

# Brexit, Systemic Risk, and a Warning for a Changing World

20<sup>th</sup> September 2019

## 1. Introduction

It was only after the United Kingdom voted to leave the European Union that people began to seriously consider how it might be achieved. Some had assumed it would be trivial. For them, even waiting out the two-year official notice period prior to departure was an indulgence that displayed an unpatriotic lack of resolve.

Most were not so sanguine. But on all sides, there was a general unawareness of just how complex and risk-laden the departure would be. This only gradually came into view. Months after the run-down had been triggered it was discovered that over [759 treaties](#) would have to be renegotiated. There was growing alarm that the intricate web of Just-In-Time logistics that enable industry, [supermarkets](#) and medical care could be profoundly disrupted, especially if the UK left without a deal. Each week new concerns came to the fore, [for example](#), how do you slaughter millions of livestock and dispose of the carcasses if the market for them evaporates? When the scale of the potential disruption became clearer, military [contingency planners](#) were drafted into various government departments to help direct the response.

As the first (March 29<sup>th</sup>) departure date approached, leaked [Cabinet Office documents](#) emphasised that Operation Yellowhammer, the contingency command and control structure, could be overwhelmed in the case of a no-deal exit. Source quoted said that the planning was ‘too little, too late’, echoing the [warnings](#) of business and union leaders about the preparedness of their companies. Summer 2019 brought another leaked Cabinet [warning](#), again about the country’s lack of preparations for a no deal departure on the revised date of October 31<sup>st</sup>, while the civil servant in charge of the UK’s no-deal contingency planning announced his departure from office, all adding to the impression that preparedness planning was being overwhelmed by an impossible task.

A [leak](#) on 18<sup>th</sup> August described some of the expected implications of a no-deal Brexit, including extended disruptions to fuel, food, and medicine supplies, higher food prices affecting the most vulnerable, jammed ports, and the potential for civil unrest. The Freight Transport Association said: *This is the first time the industry is learning of any threat to fuel supplies – a particularly worrying situation, as this would affect the movement of goods across the country, not just to and from Europe, and could put jobs at risk throughout the sector which keeps Britain trading.*

Since the vote, the level of social and political fracturing has intensified. Norms of public and political behaviour are repeatedly tested, and the atmosphere has become febrile and polarized. For a growing number of people Brexit has morphed from political choice into [sacred value](#), with the corresponding rise in the risks supporters are willing to impose upon their fellow citizens to see it to its brisk conclusion, and even that may never be enough. In Northern Ireland, deeply polarised but at peace, wounds are re-opening as a potential hard border with the Republic of Ireland test identities and economic dependencies. Parliament and the government remain trapped in a state of hyper-animated stasis. While outside, pounding on its gates, Nigel Farage’s one-man political party rouses his followers with talk of betrayal to the accompanying sound of an [air raid siren](#).

As the UK is deeply enmeshed within global systems, it is also a potential source of external contagion. Ireland, the Netherlands, and France are among countries working on contingency plans, but in an

interconnected and interdependent world, there is scope for all manner of surprise. This is especially pertinent at a time when the global economy is increasingly fragile, trust within and between countries has declined, a global banking and Eurozone crisis has only been parked, and the range and intensity of global threats are growing.

The United Kingdom's civil service is professional and competent, while its contingency capacities are amongst the best in the world. Yet managing a departure to mitigate bad outcomes, even with a lead-time and a specified departure date, has revealed a level of response complexity that any modern society would struggle to match. Brexit, especially its no-deal variant, presents a broad societal shock on a range of temporal scales -- directly affecting social relations, governance, international relations, supply-chains, critical infrastructures, economic production and demand, financial stability, public health and security. It is a potential *systemic risk*, affecting the 'operating systems' that sustain society and collective welfare.

But Brexit it is only a fragmentary manifestation of much wider and deeper processes that are rapidly transforming the risk environment to which all societies are exposed. This essay uses Brexit as a leitmotif to explore this transformation. Through it we can observe the casual complacency we share about how our societies function and service our most basic needs, even as it becomes increasingly vulnerable as the complexity, efficiency and interdependence that underpins it grows. And secondly, it demonstrates how multiple stressors, environmental and socio-economic can interact to generate new stresses and tipping points.

