered rather than searching for and considering what is there
- Ludic fallacy: attempts to predict the future with tools and models that cannot capture rare events. Mathematical models of an uncertain risk create a false sense of certainty, thereby possibly doing more harm than good. "No probabilistic model based on *in-box* thinking can deal with *out-of-box* type events."

SYSTEMIC RISKS

In complex and tightly-coupled systems, small initial shocks can propagate through the individual subsystems, interacting in unexpected ways and creating a chain reaction that can ultimately lead to complete system failure. This also increases the challenge of dealing with the incident – multiple issues cascade, overwhelming the response capacities of emergency responders.

DEALING WITH TRUE BLACK SWANS
Apart from simply avoiding (or trying to) the failings above with out-of-the-box thinking and a departure from the Act-of-God mindset, Krausmann identifies a number of strategies to cope with Black Swan challenges.

- Risk-based versus precaution-based strategies: employing less dangerous substances and production processes, lowering the quantity of hazardous substances on site, and implementing passive safety systems
- Disaster incubation theory and warning signals: analysis of multiple precursor events that accumulate before total failure occurs
- Mindfulness: a preoccupation with failure, exploring one's own or others' near misses
- Resilience engineering: locating the pathways to recover from an unforeseen crisis
- Scenario planning

SCENARIOS
At SAMI of course we recognise the value of qualitative scenarios which do not describe *the* future to come, because it is variable and unknowable, but a set of possible futures that helps decision makers to orient themselves in the maze of uncertainties they have to tackle. Scenarios question existing beliefs and worldviews, and frequently include elements that cannot be formally captured through models.

This also includes:

- Backcasting: starting at a final imagined outcome (e.g. the most catastrophic failure conceivable) and analysing backwards the conditions under which it could occur;
- Red teaming: serves as devil's advocate that challenges linear thinking

Scenarios are only useful if taken seriously and if there is no hesitation to act on contingency plans once a crisis materializes. As the COVID pandemic has shown, the best preparedness planning will be unsuccessful if its implementation falters once a disaster looms at the horizon.

If you need help with building scenarios to avoid some of these problems, SAMI Consulting is well-placed to do so.

Written by Huw Williams, SAMI Principal. Published 10 June 2021.

Future Proofing for resilience – and for opportunity

Image by Arek Socha from Pixabay

Humanity has always been intrigued by events which would destroy it.
The Gilgamesh epic leads to the Babylonian flood myth leads to the Biblical story of the Flood which (almost) ends mankind. The end of the world and the last judgement occupies – one might almost say obsesses – the minds of the Abrahamic religions in the Middle Ages and later, so much so that eschatology occupies its own discipline in theology.

The development of the atomic bomb brought the science fiction of the late nineteenth and the first half of the twentieth century into the world. In a less religiously observant society, the fear of a theological end of days was replaced by the more immediate, and more secular, fear of imminent nuclear annihilation. This fear remains with us: it remains the focus of bodies like the Nuclear Threat Initiative, podcasts like the excellent Atomic Hobo, and a continuing strand of dystopian and apocalyptic fiction.

The threat of absolute nuclear destruction has increased, not decreased, since the end of the Cold War. As it has faded into the background of the general consciousness, though, it has been replaced by other, equally dystopian fears. Climate change and the coronavirus pandemic are very real events which have brought the fragility of human life firmly to the fore. And as we worry about those, our horizons have expanded to worry about other existential, or at the least civilisation-destroying risks, from solar flares to meteor strikes, from engineered viruses to terrorism.

This time, though, there is plenty of advice, thought and research available. At the University of Cambridge, the Centre for the Study of Existential Risk is dedicated "to the study and mitigation of risks that could lead to human extinction or civilisational collapse". The Bulletin of Atomic Scientists "informs the public about threats to the survival and development of humanity from nuclear weapons, climate change". At Oxford, the Future of Humanity Institute brings "the tools of mathematics, philosophy and social sciences to bear on big-picture questions about humanity and its prospects". The Leverhulme Centre for the Future of Intelligence examines the opportunities, and risks, of AI. And also at Oxford, The Oxford Martin School is dedicated to bringing "together the best minds from different fields to tackle the most pressing issues of the 21st century".

