

# Respecting the Grey Swan

40 years of Reputation Crises

Research by





# Foreword



**Greg Case**  
Chief Executive Officer  
Aon

In this highly volatile world, risk is ever present - and because we are more interconnected and interdependent than ever before - it is also more severe. It is why at Aon we are not only focused on helping clients navigate the risks they are now facing, but we are also more keenly focused on helping them see around the corner to help them prepare for what comes next.

Today, clients are justifiably focused on the unprecedented socioeconomic impact of the COVID-19 pandemic, but they are also increasingly aware of other challenges like climate change, supply chain disruption, reimagining and configuring how and where work gets done, and the growing health-wealth gap. They are also learning how these issues connect to existing challenges. As a result, we are witnessing a fundamental reordering of client priorities on a global scale.

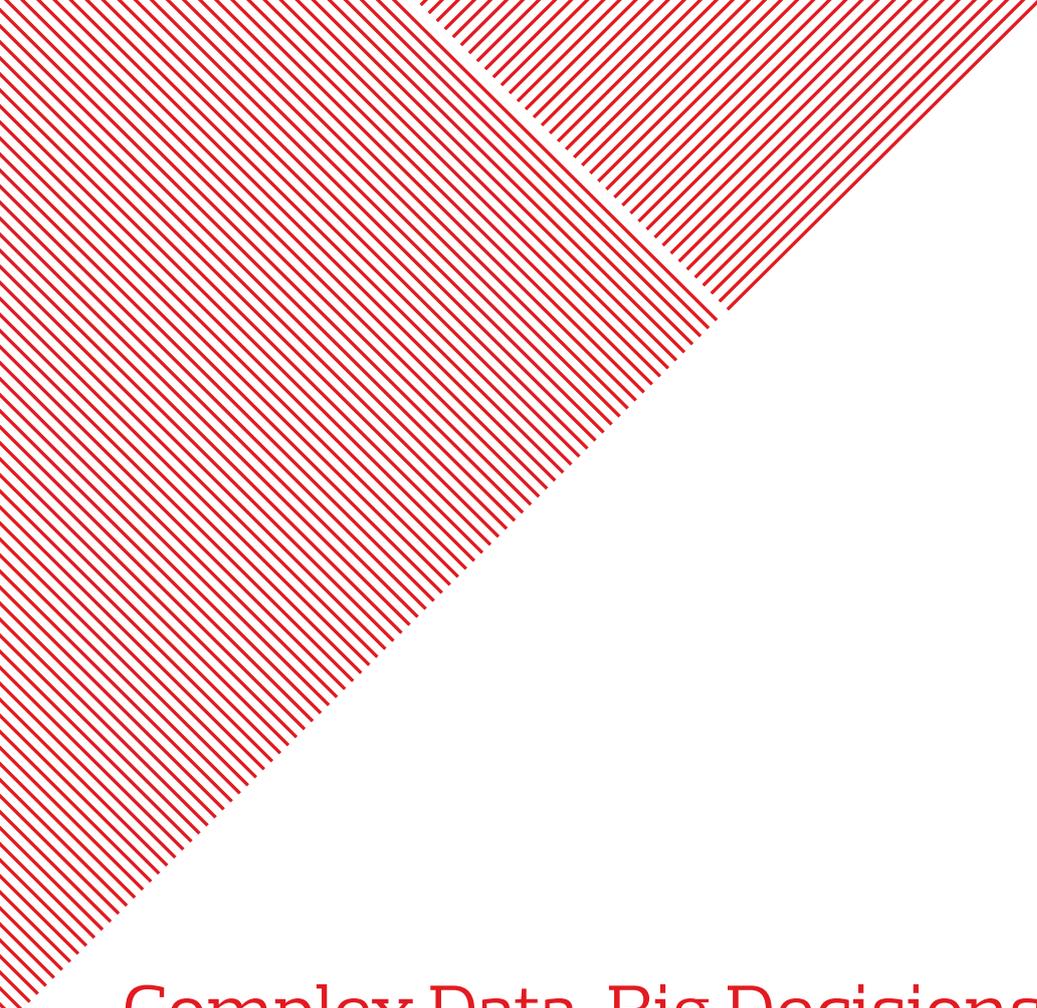
It is also why - now more than ever - reputational crises remain one of the major risk concerns for any organization anywhere in the world. Clearly, how leaders respond to these long-tail or “Grey Swan” risks are a key indicator of the overall strength of their leadership and their business.

2020 will remain a clear historical reminder of the importance of ensuring that an organisation is prepared for all of its extreme risk scenarios. Research, experience, and our client engagement efforts make it clear that organisations need to reimagine their risk landscape, how it is rapidly changing and how to address these scenarios going forward.

If and when a reputation crisis occurs, this research reinforces the importance of promptly acknowledging the seriousness of the event itself but, most importantly, how to translate this understanding into decisive action. Such decisive action will instill confidence in colleagues, clients and communities.

Since 2017, Aon has proudly partnered with Pentland Analytics to produce exclusive independent research focused on a better understanding of why some organisations succeed and emerge stronger after a crisis while others fail. With an exclusive dataset that represents over 40 years of reputation crises, Pentland Analytics is in a truly unique position to identify and analyse this growing threat.

We believe the key findings and examples in this report will provide you with guidance and tools to prepare for what comes next.



# Complex Data, Big Decisions

Extreme events can be difficult to analyse. For a start, there's not much data. Uncertainty is high as are the values. The data tend to be noisy, ambiguous and complex.

And that's before we consider our natural capacity for biased interpretation. We can agree perhaps that an evidence-based study of events that don't happen very often is not without its challenges.

The global impact of the coronavirus (COVID-19) pandemic has reminded us all of the challenges we face in managing extreme events. In Taleb's thought-provoking book<sup>1</sup>, he focuses on "Black Swan" events which he defines by their rarity, extreme impact and retrospective (though not prospective) predictability. Black Swan events are *extremely* rare. They have yet to be imagined. They are the unknown unknowns with unpredictable causes.

In this paper, we focus on their lesser known cousins, the Grey Swans, occasionally referenced and seldom defined. These too are rare but we know that they exist, and they are not so rare that we cannot make sense of them. They offer us rich opportunities for learning. Offered herein are a few observations, based on Pentland Analytics' unique and proprietary Reputation Crisis Databank of Grey Swan events. The database currently includes 300 corporate reputation crises from the last 40 years. Each of these reputation Grey Swans has been analysed, its impact on shareholder value modelled and the drivers of recovery identified.

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<sup>1</sup> *The Black Swan - The Impact of the Highly Improbable* (2007), by N. N. Taleb, published by Random House.

## Key observations

- 1 Limited, ambiguous and uncomfortable data are easy to ignore.**  
We neglect preparing for low probability, high severity events.
- 2 The impact of Grey Swan events is substantial and enduring.**  
In over 10% of reputation crises, over 50% of shareholder value is destroyed.
- 3 Value recovery is a function of critical pre- and post-loss decisions.**  
Grey Swans require focused attention and investment.

The research provides us with an evidence-based picture of the many challenges we face when seeking to manage extreme events, the magnitude of their impact, and the choices we can make in our ambitions for greater resilience and better performance.

Described in the next section are Swans of variously coloured plumage and some of the pitfalls that await us, as we attempt to manage these unruly birds. There follows a shareholder value analysis which uses Pentland Analytics' proprietary models to produce a clean measurement of firm-specific impact. Punctuating the analysis are four selected case studies: the Boeing 737 MAX air crashes, the Vale Brumadinho dam disaster, the ransomware attack against Norsk Hydro and the Ocado warehouse fire. In each case, the post-event year completes prior to the outbreak of COVID-19, ensuring that the analysis is free from potential coronavirus effects. The paper concludes with consideration of how we might respond to the threat of Grey Swan events, with a view to building our reputation resilience.

I hope that you will find this latest research helpful, as you strengthen your organisation's resilience to rare, and not so rare, events. I am very grateful to Aon, a leading global professional services firm, for its support of this work.

**Dr Deborah Pretty**  
Founder  
Pentland Analytics

# 1

## Defining the Grey Swan

Statistical analysis is great. But only when there are sufficient data to establish prior probabilities, a robust predictive model and an understanding of what may be considered “the norm”.

These are our White Swan events. They occur with reasonable frequency, strike with reasonable impact, keep our data scientists busy and are inherently preventable.

In the realm of extreme events, however, we have limited data. As Taleb highlights<sup>2</sup>, Black Swan events are unprecedented and, prior to their occurrence, inconceivable. There are no data to model in advance and they are random, making them intrinsically unpredictable. Yet they have a huge impact (positive or negative) and can determine our futures.

