ENGINEERING A SAFER FUTURE

LEARNING FROM CRISIS: FROM DISRUPTION TO TRANSFORMATION

What has the Covid-19 pandemic taught us about the future of data?

DATA

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CONTENTS

ENGINEERING A SAFER FUTURE
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This report, *What has the Covid-19 pandemic taught us about the future of data?*,
is one of a series of related reports and podcasts available at
www.lrfoundation.org.uk/en/learning-from-crisis

Summary report

Data

Safety at work

Education

Infrastructure

Public understanding of risk

ABOUT THE SERIES: LEARNING FROM CRISIS

Resilience is the ability to withstand, adapt to changing conditions, and recover positively from shocks and stresses.

The Resilience Shift is committed to understanding how crisis can reveal both the weaknesses and strengths of the systems on which we rely, and to sharing stories and insights across a variety of sectors towards building long-term resilience.

We have investigated the experience of recent crises, bringing together diverse experiences and perspectives across stakeholders to bear witness to the impacts of deeply disruptive events, and the individuals, decisions, technologies and processes that shaped the response and recovery.

Learning from Day Zero[1] is a series of film-based learning modules capturing reflections from key individuals involved in the response to the 2017-18 water crisis in Cape Town, South Africa. Developed in partnership with the Cape Town Drought Response Learning Initiative, these modules feature insights curated from over 50 hours of in-depth, filmed conversations with government officials, civil society activists, academics, and business and community leaders.

The *Resilient Leadership*[2] project is a real-time reflective learning document that captures reflections from city government and corporate leaders navigating their organisations' responses to the Covid-19 pandemic. Through insights distilled from weekly conversations over a 4-month period, the project reveals key attributes of leadership during a crisis and identifies three questions to shape the future of resilient leadership.

Engineering a Safer Future[3] – insights from which appear in this publication – seeks to explore the impact of disruption and its ability to create a window of opportunity for transformative change. The insights emerged from in-depth expert conversations with senior leaders about the ramifications of the Covid-19 crisis in more detail within specific sectors.

Collectively, these investigations not only strengthen our broad understanding of resilience in practice, but also help us to shape and influence future work. They also actively explore different and innovative approaches to capturing and sharing learning.

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1 https://www.resilienceshift.org/cape-town-learning-from-day-zero/
2 https://www.resilienceshift.org/resilient-leadership/
3 www.lrfoundation.org.uk/en/learning-from-crisis

ABOUT THIS CONVERSATION: DATA

In the *Data* session, conducted on 17 September 2020, participants were asked to examine how their work life has changed between January and September 2020 due to the Covid-19 pandemic; how they have managed to stay resilient – both personally and professionally – and prepare for a 'new normal' future.

The session was a moderated conversation around data changes in a post-Covid world, from small-scale practical issues to long-term consequences to our institutions and systems. The conversation drew on emerging findings from the Foundation's research as well as input from grant holders and experts around global perceptions on data, and how these might be affected by the Covid-19 crisis. The session reflected on how Covid-19 has disrupted existing practice around data access, management and use, how practices have adapted, and what lessons the current disruption holds for our shared future.

ENGINEERING A SAFER FUTURE

At The Resilience Shift, we have long recognised that the past is an increasingly unreliable predictor of the future, and that deep uncertainty around challenge and risk is felt across many sectors. In 2020, the rapid global impacts of Covid-19, and its consequences across every aspect of the work that Lloyd's Register Foundation supports, provided a unique opportunity for us all to consider the transformations we'd like to see as we emerge from this crisis.

Together, Lloyd's Register Foundation and The Resilience Shift have developed this series of conversations as an antidote to the pervasive online 'noise' that confronts us as we seek serious discussion and meaningful insight into the ramifications of this crisis. We sought to bring together innovators working within the Lloyd's Register Foundation's grant programme, joined by outside subject matter specialists, with the aim of surfacing insights on the likely scale and permanence of changes that Covid-19 has triggered. Our participants also examined how we approach infrastructure systems and interdependencies, and what the pandemic can tell us about our existing preparedness and horizon-scanning practices.