It is the interactions between intensifying stresses and shocks through more vulnerable societal systems that is the defining process underlying the stability and fate of societies. Seen from this perspective, it is likely that we are severely underestimating the potential for large-scale systemic risks. Therefore, whatever the outcome, the preparations for a no deal Brexit as should be regarded as a warning and a test-run for the far greater stresses and shocks to come.

## **2. The Transformation of Dependency**

*"With the certainty of near-term non-linear changes, the critical assumption of the relationship between past and future risk must now be revisited"*

Global Assessment Report, United Nations Office of Disaster Risk Reduction. 2019

Just as we rarely notice the ground until we trip, we take for granted the web of conditions that make the everyday run smoothly. Think of the supply-chains that feed our supermarkets and businesses, the electric grid that enables the clean water, communications, transport and manufacturing that our societies rely upon, the financial systems that sustains the flows of goods and services, and the societal cooperation that protects our security and capacity to respond to problems.

As this global system has grown in scale and complexity it has transformed the nature of our dependencies in an anomalous and recent transformation. In about two hundred years it has enabled the human population to expand more than 7 times, linked through an exponentially expanding and complexifying human system. This has been enabled by accelerating flows of energy and other

materials required to maintain each level of complexity and to provide the basis for further adaptation and problem solving.

In diverse ways, it has driven a revolution in how our species has met its most basic needs. For example, in the most developed parts of the world, food shortages, seasonality, and variability of supply, our bedfellows through the history of life, have disappeared. In the UK only about [one percent](#) of the population are now involved in agriculture, yet we take an abundance and variety of food for granted. And even those few workers can in most cases be considered not so much producers of food, but a staging post where energy, fertilizers, seeds, feed, pesticides and machinery are combined before food is shipped, processed and delivered. It's cheap – freeing up the capacity of the economy for the diversity of other goods, services and jobs. And it's efficient - there's only a few of days food available in our cities, though we've had little incentive to notice.

The intricacies of the conditions that underpin society confound the imagination, but we can make a gesture towards it. Consider the BMW factory in Oxford which makes 1,000 Minis a day, each one containing over 4,000 parts, three-fifths coming through the port of [Dover](#). These parts arrive in precise sequences and are delivered directly onto the production-line on a Just-in-Time basis.

One can make a simple estimate that each of those parts comes from a factory which itself has an average of 400 inputs (assuming they're less complex), and again, each of those in turn come from a factory with another 400 inputs — then just three steps down the supply-chain there are already a potential 640 million supply-chain interactions.

But that's barely the start of it. The factories, production systems, and employees are sustained within the fabric of a global civilization. They depend upon electrical grids, transport, water, fuel, telecommunications and financial networks — and all their conditional dependencies. They rely upon the skills of workers, and the education, housing, and food that makes them productive. They require the extraction, processing, delivery and affordability of energy and other raw materials. They depend upon the relative stability of a variety of socio-economic, environmental, climatic and geological conditions across the globe. Globalized economies of scale are required to make the whole thing viable. For people to afford the cars, they too must ply their own trade, which depends upon the same global systems integration. The evolved regularities of our collective behavior – trust, myth, group identities, institutions, legal systems, cultural norms and expectations that give coherence and direction to the physical flows of goods and services.

Despite the ostensible change we see around us, we live within a system that supports remarkable predictability. Our expectation that water is available, that we can buy food next week, attend a meeting next month, or roll out an infrastructure project that may take years to complete, depends upon the continuity of global systems integration and its constituent processes.

Nobody designed this vast, intricate and synchronized web of supporting conditions, there's nobody in control. The management of it is far beyond human capacities. Its myriad parts, including our own feelings, perceptions and understanding of the world - evolved, interacted and adapted together to create an increasingly singular, global, high-speed, efficient and interdependent living human system. People and organizations may have power and control within niches, but they are dependent upon, and constrained by the totality of the relationships.