TABLE 1 | A BEVY OF SWANS

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Unknown unknowns	Known unknowns	Known knowns
Unprecedented, unimagined	Conceivable but neglected	Base case
Extremely rare, massive impact	Unlikely, major impact	“Normal” expectations
No data >> Unpredictable	Limited data >> Patterns and insights	Lots of data >> Predictable

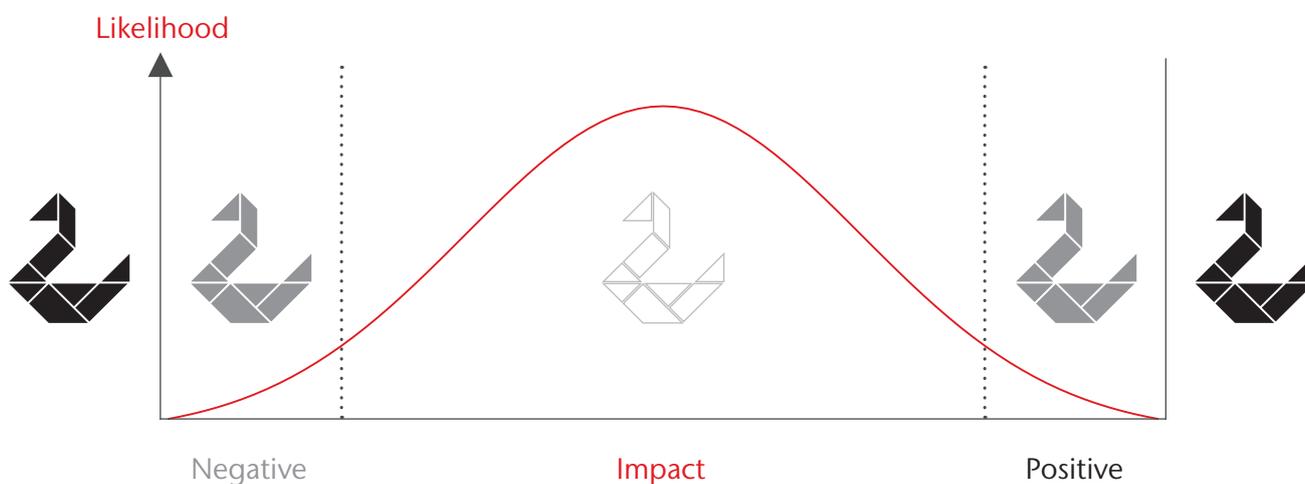
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<sup>2</sup> Ibid.

Lying between these two characters, is the Grey Swan: the subject of this paper. We are aware of the possibility of these events but, equally, understand their occurrence to be unlikely. Should such an event befall us, its impact will be significant. We have been warned that it could happen but believe that it is unlikely to happen to us, and have invested our scarce resources elsewhere. Others have suffered such crises and the steady accumulation of evidence offers us the opportunity to learn from their experience.

Black Swans sit outside the distribution, unpredictable and alone. White Swans sit comfortably within normal expectations, reassured by the myriad of statistical modelling techniques at our disposal. It is in the tails of the distribution, however, that we find the most fertile ground for insight. Examination of the extremes prepares us for crisis and informs the norm. These Grey Swans lie in wait and offer the most potential for improving our risk management strategies and making value-enhancing decisions.

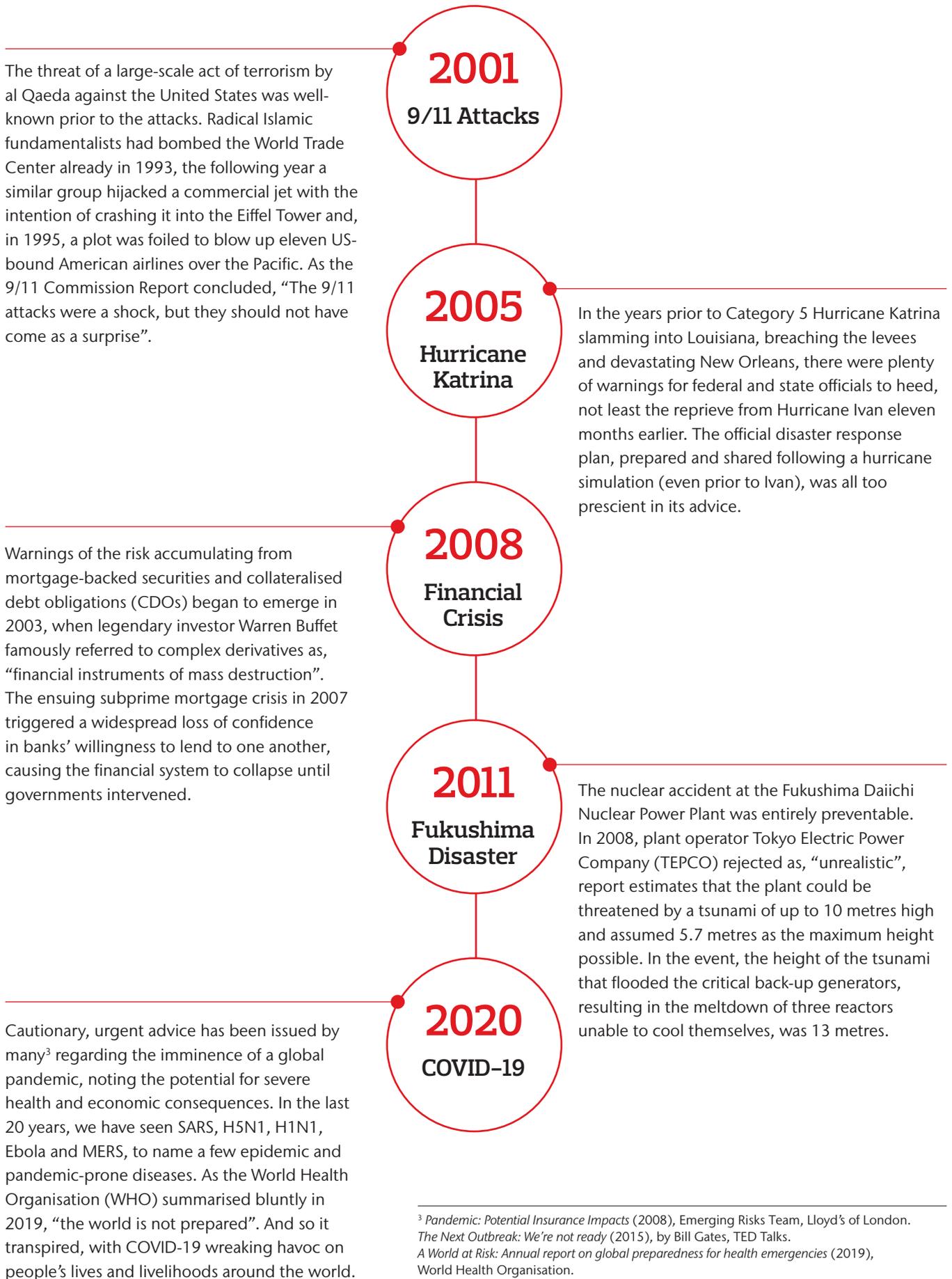
**FIGURE 1 | WHERE THE GREY SWANS LIE IN WAIT**



True Black Swan events are outliers that happen rarely. Examples might include the First World War (triggered by the random assassination of Archduke Franz Ferdinand in Sarajevo) but not the Second World War (concerns over the rising power of the Nazi Party were raised repeatedly by Winston Churchill throughout the 1930s). Another example of a Black Swan event might be the stock market crash on 19 October 1987, when the S&P 500 Index plummeted over 20% in a single trading session. Such a precipitous fall was without precedent and changed our expectations of stock market behaviour. A positive Black Swan, as noted by Taleb, might be the invention of the internet: unplanned, unforeseen and highly consequential.

Many extreme events are referred to commonly as Black Swans but, once investigated, are found to be Grey Swan events. Figure 2 captures five such Grey Swan events from the last 20 years, all of which were anticipated, discussed and warned about with increasing urgency.

**FIGURE 2 | GREY SWANS MASQUERADING AS BLACK**



What is it about Grey Swans that makes us dismiss the warnings so readily? None of us sets out to make a mistake. Generally speaking, we all try our best with the information available to us at the time. Our difficulty in these cases is two-fold. First, we are not that accomplished at processing probabilities. Second, we are fearful souls, tending to prefer consensus over conflict.

When we are faced with considerable, challenging and sometimes conflicting information, our brains try and make sense of it by taking mental shortcuts. Summarised in Table 2 are a few of these numerous so-called cognitive biases: those most pertinent to our Grey Swan discussion.