And now we have "Future Proof", a new report from the Centre for Long-Term Resilience in the UK. The CTRL is a private body, headed by two former senior civil servants, and it is its focus on "putting resilience at the heart of policymaking" that both distinguishes it from, and makes it in many ways more practical than, much of the other thinking in the space.

For a start, "Issue-specific policy recommendations" start on page 15 of a 52 page book. One feels that the authors are used to giving practical advice to hard pressed ministers who have little time or attention and who need to know what to do, and why.

These recommendations are really rather good. Sections cover biosecurity, artificial intelligence, improving the UK government's risk management process and (somewhat inevitably), increasing funding for research into extreme risks. One could, were one an adventurous minister, take this report and run with it. If you did, you would make probably the greatest change to the UK's non-military resilience profile for decades.

We particularly like the "roadmap to improve UK management of extreme risks." Establishing a "dedicated red team to conduct frequent scenario exercises" is of course close to our hearts.

The "Three lines of defence" model is simple and achievable. Risk ownership units in government departments report to an Office of Risk Management and a Chief Risk Officer at the centre (probably the Cabinet Office) with oversight from a National Extreme Risks Institute. This formalises a risk management approach which, as the authors say, "is currently done quite effectively for non-extreme risks, but much less so for extreme risks".

Tucked away at the bottom of the risk management section is "increase the resilience of the national grid". And this highlights the one significant drawback of this

report. As we have said, taken as one report, and implemented thoroughly, "Future Proof" would make a major difference to UK resilience. But it would not be enough. There are more extreme risks we need to think about – and importantly, there are extreme opportunities.

We know from our work with government, here and overseas, that preparing for the future can get swept up in the demands of the now. SAMI is, indeed, part of the future proofing infrastructure that the authors are looking for. Initiatives like the Futures Framework give an opportunity for government to engage with the risks and opportunities of life in the next five, ten, fifty years.

Futures thinking is not just about resilience and risk mitigation – it is also about opportunity. The authors are right that the pandemic, by bringing a crisis front and centre (and straight into the Treasury, importantly) provides an opportunity – what they call a "social immune response" – to re-evaluate our approach to risk. Before the shock of the pandemic fades, "we need to seize this opportunity to put in place lasting protections to safeguard the country from extreme risks — both at a risk-specific level and at a systemic level."

We agree: with the important caveat that government should also put in place lasting structures to allow the country to benefit from the future. Understanding the future – through the work that SAMI and others do – will allow the government, and the UK, to do both.

Written by Jonathan Blanchard Smith, SAMI Fellow and Director. Published 17 June 2021

The Resilience Imperative

Image by [Wokandapix](#) from [Pixabay](#)

The uncertainty generated by the pandemic has led McKinsey to follow BCG's attempt, that we commented on previously, and focus on resilience. Their recent report, "Succeeding in uncertain times", identifies six dimensions of resilience and proposes ways of changing your organisation to become more so.

The basic premise is that the future is becoming less predictable, so it is not possible to develop plans to respond to every eventuality. Instead, organisations should aim to be in a position to cope with whatever gets thrown at them. McKinsey suggest different capabilities needed to be able to respond effectively to a wide variety of challenges.

Financial resilience

Organisations should balance long- and short-term financial objectives, and have sufficient reserves to weather financial shocks, whatever the cause. This is the basis of Bank of England "stress tests", and begs the question: "how much is enough?".

Operational resilience
This covers flexible production capacity, and supply chain substitutability. This may well require extra investment to build spare or redundant capacity and in-depth analysis of suppliers' risk profiles. McKinsey don't discuss the trade-offs implicit in this.