With the five sessions respectively focused on safety at work, data and information systems, education, infrastructure and public understanding of risk, this series explores both the impact of disruption and how disruption can create windows of opportunity for change.

APPROACH AND FORMAT

The closed-door, intimate roundtable format was designed to facilitate fluid interaction amongst a small group of partners, associates, subject matter experts and grantees of the Lloyd's Register Foundation and of The Resilience Shift. Participants were given latitude to steer the conversation towards their specific sector or area of concern, their experience of challenges, and their thoughts on plausible ways forward.
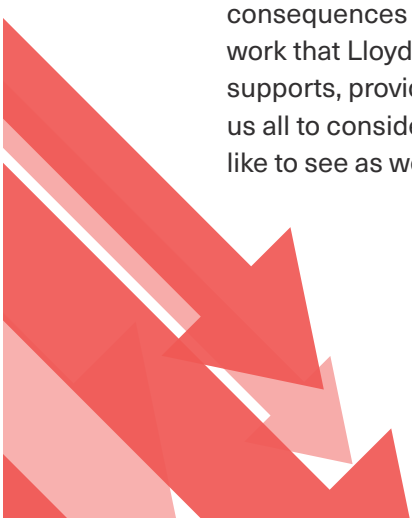
PARTICIPANTS

ABOUT THE MODERATORS

Dr. Juliet Mian | The Resilience Shift*
Deputy Director

An experienced Civil Engineer of over 20 years' experience working on infrastructure projects both in the UK and overseas, Juliet is a systems thinker who cares deeply about delivering engineering solutions to meet the challenges our planet faces.

Chris White | Lloyd's Register Foundation
Senior Programme Manager

Chris is a programme manager with expertise in whole life cycle of natural and mathematical sciences, complexity science and risk, uncertainty and industrial engagement.

ABOUT THE PARTICIPANTS

Dr. Mark Girolami | Alan Turing Institute*
Director, Data Centric Engineering Programme

Mark has had a broad career including 10 years as an engineer at IBM. He has significant experience of developing and applying advanced statistical and computational techniques to engineering challenges. Prior to joining the University of Cambridge Professor Girolami held the Chair of Statistics in the Mathematics Department at Imperial College London. He was one of the original founding Executive Directors of the Alan Turing Institute, the UK's national institute for Data Science and Artificial Intelligence, after which he was appointed as Strategic Programme Director at Turing.

Dr. Jeni Tennison | Open Data Institute*
Vice President and Chief Strategy Advisor

Jeni gained a PhD in AI from the University of Nottingham, then worked as an independent consultant, specialising in open data publishing and consumption, before joining the ODI in 2012. She served on the W3C's Technical Architecture Group and co-chaired the W3C's CSV on the Web Working Group. She also sits on the Advisory Board for the Open Contracting Partnership; the Board of the Global Partnership for Sustainable Development Data; the UK's Health Tech Advisory Board; and advises the Board of OpenUK.

Deanna MacDonald | Blockchain Labs for Open Collaboration* Co-founder & CEO

Trained as a global political economist with over a decade of industry experience in developing, applying and scaling technology, Deanna is a global speaker and workshop facilitator on blockchain and new forms of governance and business models. Co-founder and CEO of BLOC, an organisation with the mission to develop sustainable, resilient and inclusive digital infrastructures for critical resources such as trade, energy and water.

John McDermid | University of York*
Director, Assuring Autonomy International Programme

John served with the UK Ministry of Defence as a research scientist and spent five years in the software industry before becoming Chair in Software Engineering at the University of York since 1987. He is a founding member of the United Kingdom Computing Research Committee (UK CRC), as well as a member of the Defence Scientific Advisory Council and the Rolls-Royce Electrical and Controls Advisory Board. He became Chairman of Rapita Systems in January 2014. He is regarded as a world-leading authority in the area of safety-critical and real-time software.