Returning to our car, if just one of those 400 suppliers to the Mini factory loses one critical input, due, for example, to distant flooding (as happened after the 2011 flooding in Thailand), a major bankruptcy (for example, 2016 insolvency of Hanjin shipping) or large-scale societal fracturing (the social and economic collapse of Venezuela), then the whole production process halts. Having the remaining 399

other parts at hand makes no difference. This unavailability can then travel up the supply-chain, potentially shutting our Mini factory. This vulnerability to the weakest link is an example of the potential for the non-linear amplification of shocks in societal systems – small disruptions can have big impacts. Because some of the supply-chain operates on a Just-In-Time basis, even interruptions of a few hours can cause significant problems. The more complex a society, the more it depends upon constituent parts whose viability depends upon more inputs and supporting conditions, and thus are, potentially, more vulnerable to the weakest link.

Yet, the extraordinary thing is that anything works at all, given that the vast, complex and globally dispersed time-sensitive interdependencies are the very things that could create the conditions for a myriad of potential disruptions? With so many semi-opaque sources of *latent risk*, why aren't we permanently in crises? Part of the reason is that such a complex society couldn't have evolved if parts of the system were being continually interrupted. The other is that the system has self-organized to stabilize and suppress volatility (see appendix [here](#) for further discussion).

This system has been, within most people's living memory, very stable. There have been disruptions, disasters, recessions and unpleasant surprises, but they are but tiny and transient scratches upon our civilizational organism. Across scales, civilizations systems have been resilient, able to bounce back from shocks or adapt in response to stress and opportunity. Severe disruptions to essentials like food, water, or energy or a hiatus in societies ability to operate are vanishingly rare in the most complex parts of the world. Where disasters have occurred, such as major flooding, or hurricanes in the US, the support from the wider system has helped the impacted region to stabilize and recover. The global financial crisis clearly had major impacts in the most developed countries, but only measured relative to peoples' pre-crisis expectations – it wasn't a catastrophe that would be recognized as such across history, and indeed by many of today's global poor.

Within this, the European Union has been the most integrationist corner of an integrating world. The removal of barriers, the harmonization of standards, shared institutions, relatively predictable currency movements, shared cultures, and the general stability of the countries within the union helped create the conditions for the evolution of rich, time-sensitive connectivity, and its corresponding contribution to increased economic activity.

The failure to appreciate the potential for disruption arising from Brexit reflects society's habituation to system stability. When things work, we take them for granted. We notice only the froth on the surface of life, not the ocean underneath. In addition, in much of the developed world years of affluence and relatively benign political environments have dulled our sensitivity to what's a stake should the pillars supporting critical societal operations suffer severe disruptions or even fail. We are all, not just Brexiteers, complacent.

### **3. Systemic Vulnerability, Systemic Failure**

*"The complexity of modern society is such that if you take out one or two little pieces of the jigsaw, the whole thing collapses"*

— Lord Arbuthnot, former chair of the United Kingdom House of Commons Defense Committee, presently advisor to the Electric Infrastructure Security Council.

The changing nature of our global civilization is transforming societies vulnerability. The global integration of local systems of dependency mean that no family, critical infrastructure, city or nation

can be truly resilient, as the conditions that sustain their organization are dispersed beyond their borders and controls. More complexity and interdependence between the parts of the human system means that there are many more paths through which disruptions can interact and amplify. It also means that a failure of critical parts of societal systems can cause the collective failure of large-scale system integration. If this happens over a wide enough scale, the collapse can become irreversible. While the growing efficiency and speed of systems and processes means shocks can transmit and interact faster, and more non-linearly.

One wide-ranging example of non-linear amplification occurred in the UK. In 2000, a five-day blockade of fuel distribution centers began to cascade through a range of societal systems affecting the work of hospitals, the re-supply of supermarkets and businesses, the ability of people to get to work, the filling of cash machines and [so on](#). Disruptions and failures generated new failures, they interacted, and the impact on society began to accelerate. Had it gone on just a few more days, large parts of the economy and society would have been arrested. The protest highlighted the vulnerability of the whole of integrated societal systems if just the 'right' part is impacted. The impacts were alarming enough that even the Canadian government commissioned a report on its impacts. Later report by the think-tank Chatham House [said](#) "*One week seems to be the maximum tolerance of the 'just-in-time' global economy*" before societies basic functionality begins to shut down. Since then, societal systems have become more complex, faster, more efficient and interdependent.