**TABLE 2 | OUR HUMAN FRAILTIES**

COGNITIVE BIAS	EFFECT
Ambiguity Effect	Prefer options with known probabilities
Normalcy Bias	Underestimate both likelihood and severity of disaster scenarios
Optimism Bias	Underestimate the probability of being affected directly
Ostrich Effect	Ignore negative information to avoid anxiety of decision-making
Herd Instinct	Align with behaviour of larger group to avoid conflict
Status Quo Bias	Prefer to continue as currently rather than risk loss

**When faced with considerable, challenging or conflicting information, our brains make sense of it by taking mental shortcuts, known as cognitive biases.**

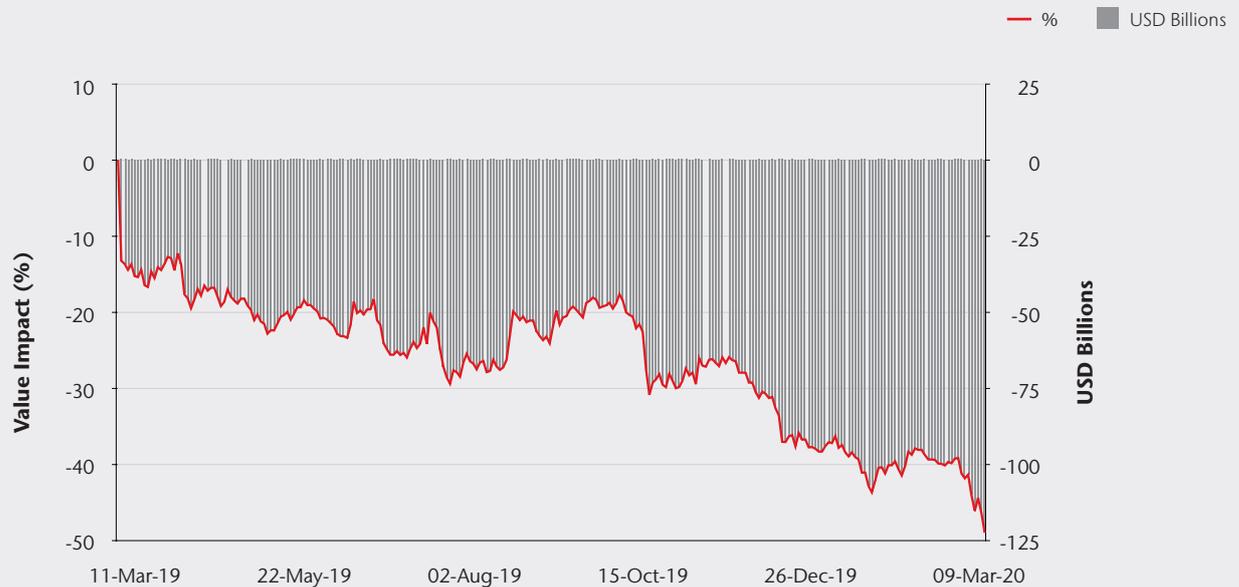
The first three biases – the ambiguity effect, normalcy bias and optimism bias – relate to our limitations as natural statisticians. We gravitate towards information that we can process and organise, while uncertain, ambiguous data that are open to multiple interpretations, are drawn by a seemingly invisible magnetic force into the “too hard” bucket. Our hesitation to mobilise against danger that is “too awful to contemplate” becomes just that. Perhaps simply we do not wish to be reminded that life is fragile. Finally, to help us navigate through the storms of life, we tend to be optimistic about our chances. Despite knowing the health risks associated with smoking or obesity, for example, we believe that “it won’t happen to me”, yet we buy lottery tickets equally believing that, “it might be me”!

The next three biases – the ostrich effect, herd instinct and status quo bias – relate to managing our emotional state. Evidence that conflicts with our rosy view of the world is uncomfortable and unpleasant, and usually requires us to make difficult decisions. It is easier to go along with the majority than stand one’s ground and cause waves. Meanwhile, a leap into the unknown is to risk pain and loss; much more comfortable to stick with that which is familiar...

None of these biases makes us bad people but they do acknowledge that we are humanly flawed. Effective risk management strategies will acknowledge these flaws openly and institute measures to combat their most harmful effects.

**Successful risk management acknowledges our natural biases and institutes measures to combat their most harmful effects.**

## Boeing 737 MAX Crisis



### Case

Ethiopian Airlines Flight 302 crashed soon after taking off from Addis Ababa on 10 March 2019, killing all 157 people on board. This was the second fatal air crash in five months to involve the Boeing 737 MAX aircraft. On 29 October 2018, Lion Air Flight 610 crashed into the Java Sea in a similar fashion, killing all 189 people on board. Around the world, aviation regulators suspended use of the Boeing 737 MAX. The US Federal Aviation Authority (FAA) chose not to ground the aircraft immediately, “based on the information currently available”, whilst the UK Civil Aviation Authority did so precisely because, “we do not currently have sufficient information”. Allegations grew as to a common cause for both crashes, related to the design of the aircraft and its anti-stall software.

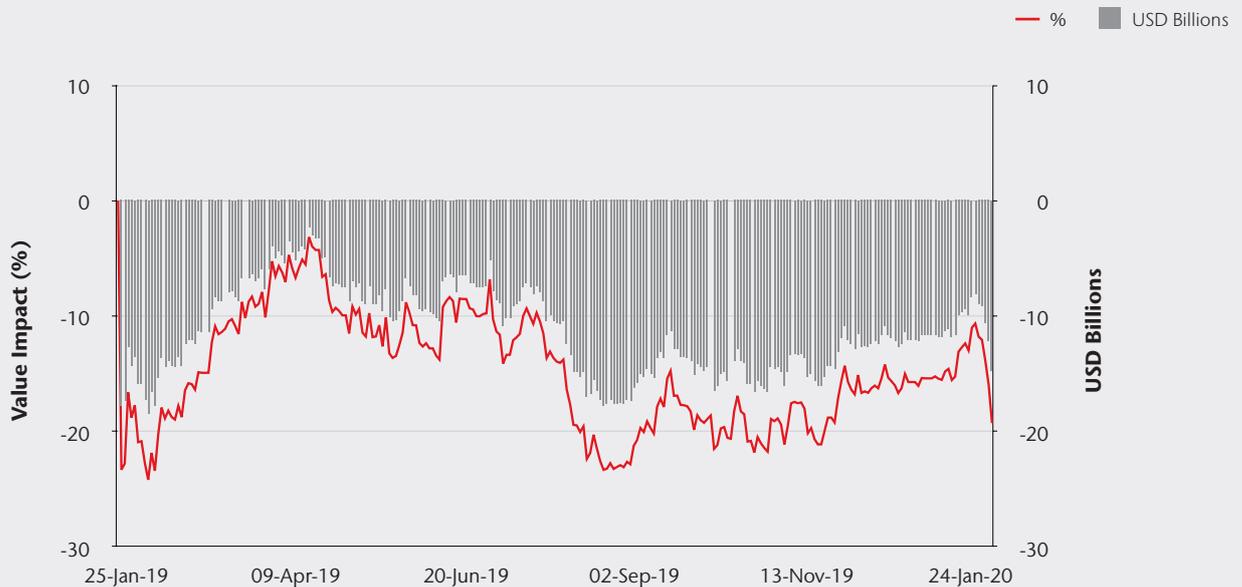
### Consequences

Communication from Boeing was perceived by the public as blinkered, technical, defensive and late. A month after the second crash, Boeing cut production of its 737 MAX and acknowledged that flaws in its anti-stall software had contributed to both crashes. Shareholders raised concerns over the combined Chairman/CEO role and the effectiveness of the Board of Directors. On 11 October, the Chairmanship was stripped from the role and, on 23 December, the CEO resigned. The former Chairman of the Board assumed the CEO position. In its 2019 full-year results, Boeing estimated direct costs from the disaster at USD18.6 billion. Potential damages, fines and litigation costs are in addition. A year on from the second crash, 50% of the firm’s value is destroyed – approximately USD125 billion – relative to the market.

### Lessons

- **Ensure independent oversight** – whether a Board of Directors or a regulatory body, for oversight to be effective, it has to be independent.
- **Prioritise safety** – where lives are at risk, err on the side of caution. Always.
- **Empathise with customers** – where lives have been lost, respond with humanity and understanding. Leave technical explanations and financial concerns for another day.
- **Make changes** – to restore trust requires honest introspection, courageous acknowledgement of one’s failings, and a demonstrable commitment to improved policies and behaviour.

## Vale Brumadinho Dam Disaster



### Case

270 people died after a tailings dam, owned by Brazilian mining company Vale S.A., collapsed in Brumadinho on 25 January 2019. Most of the victims were employees or contractors of Vale. A tailings dam is constructed to hold mining waste from the mining process. Just over three years previously, on 5 November 2015, the Fundão dam collapsed in Mariana, killing 19 people and devastating the Doce River valley in what was considered to be Brazil's worst environmental disaster. This dam was owned by Samarco, a joint venture between Vale and BHP Billiton. As the death toll from the second tragedy rose, anger from the bereaved grew towards both Vale and the Brazilian authorities.

### Consequences

Vale immediately suspended its dividend, share repurchase programme and bonus payments to executives, and commissioned an independent report into the cause of the disaster. On 29 January, Vale announced that it would decommission all its tailings dams constructed by the "upstream" method, a design already banned in Chile and Peru, as such structures could be vulnerable to earthquake tremors. On 2 March, the CEO agreed to a "temporary resignation" after federal and state prosecutors recommended his removal. In its 2019 income statement, Vale registered USD7 billion in provisions and expenses related to the Brumadinho disaster. The independent report into the collapse found that there were no signs of distress prior to failure, but that factors including design, poor drainage and heavy rainfall were to blame. On 21 January 2020, among a group of sixteen former and current executives, the former CEO was charged with homicide.

### Lessons

- ▶ **Prioritise long-term sustainability** – update technology and invest in risk management with at least as much commitment as in productivity. They are complementary partners.
- ▶ **Foster a 'safety first' culture** – this applies equally to joint ventures, and recognising the value of clear risk management activities planning and transparent communication, both internally and with external auditors.
- ▶ **Highlight human factors** – invest in maintenance, encourage and pay heed to warnings, and ensure effective, incentivised site management that has the support of the Executive Board.
- ▶ **Consider sitings carefully** – this applies from siting tailings dams too close to communities and public water supplies to, in other cases, relying on key suppliers located in flood zones.