* Lloyd's Register Foundation grant recipient

EMERGING INSIGHTS

Simultaneously, Covid-19 has given everyone on the planet the same frame of reference. We have seen the emergence of a truly impressive spirit of common purpose, but we have much to learn from the lessons of this crisis. We are coming to terms with how varying local standards can exacerbate global issues.

Several of the changes that we have seen during Covid-19 seem to be here to stay. Many organisations are questioning the need for workforces to return to the office; what happens to those office spaces and the other businesses dependant on the economic activity of their workers?

The pandemic has also demonstrated that when reacting to a disruption, momentum is important; countries that instituted lockdowns only after waiting to see conclusive data on their likely effects seem to have generally experienced greater economic disruption than those that implemented response measures ahead of conclusive data. This has bearing on our global responses to future disruption.

Covid-19 and its dramatic reshaping of cyber infrastructure creates a new generation of critical infrastructure requiring new levels of security and oversight. Many organisations that never considered themselves part of the critical infrastructure discussion are now classified as such.[4]

The amount of data created over the next three years will be more than the data created over the past 30 years, and the world will create more than three times the data over the next five years than it did in the previous five.[5]

"Models can't tell us everything about the complex systems that we are trying to understand."

"You can't wake people up from the Matrix without an alternative."

4 Deloitte. www2.deloitte.com/global/en/pages/risk/covid-19/covid-19-the-impact-of-cyber-on-critical-infrastructure-in-the-next-normal.html
5 IDC. www.idc.com/getdoc.jsp?containerId=prUS46286020

EMERGING INSIGHT 1

The Covid pandemic has highlighted the disjunct between our ability to collect data and our ability to interpret and use that data to support resilience

Our ability to collect and transmit data is remarkably mature. From the rapid development of initial tracking systems during the spread of Covid-19, to contact-tracing efforts, to the transition of entire economic sectors to remote work and automated solutions, our ability to generate and move data has been critical to our response to this crisis and should be hailed as a real achievement.

Our ability to optimally parse, communicate and work with this wealth of data, however, lags behind our collection skills. Risk communication and crisis management has been complicated by difficulties distilling data; public mental health has been endangered by an overwhelming amount of data about threats; the data we measure to target logistics systems and track office worker productivity has faced challenges adapting to a sudden change, and our reliance on data and the systems that provide it is a key vulnerability.

THINGS TO THINK ABOUT:

• How has the Covid pandemic challenged the ways your organisation or sector works with data? What fragilities in your data ecosystem has it revealed?

• How can your organisation use data to integrate measurable improvements to social equity and wellbeing outcomes into projects?

• Which data-dependent operations in your organisation were most severely impacted by the pandemic?

• Which datastreams or datasets were most important to your ability to respond effectively to the challenges posed by the pandemic?

• What challenges did you face in managing data during the pandemic?

Sensors are being embedded into anything and everything and throwing off data that can help contextualise data. This data along with increasing amounts of metadata (data about data) is growing aggressively and soon will surpass all other data types.[6]

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6 IDC. www.idc.com/getdoc.jsp?containerId=prUS46286020

EMERGING INSIGHT 2

Crisis decisions around data platforms and regulation can lock-in downstream damage

Rapid adoption of both technological systems and regulatory frameworks in response to a disruptive event like Covid-19 can offer attractive short-term solutions at the risk of significant long-term consequences. In terms of systems, 'crisis offerings' of off-the-shelf or turnkey solutions to shifting requirements can cause lock-in, accentuate or accelerate digital inequality, and is almost without exception more difficult to unravel and regulate than to adopt. In terms of policy, 'crisis politics' allows governments leeway to restrict or remove data privacy rights and steer regulation around data science in the name of expediency.