The above example highlights the critical role of fuel energy, next we turn to electricity. The major geomagnetic storm like the one that hit our planet in 1859 that became known as a Carrington event made little difference to everyday life. If it happened today, because of our electricity dependence, it would be devastating, destroying electric transformers and many other systems. Without power for a prolonged period, clean water stops flowing, sanitation backs up, food deliveries stop, freezers thaw, phones and internet go dead, petrol pumps can't operate, offices and factories are dark, the financial system ceases to function, goods and services do not flow, and the capacity to keep nuclear cores cool can be lost. Unprepared communities may look to their government for help but find only disorientation as governance depends upon the same systems integration, and the scale of the shock would overwhelm contingency capacities. The critically damaged part, the electric transformers, have such a low capacity supply-chain that replacing the damaged ones would take years - assuming the manufacturing itself did not become impossible due to the direct and indirect impacts of the Carrington event. Even if there was resilient electricity infrastructure in some places, those societies would be still vulnerable to economic, financial, social, and supply-chain contagion originating from the directly impacted parts – imperiling societal operations including the supposedly 'resilient' grid, which would still be vulnerable due to its weakest links. Today concerns about a prolonged wide-area grid failure include a major cyber/ hybrid attack or high-altitude nuclear detonation.

The effort by major central banks and governments to 'save' the financial system in 2008 was ultimately to avoid a breakdown in the ability to transact for trade. Had such a tipping point been passed, rapid contagion through global supply-chains would could have undermined the ability to re-stabilize the financial system, further amplifying supply-chain contagion in a re-enforcing spiral. Had such run-away conditions occurred, the ability to sustain any critical infrastructures services would soon been called into doubt. As Damian McBride, the UK Prime Minister Gordon Brown's advisor makes [clear](#), there was always uncertainty as to whether the effort to save the financial system would be successful.

A major global pandemic like the one we experienced a hundred years ago would have a far greater impact today due to the potential for non-linear amplification through societal systems. We are much better at out-brake monitoring, vaccine development and response at a certain scale, however the

potential for animal-to-human transmission, global transport networks and the on-going struggle of viral life mean the potential for a major global pandemic is growing.

Any natural disaster or war affecting a country on the other side of the planet can spread shocks and even global systemic de-stabilization, especially if the impacted region is both big enough, and plays a central role through its position within the global system.

What can be noticed through these examples is that, because critical systems are interdependent, any shock, or combination of them, if it hits the right part and is of sufficient scale, can cause the same broad outcome- a systemic collapse in societal complexity. It which would be felt as a shut-down in the flow of goods and services, or a sudden fall in a societies ability to use energy. This may or may not be recoverable. Because diverse hazards have broadly the same outcome, If you prepare for the impact of one, you are prepared for the impact of all.

The economic models used to estimate the impact of Brexit are blind to the dynamics of societal contagion processes. The yardstick through which impacts are measured, the monetary cost, do not 'see' the loss of distinct and particular inputs into societal processes and connections through society, nor how disruptions can interact with each other to generate new disruptions. Nor do they measure the cost of a rupture in the social contract, what that means for wellbeing, and the implications for how the UK faces the next crisis. This is not to say that Brexit will cause deep de-stabilization, only that the bigger the shock the more economic models will fail to represent systemic vulnerabilities.

The structure of our dependencies is making us more vulnerable, but this is only half the story.

#### **4. The Forest and the Trees**

*"Risks can crystallize with disorientating speed. In a world of complex and interconnected systems ... [they can] lead to sudden and dramatic breakdowns. ... If we exhaust our capacities to absorb disruption and allow our systems to become brittle enough to break, it is difficult to overstate the damage that might result."*

—The Global Risks Report, World Economic Forum, 2018

The causal forces behind Brexit are complex, emergent and must remain to some degree opaque. However, the visibility and the hostile and politicalized deployment of refugees arriving into Europe in the years just prior to the vote, compounded the persistent effects of the 2008 global financial crises and responses to it. Together they likely contributed to the narrow victory of the leave side, a tipping point that would delineate two very different paths that would have implications far beyond the UK. The refugees escaped a tragedy in Syria that was influenced by internal shifts (demographic changes, economic challenges forced by peaking domestic oil production, impacts made more likely by climate change), and international forces (social contagion as part of the Arab Spring , volatile global food prices influenced by climate change and oil prices, and side-effects of US quantitative easing instituted response to the financial crisis).