# 2

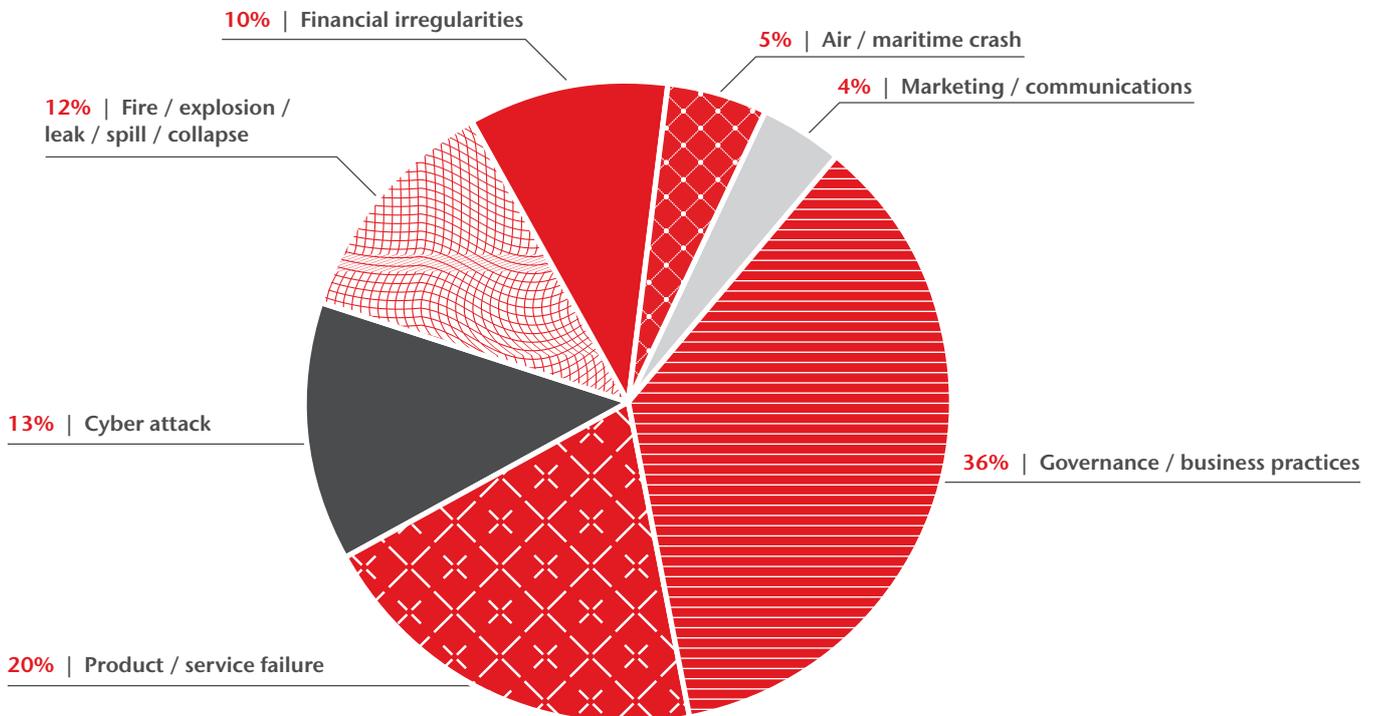
## Measuring the Value Impact

Grey Swans can fly in from anywhere. This section will focus on (negative) reputation Grey Swans: sudden events that threaten significantly the reputation of a company.

The analysis builds on research conducted over 30 years<sup>4</sup> and is based on data drawn from Pentland Analytics' Reputation Crisis Databank that includes currently 300 corporate reputation crises spanning the last four decades. The data are global and all major industry sectors are represented. The analysis will demonstrate that the impact of Grey Swan events on shareholder value is significant and sustained.

Shown in Figure 3 is the breakdown of the portfolio by event type. Over a third of the reputation crises stem directly from a failure in governance or poor business practices. This includes cases of executive malfeasance, allegations of discrimination and corruption, pricing or market manipulation, and other cases of corporate misconduct.

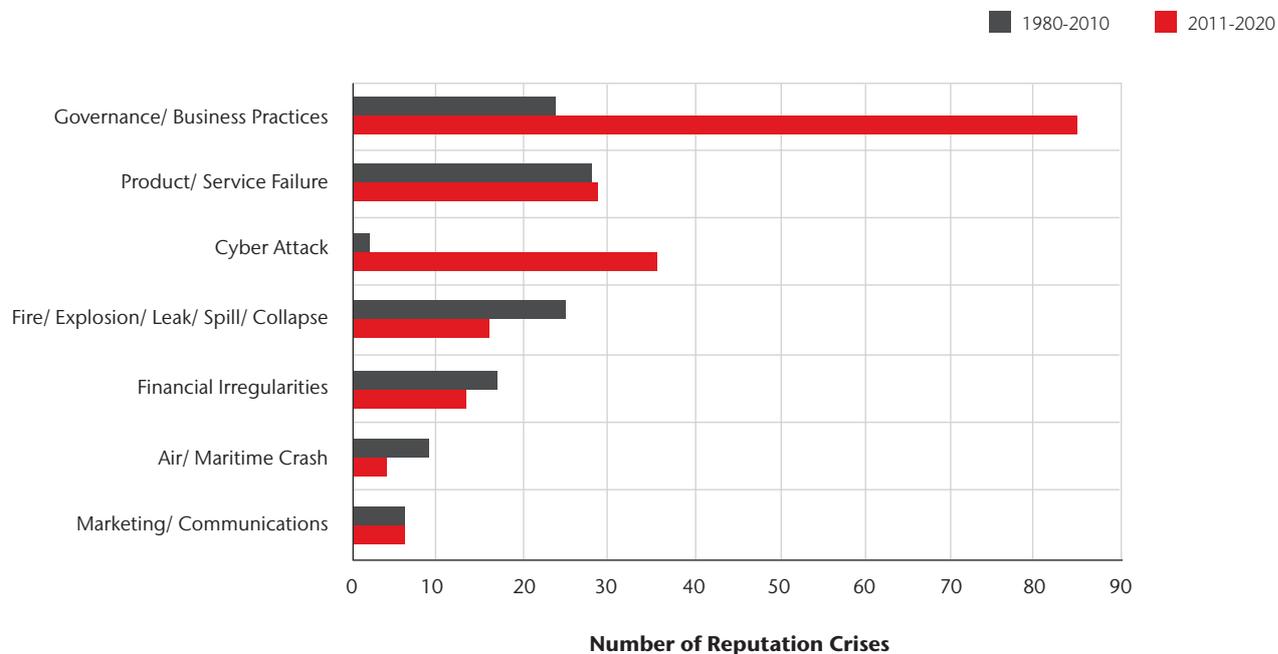
**FIGURE 3 | SOURCES OF REPUTATION GREY SWAN**



<sup>4</sup> *The Impact of Corporate Catastrophes on Shareholder Value* (1993), by D. J. Pretty, Energy Insurance Review.  
*Reputation at Risk* (2000), by D. J. Pretty, Global Reinsurance.  
*Reputation Risk in the Cyber Age* (2018), by D. J. Pretty, research commissioned by Aon.

Figure 4 shows how the composition of the portfolio has changed over time. The full portfolio is split into two groups: 111 events occurring in the first 30 years of the study period and 189 events from the last decade. Digitisation has skewed the database towards more recent events, as their data are more accessible.

**FIGURE 4 | CHANGING FOCUS OF ATTENTION**



The greater (or lower) prevalence of an event type in each portfolio does not necessarily imply greater (or lower) incidence. It reflects also the attention afforded to such events by the media and, thereby, their capture into the database. Attention span and column inches are finite, and will be allocated according to perceived interest in the news. All information is sourced from the public domain.

Whilst the reason for a greater incidence of cyber attacks is obvious, we have seen also a huge increase in the attention given to (if not the occurrence of) governance failures and poor business practices. It is clear that the demand on companies to demonstrate leadership in environmental, social and governance (ESG) issues is intensifying. Of all the sources of reputation Grey Swans summarised in Figure 3, failures in governance and poor business practices are the most damaging to shareholder value. On average, these crises destroy almost 15% of value over the post-event year.

It is the greater prevalence of these Grey Swans in the database that is most responsible for pulling down the average value impact over time, as illustrated in Figure 5. The graph depicts a modelled share price impact, with market-wide movements removed and returns risk-adjusted. Through Pentland Analytics’ proprietary models, a clean measurement of firm-specific impact is captured. The 300 events are combined into an aggregate portfolio and aligned such that Event Day 0 is the day each crisis first broke into the public domain. 261 trading days is one calendar year with weekends stripped out.