Technological resilience

McKinsey focus on IT infrastructure – on which virtually all organisations depend these days – and the risk of breakdowns and cyber-attacks. Business continuity plans and disaster recovery capability are their proposed responses – surely a standard across most industries.

Organisational resilience

McKinsey recommend a diverse, high-skilled workforce, operating in a culture of fast and agile decision-making within a set of "thoughtfully developed" rules and standards. Dancing unicorns are good too.

Reputational resilience

I thought this was one of the more interesting areas to explore. Reputational pressures on organisations of all kinds are increasing. Environmental, social, and governance (ESG) policies are coming under increasing scrutiny. In a crisis, can you stick to these principles, or will you fall back on more basic corner-cutting? How well are you able to communicate with stakeholders, how transparent are you prepared to be when things are really difficult?

Business-model resilience

Innovation and entrepreneurship are required to respond to fundamental shifts in market dynamics. There should be a portfolio of alternative approaches in nascent form that can be called upon in a crisis.

McKinsey go on to discuss **anticipation and response.** Anticipation through scenario creation is of course where SAMI focusses. McKinsey identify several areas of uncertainty related to the six dimensions for which contingency plans should be identified: supply-chain disruptions; cyberattack; physical climate-risk events; technical change; macroeconomic downturns; geopolitical disruption; major regulatory shift. Clearly not everything can be anticipated – there are genuine "black swans" – but in practice the limitation is not so much imagination but willingness to address unpalatable potential futures. Optimism bias is common to many executives and Boards.

How the organisation responds to a crisis can make the difference between success and failure. McKinsey suggest that top-quintile performance through the global financial crisis (2007–11) outperformed other companies in 2017 by more than 150 percentage points. Personally I'm not sure what that type of statistic actually means and how it helps organisations prepare.

They do suggest that resilience needs to be "***baked in***". This springs from a diversity of skills and experience, fostering of innovation and creative problem solving. These characteristics are helpful in good times and indispensable when quick, collaborative adaptation is needed for an institution to thrive. Institutions should link resilience to existing enterprise-risk-management processes and should consider investment in anticipation and response capabilities.

McKinsey consider a range of ***industry sectors*** and identify "Resilience capabilities" and "Surprise gaps" for each. I'd suggest that companies in those sectors should already have the "surprise gaps" covered, and that McKinsey are being rather conservative in the range of challenges that could emerge.

One aspect of resilience overlooked is that of timescales. Not every aspect of your organisation can be completely agile, flexible and responsive – some things need time to adapt to new circumstances. For those, more thought about future change is needed in advance.

Their emphasis – as with many such analyses – is on threats, and they pay little or no attention to unexpected opportunities, other than to argue that responding better than your competition gives you an advantage. Still less do they consider Taleb's "anti-fragile" approach, where coping with the challenge makes you stronger than before. The motto "never waste a good crisis" certainly has power. Examples from the pandemic could be organisations that have pulled together emergency teams at short notice and have built new skills and capabilities in their staff. The NHS for one does seem to be actively trying to do this.

Written by Huw Williams, SAMI Principal. Published 23 June 2021.

Beyond Resilience

Image by [Wokandapix](#) from [Pixabay](#)

In recent posts ([here,](#) [here](#) and [here](#)) we have looked at building corporate or government "resilience" as a way of dealing with the unexpected. Throughout these analyses, it seemed that while building resilience is nearly always a good idea, it is not sufficient on its own as a robust foresight strategy. Approaches to resilience seemed predicated on two basic assumptions, which I would like to challenge.

Firstly, there is a fatalism that suggests that, because the future is unknowable, one should abandon attempts to explore the possibilities and instead simply focus on being able to react to whatever is thrown at you. "Black swans" – inherently "unknown unknowns" – mean that it is impossible to plan for every eventuality, so improving responsiveness is the best one can do.