This sketch gives a glimpse of an emerging reality where diverse stresses and shocks transmit and interact across the globe, generating new sources of disturbance, and where stressed societies can lose resilience, becoming more vulnerable to the next crisis. The focus on facets of this predicament obscures the reality that it is their convergence that matters.

This reflects that we have entered a period where there is a growing potential for oil, food, and water constraints and disruptions, in addition to the rising impacts from climate change and the feedback from the multi-dimensional effects our species is having upon our civilizations ecological niche. Within the human system the potential for a severe financial and economic crisis grows as indebtedness and contingent liabilities continue to escalate, productivity and our ability to innovate around problems is experiencing declining returns, while tensions within and between nations grows. Any one of these can be critical for the maintenance and stability of global systems integration, yet we are seeing intensifying stresses on all fronts.

In broad terms these stressors have non-linear impacts, they act to constrain economic growth, increase the likelihood of economic recessions and depressions, raise the social and economic cost of maintaining existing systems and societal expectations, and increase the likelihood, duration and intensity of shocks, and the potential for compounding with each other. Shocks here include supply and demand shocks, physical damage to society and infrastructure, supply-chain contagion, financial crises and contagion, social unrest, political revolutions, state capture, refugees, and war.

The impacts too, become non-linear. Losing a thousand pounds means different things depending on whether it's your first, or last. Even more so if your rent is late and eviction beckons, a family member sick and needs medicine, and those who once might have supported you, be it friends or state, are themselves overwhelmed. Similar scenarios could be drawn for any number of societal systems. Non-linearities can turn into tipping points – as industries or infrastructures fail, wars start, the functions of a state fail, or run-away contagion processes are initiated.

The potential risk for amplification is enormous due to the extent of latent risk mentioned in section two. Complex, delocalized, societal systems, adaptive to system stability with correspondingly low resilience, and vulnerable to the weakest link can create the conditions for rapid and diverse contagion and compounding. In such an environment, uncertainty grows, the future becomes more dangerous, and systemic stability begins to unravel. Our human system is like a highly precision engineered racing car that's been designed for, and only ever driven on a smooth, well maintained road. It's running off track into wild boulder-strewn countryside.

As the need to build resilience into existing systems becomes more apparent, our capacity to invest - in inventories, flood defenses, and back-ups is more difficult, as incomes fall, financing becomes scarce or non-existent, and the ability to produce and access constituent materials becomes uncertain. Further, in an increasingly stressed and volatile environment, the necessity of maintaining existing systems and expectations is more likely to take precedence over investments in future resilience. For example, our food systems are very vulnerable, but making them more resilient at scale would raise food prices. Yet if food prices are already high due to production/ distribution constraints, if incomes are falling, and governments intervention capacity is already strained, adding further to food prices risks potentially intensifying present crises (food prices having highly non-linear societal impacts), to marginally ameliorate a future crisis. In such contexts, people tend to become even more present focused. This is a feature of *civilizational lock-in*, we become trapped within increasingly dangerous systems of dependency as our adaptive capacity becomes further undermined.

The process of escalating global stress and shocks also raises the likelihood of catastrophic system failure (outlined in section three). Constraints on growth and rising volatility increase the risks to an already seriously over-extended financial system; social fracturing can intensify as societies expectations can no longer be met while rising international tensions raise the risks of war; meanwhile the threats of a severe natural disaster still remains, and that of a catastrophic pandemic grows.