**FIGURE 5 | REPUTATION CRISES ARE INCREASINGLY DAMAGING**

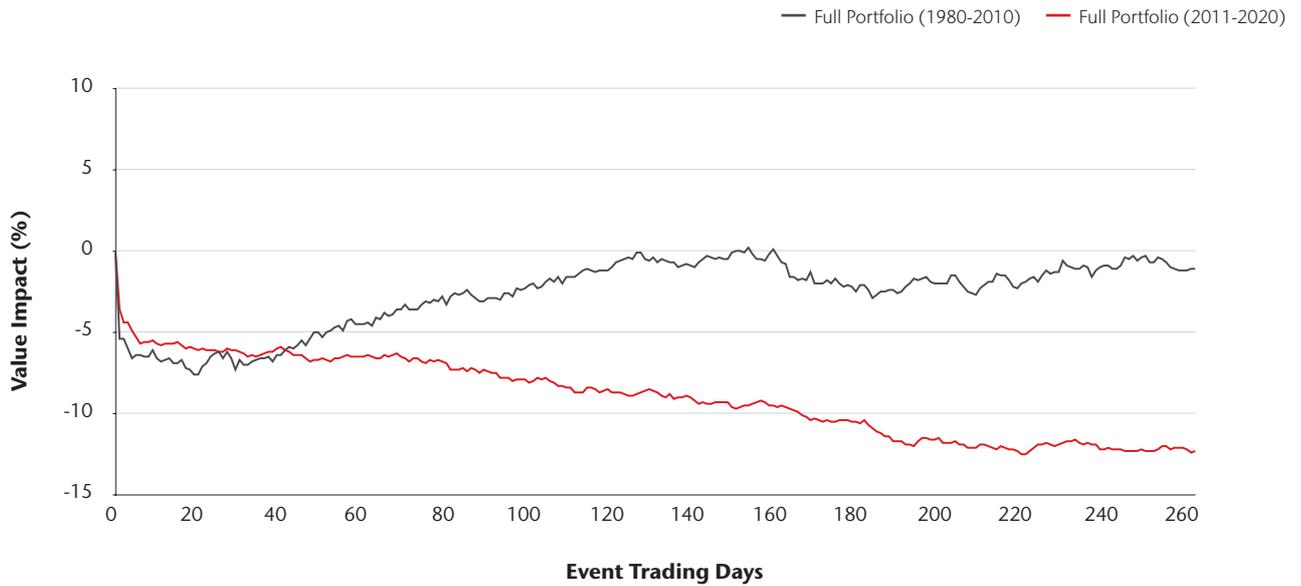


Figure 5 shows that, in the earlier study period (1980-2010), shareholder value returned to market expectations (value impact equals zero) by the end of the post-event year. However, over the last decade (2011-2020), the average impact on shareholder value from these reputation Grey Swans is -12%. When the two portfolios are combined into a single 40-year study period, the average impact on shareholder value is -8%, reflecting a total of USD1.2 trillion in destroyed value.

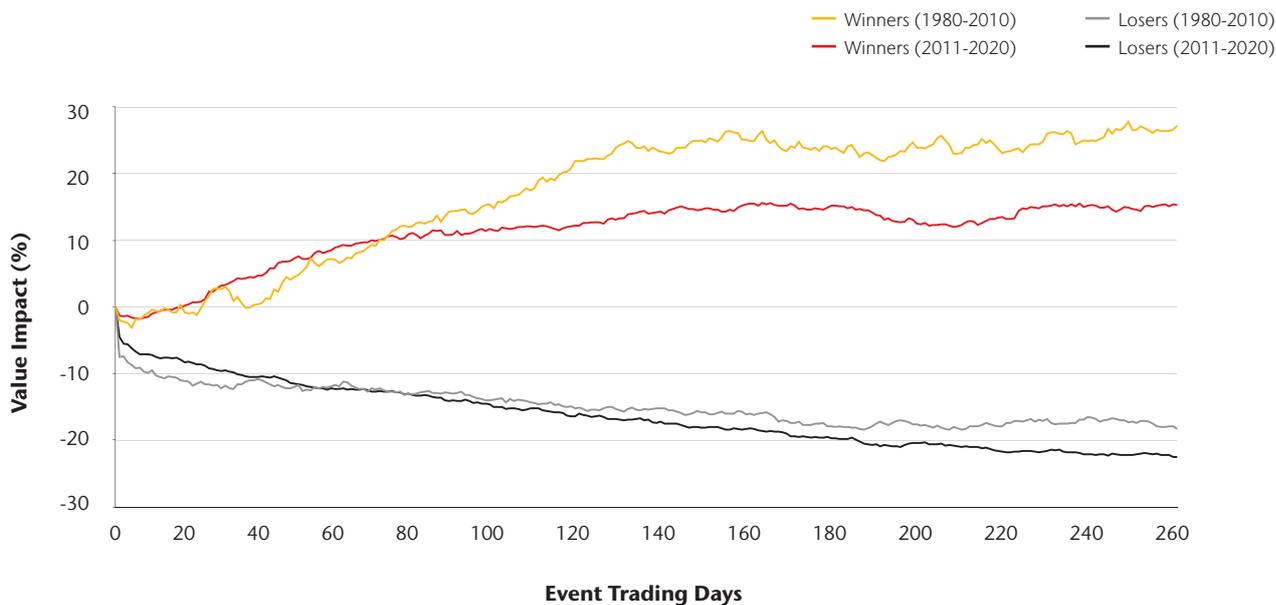
Crisis-struck firms tend to fall naturally into one of two fairly distinct groups, that we might call Winners and Losers, depending on how well they recover their shareholder value in the aftermath of a crisis. Initially, all firms suffering from a reputation crisis tend to fall in value but, within a few trading days, the two groups diverge, as investors place their confidence (or not) in the management’s ability to generate future cash flow. The initial fall in value reflects the market estimate of the immediate impact on cash flow and the extent to which insurance might limit the damage, while the longer-term value outcome (positive or negative) is driven by the effectiveness of the company’s preparedness and managerial response.

**Across the 40-year study period, reputation crises destroyed USD1.2 trillion in shareholder value.**

Share prices react to new information. Considerable news is generated in the immediate aftermath of a crisis and investors use this information to reassess their expectations of future cash flow. The divergence between Winners and Losers is the result of these revised expectations.

Some companies excel, and their executive teams demonstrate that they have what it takes to manage reputation crises and emerge stronger. Others struggle and the market is left unconvinced. It can be seen from Figure 6, as the two study periods are compared, that it has become harder over time to impress investors and exceed market expectations.

**FIGURE 6 | IT'S GETTING HARDER TO EXCEL**



Combining the data into a single portfolio of 300 crises across the 40-year period, the spread between Winners and Losers is over 40% of shareholder value: 93 Winners generating 21% of value on average over the post-event year (equivalent to USD1.2 trillion), and 207 Losers experiencing a symmetrical value loss of 21% on average (equivalent to USD2.4 trillion).

The attributes of Winners and Losers have stayed remarkably stable over the last 40 years, and are now honed into the five core drivers of value recovery presented in Table 3.

**TABLE 3 | DRIVERS OF VALUE RECOVERY**

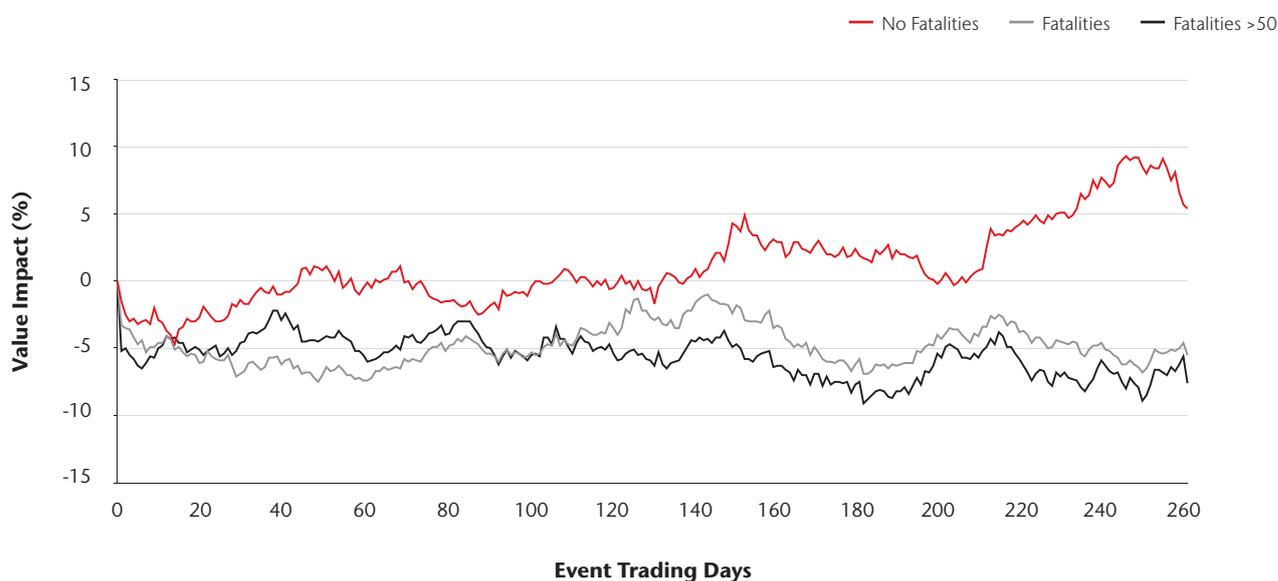
	THE WINNERS	THE LOSERS
<b>1 PREPAREDNESS</b>	<ul style="list-style-type: none"> <li>• Deep commitment to loss prevention and mitigation</li> </ul>	<ul style="list-style-type: none"> <li>• Failure to prioritise risk preparedness</li> </ul>
<b>2 LEADERSHIP</b>	<ul style="list-style-type: none"> <li>• Strong, visible leadership from CEO</li> </ul>	<ul style="list-style-type: none"> <li>• Weak or delgated leadership, failure to take responsibility</li> </ul>
<b>3 COMMUNICATION</b>	<ul style="list-style-type: none"> <li>• Prompt, accurate, effective disclosures</li> </ul>	<ul style="list-style-type: none"> <li>• Delayed, opaque, partial or inconsistent disclosures</li> </ul>
<b>4 ACTION</b>	<ul style="list-style-type: none"> <li>• Rapid, targeted, credible action</li> </ul>	<ul style="list-style-type: none"> <li>• Absent, unconvincing or limited action</li> </ul>
<b>5 CHANGE</b>	<ul style="list-style-type: none"> <li>• True remorse: commitment to meaningful change</li> </ul>	<ul style="list-style-type: none"> <li>• Minimal, inauthentic, reluctant contrition (if at all)</li> </ul>

Anger and confusion, amid relentless media attention, intensifies the pressure on the CEO.