In one example, the pandemic has seen an increasing emphasis on and demand for automation across a variety of industries and at all scales, from automated warehouse item picking to reduce worker exposure to automated cargo ships to eliminate jurisdictional and transmission risks to maritime crewmen. Once automated solutions are engaged, however, it can become increasingly difficult for humans to get back into the control loop. This tendency presents acute risks on its own and can contribute to technological lock-in and dependency vulnerabilities.

THINGS TO THINK ABOUT:

- What new platforms or procedures has your organisation or sector deployed or become more reliant upon due to the pandemic?

- Does your organisation or sector have robust processes in place to vet the permanence of technological or automated solutions? Do these solutions undergo any sort of periodic fitness review?

The information and communications technology (ICT) ecosystem as a whole accounts for more than 2% of global emissions, on a par with the aviation industry's emissions from fuel.[7]

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7 Nature. www.nature.com/articles/d41586-018-06610-y#:~:text=Data%20centres%20contribute%20
   around%200.3,than%202%25%20of%20global%20emissions

EMERGING INSIGHT 3

We need to be sure we're measuring the things that matter

Data is critical to understanding trends in every single sector and at every scale, but in order for that data to be truly meaningful, we must ensure that we're measuring the things that matter. In the case of Covid-19, an agile reporting focus has been critical to ensure that our data streams are reliable, whether counting mask distribution, ventilator production, infection rates or contact tracing.

A system that measures local optimisation of one dataset (for example the immediate economic benefits of commuter air travel) can obscure the reality of global effects in related datasets (for example the long-term global climate consequences of aviation-related emissions). Rigorously interrogating the narratives our data supports is critically important to shifting how we understand and value our world.

THINGS TO THINK ABOUT:

- What critical data did the pandemic prompt your organisation or sector to focus on? Did partner/client/adjacent organisations need new datasets from you, or need to provide new datasets to you?

- What changes has the pandemic experience made, if any, to the kinds of data your organisation or sector collects or tracks?

- How does your organisation or sector talk and think about data? What measures have you taken to make sure your data-dependent systems are robust, redundant and reliable?

EMERGING INSIGHT 4

How we construct, measure and implement data-driven solutions needs to take account of human patterns and needs

In the face of disruptions such as the Covid-19 pandemic, there is often an instinct to leap to technological solutions without adapting to the human systems that technology supports. As one example, there was widespread lag on codification of time boundaries around working from home as human resources departments in multiple industries reacted to the shift to remote work patterns. This is fundamentally an issue of data nuance, namely measuring for 'productivity' or 'efficiency' without considering the human patterns that affect those outcomes.

The resilience consequences of this seemingly minor matter of office protocol were potentially severe: since the data links were 'always on', many workers felt an obligation to respond to directives 24 hours a day, risking burnout and cascade failure. The technology is designed to maximise *efficiency* rather than *effectiveness*; standards and systems need be able to measure both recognise the difference.

THINGS TO THINK ABOUT:

- In what ways are the technology platforms used by your organisation or sector optimised for efficiency, rather than effectiveness? What are the likely mid-term and long-term impacts of this focus on your organisation?

PRIORITY ACTIONS / KEY TAKEAWAYS

KEY TAKEAWAY 1

From a data perspective, we need to operate as if Covid is a model for future events

In terms of its global simultaneity, Covid-19 is a rare case study of our preparedness for the sort of systemwide disruptions we are likely to face in the future, particularly from climate change. While the pandemic highlighted our ability to collect and work with data, it also highlighted vulnerabilities and challenges in our approach to data that need to be addressed to better respond to future crises.

From the resilience of our data systems and networks themselves, to how we sift and communicate data about risk, to our ability to adapt quickly to data-intensive operational transitions such as remote working or increased dependence delivery logistics, this crisis has provided a window of opportunity to think through our relationship with data and technology ahead of future disruptions.

KEY TAKEAWAY 2

Now is the time for action around data privacy

The Covid-19 crisis has made clear that from a resilience point of view there's a balance to be struck between the public good and individual rights where data privacy is concerned. Conversations around data privacy and digital rights have been gathering importance across a wide variety of sectors, for the past decade and more.