If much here does not reflect a dominant consensus, mostly it's not for subtle or technical reasons. Economic models do not see the complexity that manifests vulnerability. Scientific bodies (the IPCC, the IMF, for example) look at stressors in semi-isolation, not their interactive, accumulating, and non-linear effects through integrated global systems. In addition, some stressors are given a prominence, while others are ignored or mis-understood. It is reasonable to conclude, that we are underestimating both the likelihood and impacts of emerging systemic risks, even if there might be disagreement on the details.

In many complex systems rising systemic volatility, and a slowing recovery from smaller shocks are indicators of approaching tipping points when integration at whatever scale can no longer be maintained. There are signs of such early-warning signals now, and as we look forward there is no reason to expect that they will not increase. Timing such tipping points is inherently difficult, but this is no reason for complacency, for as we have seen, the structure of our human system means destabilization can emerge rapidly.

As the global economy enters a global slowdown, it is expected that new monetary and fiscal mechanisms will be used to boost demand in the real economy. There is an assumption that this will involve investment in green infrastructure. However, green investment does not necessarily increase resilience, and it may even reduce it. As such monetary and fiscal policy is likely to be time limited, and cannot forestall for long growing systemic risks, it makes sense that that funding is prioritized on resilience. This includes investment in *extant critical infrastructure resilience* (e.g. the ability to sustain urban water and sanitation in a crisis), and *basic societal resilience* – supporting the basic welfare of societies in the conditions where extant critical infrastructures fail. In other words, we need to prioritize while we still have the adaptive capacity.

## 5. Between the Tightening Bind and the Gathering Storm

Mr Scoresby (An aviator):

*You speak of destiny as if it were fixed. And I ain't sure I like it any more than the war I'm enlisted in without even knowing it. Where's my free will if you please? And this child seems to me to have more free will than anyone I've ever met. Are you telling me she's just some clockwork toy wound up and set going on a course she can't change?*

Serafina Pekkala (A witch):

*We are all subject to the fates. But we must act as if we are not, or die of despair.*

*-His Dark Materials, Philip Pullman*

Risk is sometimes defined as the combination of likelihood and impact. Two broad and inter-related *Large-Scale Systemic Risks* have been sketched above a) an *Axial Stress* period of deepening socio-economic stress, growing shocks and uncertainty through which no government, no matter how wise and compassionate, can sustain societal expectations, and b) *Systemic Failure*, where interdependent societal systems fail collectively, this may be reversible, or not. Both we have argued have a growing likelihood, the impacts would be prolonged and severe to catastrophic. One may think other, kinder futures are more likely, however, prudence should make us mindful of the downside risks, that's why we buy fire insurance.

But if one at least accepts some validity in the above, where might we put our efforts? One response



Is to attempt radical surgery or deep systems change upon our societies. But as Brexit has showed, bold visions unmoored from the complexities of societal operations risk undermining those visions as radical interventions in one part can cause rapid and unintentional shocks that can cascade and feed-back through the wider systems. One can never know for certain where tipping points are that, once crossed, can initiate such a destabilizing process. This vulnerability to major intervention can be expected to increase as environmental, economic, and social stresses mount. Whether it is political or economic revolutions, rapid and deep de-carbonization, or radically transforming critical societal systems – we cannot know in detail the impacts of such project on the foundations of societal welfare, and even the best of intentions can initiate disaster. And as disaster may indeed be coming, irrespective of our actions, it is probably more effective and pro-social to work on preparing for the impacts now.

As people and institutions rarely acknowledge a warning that challenges established worldviews and analytic traditions, personal and institutional sunk costs, and cherished expectations, one can only expect a limited engagement from society. Yet as citizens, and within our social and institutional roles, those who are willing have an opportunity to engage in the most significant and worthwhile challenge that has been offered in many generations. That is, to build the social capital and preparedness capacities to face unprecedented challenges in the years ahead. This cannot be achieved by international institutions or governments alone, but it will require the effort and imagination through all levels of society.

It has been a disorientating and depressing experience for many, from the UK to the United States, and indeed across the world to experience the rise in anger and polarization of recent years. But the reality of our lives is that we are thoroughly interdependent with each other, the socio-economic networks that bind us, and the planet and its living systems that holds us all. When we tear at the fabric of our relationships, we undermine the welfare of all, and our capacities to face the dire challenges ahead.