It makes no moral sense to refer to Winners and Losers when considering events in which people have died. It is more challenging in every way to recover from crises where human lives have been lost. Anger and confusion among the bereaved, relentless attention from the media, and impatient demands from stakeholders all intensify the pressure on a Chief Executive Officer (CEO). Communication must be that much more open and sensitive, action must be swifter and repentance more earnest.

Figure 7 illustrates the impact on value from a sub-portfolio across the two categories of event that are most prone to mass fatalities: fires/explosions/leaks/spills/collapses and air/maritime crashes. Across the 53 events analysed, 6,624 people lost their lives.

FIGURE 7 | MASS FATALITY EVENTS



One way in which to gain insight to extreme events is to analyse the distribution around the tails of *their* distribution, and one way of doing that, is to leverage Extreme Value Theory (EVT). This focus on extreme values recognises the presence of uncertainty and randomness around the tails of a distribution, and considers these extremes in their own special class of events, deserving of their own distribution. Applying EVT to the 300 reputation crises in our portfolio, Figure 8 captures the minimum value impacts for each event: that is, the worst day in the post-event year for each of our reputation Grey Swans.

On average, shareholders can expect to lose 26% of value at some point during the post-event year.

These minimum value impacts are presented in chronological order, so the early part of the graph shows the worst day for each crisis occurring in the 1980s, through the decades to the latter part of the graph showing the worst day for those crises occurring most recently. As we are examining crises, it is no surprise to see the vast majority of value impacts in negative territory. On average, were a reputation crisis to strike, shareholders can expect to lose 26% of value at some point during the post-event year. This highlights the challenge that executives face with the sudden arrival of a Grey Swan event. In 36 of the 300 reputation crises studied, over 50% of value is destroyed.

**FIGURE 8 | TESTING THE LIMITS**

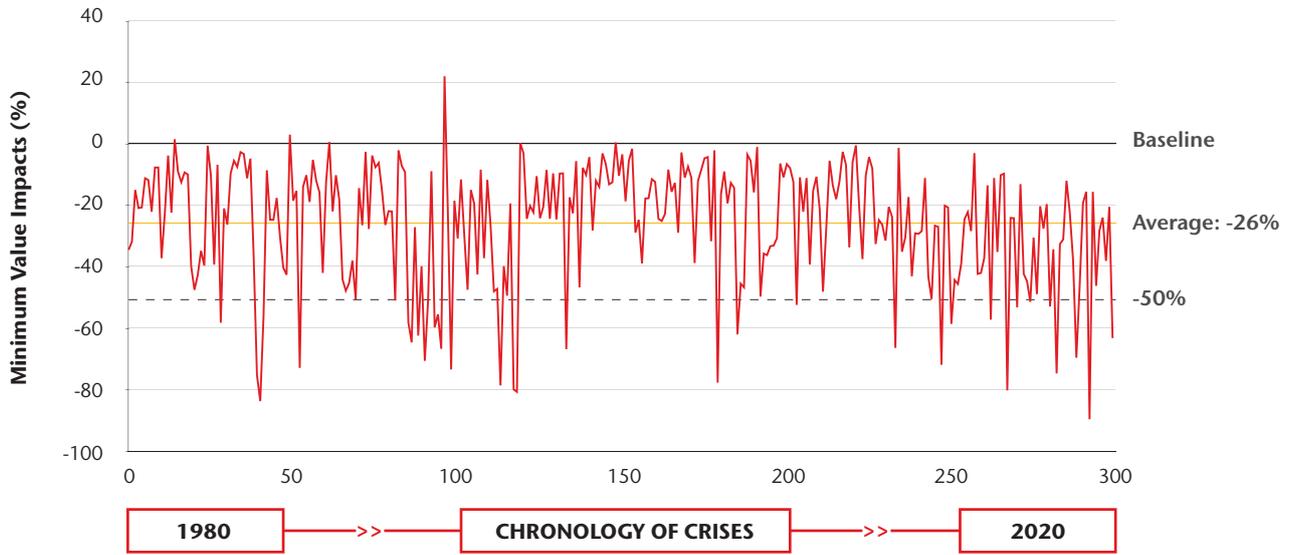
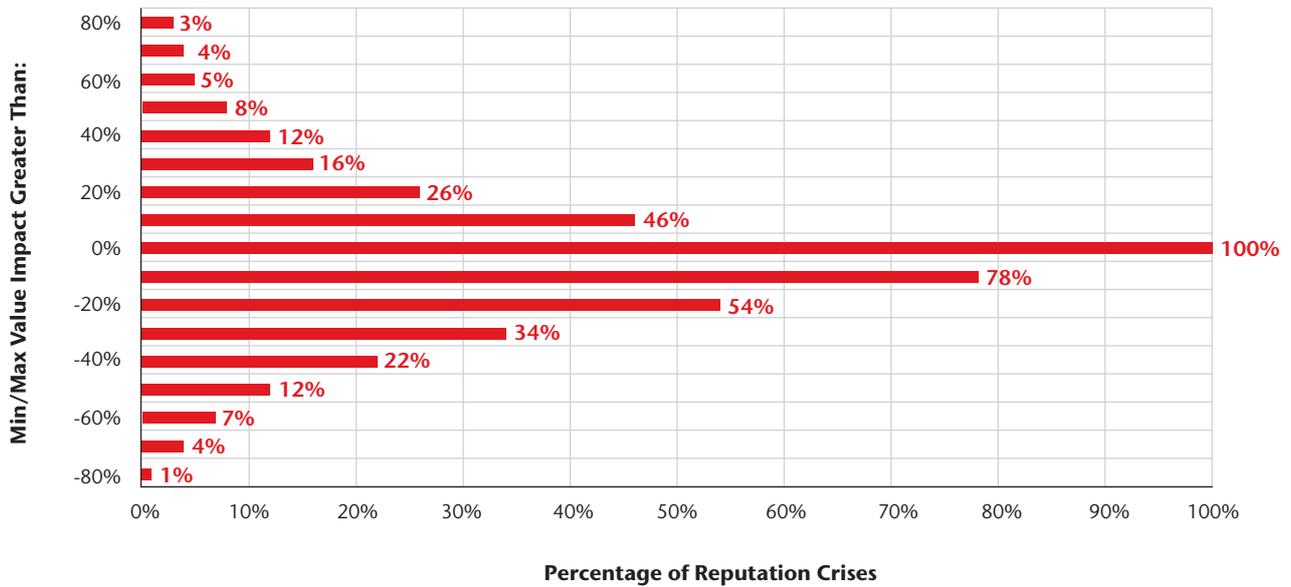
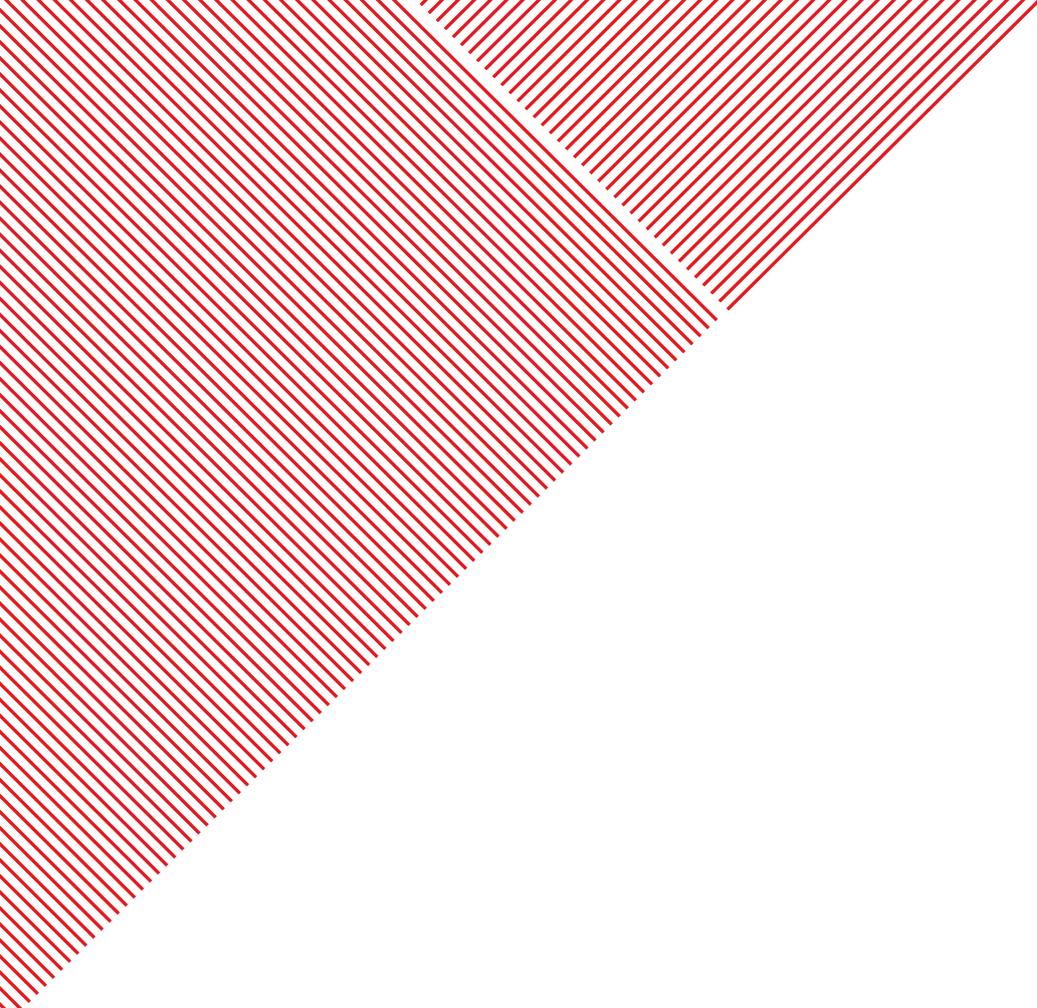