The confusion and mutability around these issues revealed by the pandemic underlines the importance of reaching multisectoral, international understandings of the extent and nature of data privacy rights, how to codify and implement those rights frameworks, and exactly what exigent circumstances will call for a suspension of those rights in the name of the public good. This is particularly critical in the face of 'crisis decision-making' around regulation and rights, which may provide expedient organisational or national solutions in the short term but can lock in long-term legal and resilience liabilities.

PRIORITY ACTION / KEY TAKEAWAY 3

Data is a critical resource; our resilience planning needs to reflect this

Technology has in many ways proved a saviour in the face of the disruptions to working and living patterns resulting from the pandemic, but our rapid shift to remote working, purely digital communications, and heavy reliance on digitally mediated logistics has left us even more vulnerable to disruptions of our technological systems than we were before the Covid crisis. Data is a critical resource, and too often our resilience planning and redundancy expectations don't acknowledge this. Especially in the wake of our post-Covid technological shifts, should the next virus be digital rather than biological, the human and economic impact could be a magnitude of order greater than that caused by the pandemic.

This acute vulnerability to digital systems failing exists alongside a secondary, more pernicious hazard, namely the divide in digital equality, both exacerbated and accelerated by the experience of Covid-19, which threatens to minimise the voice, contributions and participation ability of digital 'have nots', particularly in the global south.

PRIORITY ACTION / KEY TAKEAWAY 4

Remote options are here to stay; how we measure data on productivity and health must reflect this new reality with greater nuance around human needs

The shift to remote work and increased reliance on digital tools engendered by the Covid-19 crisis is likely here to stay. As our various sectors and industries adapt to this shift and evolve the platforms and data procedures used to enable it, we must remain conscious that these systems exist to support human needs and not the other way around.

Measuring how this shift is impacting workforces is critical to the long-term success of remote work. Industries and individual organisations must adapt protocols to both support new work patterns emerging from non-location-based interaction, and work to extend digital platforms to encourage and re-enable the informal and serendipitous interactions that form the 'human glue' of a productive workplace.

ABOUT LLOYD'S REGISTER FOUNDATION

The Lloyd's Register Foundation seeks to secure for the benefit of the community high technical standards of design, manufacture, construction, maintenance, operation and performance for the purpose of enhancing the safety of life and property at sea, on land and in the air.

The *Engineering a Safer Future* programme is designed to focus on sharing existing experience and knowledge within and between sectors, and forms an important part of the delivery of our strategic theme accelerating the application of research.

The Lloyd's Register Foundation's programme supports resilience, by addressing:
• Governance: incentives, standards, rules, legal and financial
• Capacity building and engagement: professional development, publications, communication and public engagement
• Data and supporting tools: shared datasets, modelling and simulation, decision support
• International and global scale networks: studies of global systems, supply chains, knowledge networks.

ABOUT THE RESILIENCE SHIFT

The Resilience Shift is a catalyst for positive change. We seek to inspire and empower a global community to make the world safer through resilient infrastructure. Our mission is to help ensure the safety and continuity of the critical infrastructure and services that make our lives possible. From water and transportation to communications and energy, resilience is essential to everything we do. We're working globally to help define resilience and provide pathways from theory to practice.

Supported by Lloyd's Register Foundation and Arup, The Resilience Shift provides knowledge and tools to those responsible for planning, financing, designing, delivering, operating and maintaining critical infrastructure systems. We are not just a think tank, not just a grant-making body, and not just a convening network. Our impact is achieved through a proactive approach combining all three of these roles.

The Resilience Shift's approach is through learning by doing in collaboration with others, as well as by sharing knowledge and fostering a global community. We want to create value for those we are seeking to influence, thereby maximising the positive impact for society. We focus on tools and approaches to put this shift in resilience thinking into practice, identifying the drivers and enablers for infrastructure resilience, and advancing a common understanding of resilient systems, within and between critical infrastructure sectors.