But we have also seen, in an [analysis](#) by the EC Joint Research Council, that "black swans" are in reality very rare indeed. Most startling events could have been – and indeed often were – predicted. It is possible to explore the implications of alternative futures and develop robust plans and contingencies. At its simplest this can be about building "fail-safe" systems or business continuity plans. These may still be vulnerable to a succession of failures (untested back-up systems are often a risk) or unanticipated interactions causing a systemic collapse.

Alternatively we can identify the range of key uncertainties and use those to build alternative views of the future. This scenario approach to futures thinking is what we at SAMI specialise in, and so we know how effective it is. Once the future scenarios are sufficiently well expressed, organisations can test different policies and

strategies against them to see how robust they are to the alternative assumptions, and develop a set of contingency plans.

The second unstated assumption is that change is a bad thing and that resilience is about helping you maintain the status quo. This comes from a natural fear of the unknown and a common desire for stability. Resisting the continuous challenges to what we know and the way we do things – our comfort zone – is a common organisational cultural failing. Although we know intellectually that change is inevitable, our initial emotional reaction is to fight it all costs. Many bureaucratic organisations build elaborate systems that are remarkably resistant to change. And, as Machiavelli pointed out, those who lose out from change are much more voluble than those who would benefit from it.

There are many examples of organisations losing out to disruptive challengers mainly because they attempted to maintain what they had rather than accept a changing situation. Kodak inventing – and then failing to exploit – digital photography is one of the more compelling ones. Cannibalising one's own primary product to prevent it being superseded by a competitor is a difficult decision for finance directors to take – but "eating your own lunch" is better than no lunch at all. In Taleb's terms organisations can become "anti-fragile". The resilient resists shocks and stays the same; the antifragile gets better. Hydra, the Greek mythological creature that has numerous heads, is supremely anti-fragile – when one head is cut off, two grow back in its place.

So a better reaction is to embrace change. Probably incorrectly attributed to Winston Churchill, the quote "never let a crisis go to waste" embodies the thought that times of change create opportunities. They allow – permit, even demand – radical action that would be resisted in "normal" times, seen as too risky. Once the dust settles and the crisis ebbs away, organisations should look to learn from the way new approaches had worked. Did they identify unnecessary, bureaucratic procedures? Were there process innovations that can be rolled out elsewhere? Did new technology play a role? Did some individuals display exceptional skills or strengths that can be put to work on other projects? And, perhaps most importantly, how well had the organisation's foresight capabilities stood up to the challenge and do they themselves need to be reviewed and revitalised?

Going further, future-adept organisations will actively seek out and create change – even change for change's sake. Deliberately becoming anti-sclerotic, such organisations remain innovators and market leaders. This is a long way from conventional concepts of "resilience".

This future focus can go beyond product innovation. Large organisations frequently re-structure themselves – this sometimes being characterised as "re-arranging the

deckchairs on the Titanic". In fact changing organisational roles – for example de-centralising decision-making then re-centralising it – can generate and then systematise new ideas and approaches, creating greater efficiencies or new opportunities. It enables and empowers more adaptable individuals, elevating them through the hierarchy and improving the quality of management.

Organisations can create a culture of future awareness. By moving talented young people into a foresight team for a limited period – say about 6 months – organisations will create a talent pool of people aware of the possibilities of change and appreciative of the need to take on the challenge when it arrives. Organisations of sufficient size may well have departments which map neatly onto the "Three Horizons" model. Finance teams and product managers focus on maximising today's profits (Horizon 1). Blue-sky thinkers in research departments are generating fundamentally new ideas (Horizon 3). And ideally, a new business team is acting as entrepreneurs (Horizon 2), converting some of the radical ideas into the next generation of profit-makers.

So, while building resilience is a good thing, and the various tips we have reviewed are valuable, at SAMI we see there being other critical aspects that should be built into organisations' futures readiness plans.

Written by Huw Williams, SAMI Principal. Published 1 Sept 2021