Figure 9 depicts the distribution of the minimum and maximum value impacts that occur during the post-event year for each reputation crisis. The central bar confirms the obvious that 100% of the events (all 300) incur a value impact of greater than or less than zero. As we might expect, the distribution is skewed to the negative, given that it is easier to emerge a Loser than a Winner; it is easier to lose value following a crisis than gain value.

**FIGURE 9 | BAD OUTCOMES LIKELIER THAN WE THINK?**





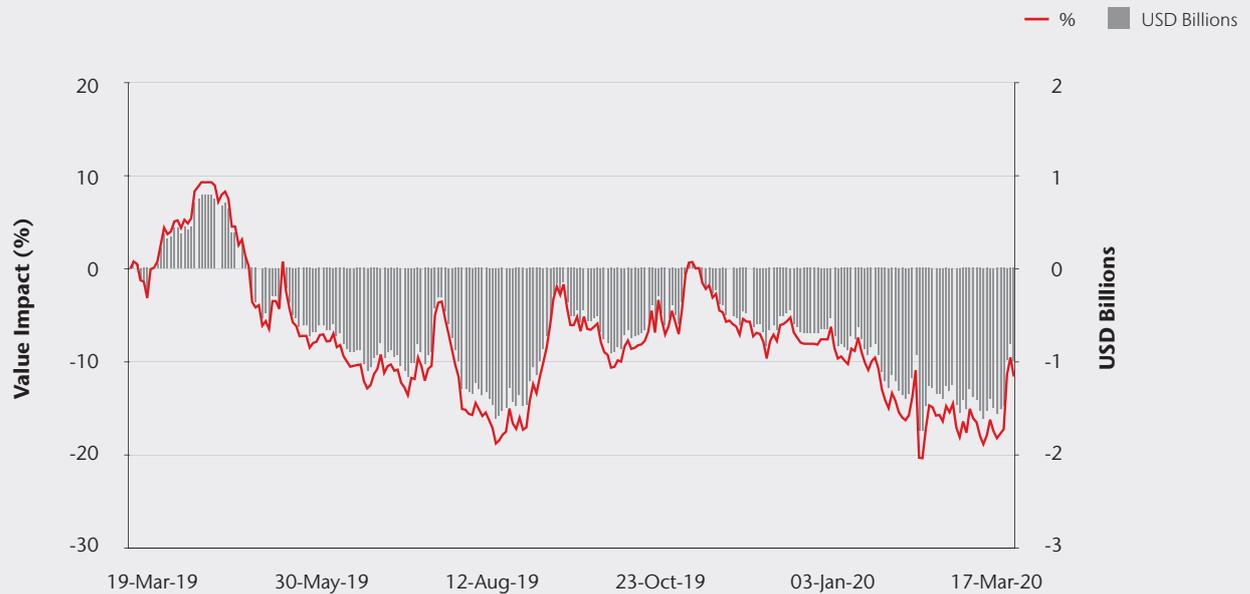
As we delve deeper, we find some interesting insights regarding likelier outcomes from such extreme events. For example, in the event of a reputation crisis, the chance of losing more than one-fifth of the market capitalisation of the company, on a modelled basis over and above market movements, is 54%; so it is more likely than not, that a company will lose more than 20% of its value in the post-crisis year. Asymmetrically, the chance of gaining one-fifth of value in the post-crisis year is just 26%. The chance of losing over 50% of shareholder value following a reputation Grey Swan event is 12%.

All the reputation crises analysed in this research may be considered Grey Swan events. All appear at the tails of the distribution, conceivable but neglected. The results of this research demonstrate that there is considerable value at risk from the management of reputation Grey Swans. In particular:

- **The value impact from reputation crises is significant and enduring.**
- **Reputation crises have become more damaging to shareholder value and to recover strongly from them has become more challenging.**
- **The likelihood of severe value destruction following a reputation crisis is greater than we might have thought.**

The first section of this paper defined a Grey Swan event and suggested some reasons why we may be prone to ignore their dangers. In this section, the magnitude of impact was investigated and measured. The final section offers some thoughts on how we might tame these Swans and build reputation resilience in a context of scarce resources.

## Norsk Hydro Cyber Attack



### Case

Norwegian aluminium producer Norsk Hydro was the target of an extensive cyber attack on 19 March 2019. Affecting Hydro's entire global network (22,000 computers in 170 plants across 40 countries), the LockerGoga ransomware gained access to critical information and encrypted the data. Hydro was operating already at reduced production levels and facing higher raw material costs as it awaited approval from Brazilian courts to increase production at its Alunorte refinery in Brazil. The alumina refinery had been ordered to halve production a year previously following an environmental dispute, and resumption could be delayed in the wake of the fatal Brumadinho dam collapse.

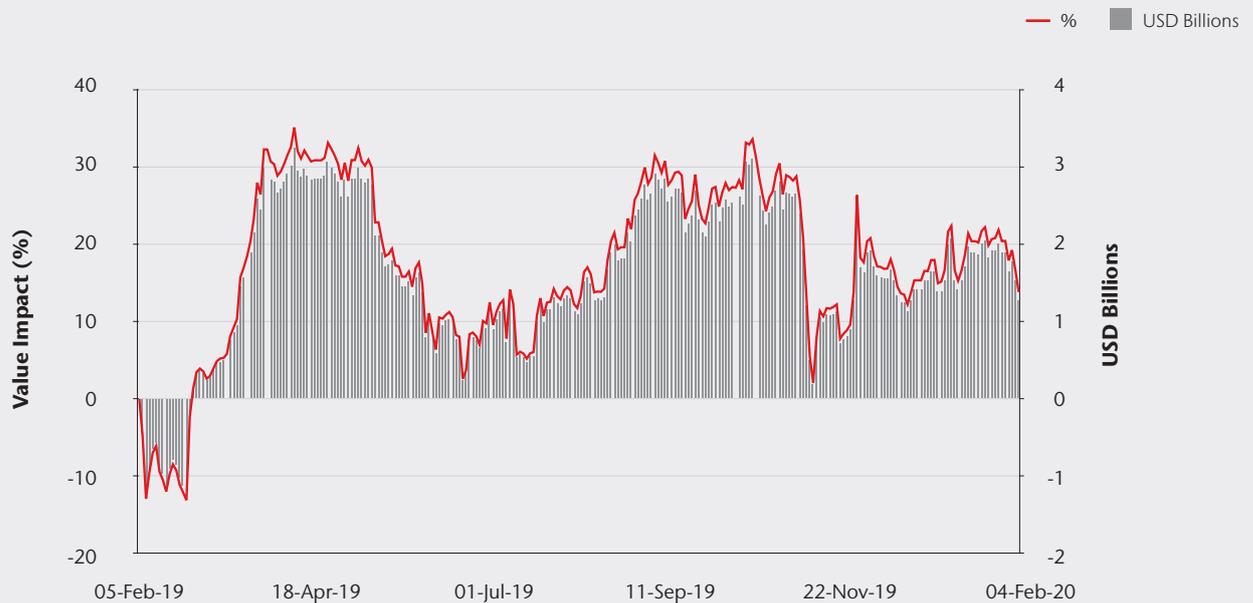
### Consequences

Hydro ceased production at several plants, switched many of its smelters to manual operation and restored its system from digital backups. Refusing to pay the ransom, Hydro immediately enlisted the aid of Microsoft's cybersecurity team and issued frequent, candid communications to share lessons with the industry. Hydro made its first broadcast on the same day as the attack, and press briefings and internal briefings continued daily. As the whole workforce reverted to pen and paper for the first few days, retirees familiar with the old paper system volunteered to return to their plants and support production. Hydro confirmed that it had cyber insurance. Within a month, Hydro's IT systems largely had been restored and its operations almost returned to normal. Despite an impressive Incident Response Plan that was executed well, slowing global demand and the US-China trade war pushed aluminium prices lower and did little to support the share price longer-term. Hydro estimates direct costs of USD70-80 million.

### Lessons

- **Invest continually in cybersecurity** – A robust network architecture and endpoint security monitoring system would have limited the impact of this attack.
- **Ensure a manual override or workaround** – As cyber attacks on industrial operations increase, it becomes essential to establish a workaround for the most critical systems.
- **Be open and transparent** – Effective communications reduced concern, controlled the narrative and reassured all stakeholders.
- **Foster good morale** – Productivity returned faster with employees all pulling hard together.

## Ocado Warehouse Fire



### Case

On 5 February 2019, a fire destroyed the flagship automated Customer Fulfilment Centre (CFC) of British online grocery retailer, Ocado. An electrical fault with one of the battery-charging units on the internal perimeter of the Andover warehouse caused the plastic lid of a grocery-carrying robot to catch fire. The robots were immobilised as the fire alarm was triggered. The sprinkler system was activated and then was turned off for five minutes by Ocado engineers, leading to considerable escalation of the fire. When staff turned the sprinklers back on and called the fire service, the warehouse was losing its battle against the blaze. There were no injuries or loss of life. All property, plant, equipment and inventory held on site were written-off. Both the assets and the associated interruption to business were expected to be covered by insurance.

### Consequences

The Andover CFC fire lost Ocado approximately 10% of its capacity, impacting its ability to grow in the short-term. Despite the loss, Ocado Retail sales returned to double-digit growth in 2019, as the company sought and found additional capacity from its remaining three CFCs. Costs relating to the Andover fire are estimated publicly at USD145 million. Insurance claims were formally accepted by insurer, FM Global, and payments were made promptly. With almost 400 patent applications, Ocado strengthened its reputation with investors as an automated warehouse technology company, rather than an online grocery delivery service, and continued to strike partnerships to provide its logistics technology to retailers around the world.

### Lessons

- ▶ **Innovation brings risk** – Learn from mistakes and undertake remedial actions to prevent recurrence.
- ▶ **Beware human error** – Sprinklers are installed for good reason. Don't turn them off!
- ▶ **Insurance brings value** – When insurance works well, it works very well; costs were undisputed and recovered promptly.
- ▶ **Keep focused on the strategy** – The prompt payment of claims helped Ocado to forge ahead, executing its strategy and strengthening its reputation as an innovator.

# 3

## Taming the Swans

Grey Swans exist. We even know their identities. The problem is that we see them as too improbable and so tend to neglect them.

The evidence suggests that we do so at our peril. The impact of Grey Swan events is significant and sustained (until the next Grey or Black Swan comes along to act as a circuit breaker, positively or negatively). Table 4 captures simply the balance of risk management priorities across the different types of event.

TABLE 4 | BUILDING RESILIENCE

		
Unprecedented, unimagined	Conceivable but neglected	Base case
Extremely rare, massive impact	Unlikely, major impact	“Normal” expectations
No data >> Unpredictable	Limited data >> Patterns and insights	Lots of data >> Predictable
<b>HEDGE / INSURE</b>	<b>BUILD RESILIENCE</b>	<b>PREVENT</b>

For Black Swan events, we have no option but to hedge, insure or limit our exposure. For our predictable White Swans, we know that they are coming, we have plenty of data to model and the investment case for loss prevention is clear. Against all events, we seek to build resilience – operational, financial and organisational – irrespective of the ultimate source of risk. However, we operate in a context of limited resources, so the real challenge with respect to Grey Swans becomes how to gauge the appropriate balance for our own organisational circumstances. Evidence from this body of research suggests three areas on which we might focus.

## 1 | Reimagine the risk landscape

Be aware of cognitive biases and seek explicitly to combat them. This includes broadening our perspectives, reframing the problem, challenging regularly our assumptions, identifying interdependencies and considering opportunity costs (the cost of not doing something) as carefully as the cost of investment. Introducing outside views, and increasing diversity in the composition of teams responsible for risk identification and assessment, will be constructive.

What might be the next Grey Swan event? What else do we discuss, debate and disregard routinely? It could be a large-scale cyber attack with physical consequences. Cyber physical risk is not new but its threat is growing rapidly, as adoption of the Internet of Things (IoT) accelerates and increases the “attack surface”: the number of connected systems and devices through which an attacker can enter or extract data.

We could turn our minds also to the Green Swan, the term coined by the Bank for International Settlements<sup>5</sup> to describe Black Swan events related to climate change: “both are characterised by deep uncertainty and nonlinearity, their chances of occurrence are not reflected in past data, and the possibility of extreme values cannot be ruled out”. The authors argue that Green Swans differ from Black Swans, however, in that the uncertainty is around impact rather than incidence, the potential impacts are enormous and existential, and the complexity of these events is immense.

Where the threat is unknown, or the uncertainty around its source is significant, it can be helpful to focus on outcomes.

## 2 | Acknowledge the seriousness of impact

We know that data on extreme events are limited, noisy and complex. But that does not mean that we cannot analyse them to discern patterns and insight, and start to make sense of them. Different approaches, such as impact analysis or extreme value theory, can shed light on potential long-term outcomes following crises. The opportunity costs of failing to invest in adequate risk preparedness or crisis management become plain.

Across many years, data build and patterns emerge; not for Black Swan events (by definition) but for Grey Swans at the tails of a distribution. The hallmarks of Winners – Preparedness, Leadership, Communication, Action and Change – are refined over time and provide now a consistent guide to value recovery.

Should a reputation Grey Swan occur, there is a strong chance of losing a material slice of shareholder value. The research results provide impetus to focused investment in resilience.

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## 3 | Translate understanding into action

Financial resources are limited, and a risk-free world is neither costless nor productive.

It is not possible to devote all necessary resources to each and every Grey Swan threat. It is possible, however, to foster a culture of responsiveness and resilience. Adaptable, agile companies with strong leadership are more able to reorganise the resources at their disposal, should disaster strike. Companies with a culture of resilience and the attendant training are less likely to be derailed by sudden shocks, whatever the source. Managers who treat resilience as a continuous effort, rather than as a one-off exercise, are more likely to be successful in their management of risk. The predictable losses should be prevented, exposure to the unknown will be limited, and the murky waters inhabited by the Grey Swans, acknowledged and acted upon.

Major events such as the Thai floods in 2011 and, more recently, the outbreak of COVID-19 in 2020, have highlighted the vulnerabilities in global supply chains, for example. The tension between just-in-time and just-in-case management models particularly has been in the spotlight. Redundancy comes at a price and, consequently, can impose a drag on short-term profits. However, new technologies can improve transparency and resilience across the value chain without having to sacrifice efficiency. The evidence demonstrates that the effects of failing to invest in resilience can be dramatic on a company's long-term performance.

**Companies with a culture of resilience and the attendant training are less likely to be derailed by sudden shocks, whatever the source.**

<sup>5</sup> *The Green Swan: Central banking and financial stability in the age of climate change* (2020), Bank for International Settlements.

## Summary

It is a series of critical pre- and post-event decisions that determine the trajectory of shareholder value following a Grey Swan event. While we have uncertainty over timing and impact, we can be reasonably certain that these tail events will happen, and very possibly on our watch. The Black Swan event would be that such a conceivable event did not happen.

It is at the tails of the distribution that Grey Swans lie, undisturbed and neglected. We can serve our companies best by using what certainty we have regarding incidence, and what we have learned about impact, to make an informed, balanced case for investment in risk preparedness and resilience.

## About the Author

### Dr Deborah Pretty



Deborah has been at the forefront of risk analytics for almost 30 years and is the Founder of Pentland Analytics.

Her research has been published extensively in academic and professional journals, and she has been honoured as guest speaker at numerous conferences around the world. Deborah authored the book, *Risk Financing Strategies – the impact on shareholder value* (1999), was a key contributor to the *Financial Times Mastering Risk* series and served for many years on the editorial advisory board of *Corporate Finance Review*.

For her work in insurance economics, Deborah was appointed Research Fellow at the University of Oxford. Previous corporate roles include as Co-founder and Principal of Oxford Metrica, Assistant Director at Sedgwick Energy, and risk analyst at Tillinghast. Deborah holds a BA (Hons) degree in industrial economics with mathematics from the University of Nottingham, and a DPhil from the University of Oxford.

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Pentland Analytics provides advanced analytics and advisory services to the executive management of the world's leading companies. The firm converts puzzling business questions into mathematical models and translates the output into clear, practical recommendations. The results inform strategic decisions and help to build clients' resilience, reputation and long-term owner value.

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