**Overcoming the Arrogance of Ignorance: Supply chain lessons from COVID19 for climate shocks**

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**Summary**

COVID19 pandemic effects remind us of our arrogance of ignorance. Society suffered. We emerge scarred, but enlightened. Can COVID19 lessons help us avoid repeating the same mistakes with future climate shocks? We offer a supply chain perspective and a set of pragmatic actions to increase resilience to climate shocks.

**Introduction**

As the seriousness of the coronavirus pandemic became clear, governments and organizations undertook rapid action in an evolving context. Responses and immediate consequences varied, and in the months ahead the effectiveness of responses will be judged. Initial indications suggest that some countries were effective while others missed the mark. Had the pandemic come out of the blue—what is commonly referred to as a *black swan*—the global uncoordinated and experimental response may be forgivable.

Our contention is that the pandemic was not a black swan; warnings and knowledge existed, but they were largely ignored and too little was done to prepare economies and societies for the potential impacts. In this Commentary we turn our attention to climate shocks and consider what lessons we can take from COVID19 to help us be better prepared.

We start from the belief that the arrogance of ignorance is ubiquitous. Greed, anti-intellectualism and anti-science sentiment continue to fuel this ignorance. Poor policy decisions, not based on science but political or economic expediency, result from this ignorance. It can be traced to many countries and many situations. It is redolent of our experience with the COVID19 crisis and of our approach—so far—to climate shocks.

Climate shocks are not black swans either. Over the last thirty years, scientific consensus has emerged on the near and far term impacts of climate change. The latest IPCC—the Intergovernmental Panel on Climate Change—analysis on the impact of 1.5 degree C warming [1] and on climate change and land [2], evidence the climate related risks for natural and human systems. As mean global temperatures rise to and beyond 1.5 degrees C, the likely impacts on the biodiversity of terrestrial, freshwater and coastal ecosystems worsen; likewise, risks increase to health, livelihoods, food security, water supply and human security.

Despite the science and overwhelming evidence, government commitments, and public awareness, action has been tepid.

We could continue to believe that climate shocks are high impact low probability events. This view feeds the willful ignorance we see with COVID19; a dismissal and ill-preparedness. The science and evidence are clear: climate shocks continue to appear and—as temperatures rise—are expected to become more frequent and more severe. Their effects might be local, regional or global. We should contemplate and consider the lessons learned from the COVID19 pandemic to better prepare economies and societies for climate shocks.

How do we overcome the *arrogance of ignorance* to prepare ourselves for climate shocks? As mitigation attempts continue, we consider how governments and organizations can adapt. We focus on issues related to supply chains—whose shortcomings have become prominent as COVID19 spread globally. We end on a series of recommended responses - a call to action - to better prepare for and avoid the potentially irreversible consequences of climate shocks.

Importantly, we emphasize that building climate shock resilience in supply chains should not come at the expense of justice and equity. The consequences of the COVID19 pandemic have not been uniform. Neither will be the effects of climate shocks. The most vulnerable and marginalized communities will suffer the most as impacts follow established lines of social inequality and racism. Climate justice concerns need to guide us to overcome the serious deficits in our attitudes. Meaningful political action needs to be based on scientific facts and a feeling of solidarity to achieve more equitable, inclusive and sustainable economies and societies.

**Shock waves across the supply chain**

The COVID19 pandemic has showcased the diverse and extreme consequences of crisis shocks, causing waves of social, political, economic, environmental, and technological transitions. Supply chains have been centerstage, with some commentators noting that sustainable organizations—for example, those exercising greater stakeholder responsibility—were more resilient in the immediate aftermath of the crisis [3].

The supply chain contains focal players--such as manufacturers and retailers--their upstream suppliers and downstream customers. Sustainable supply chain activities are consistent with industrial ecology and circular economy principles such as exchange of wastes, mass flow management, and closed-loop practices such as reuse, remanufacturing, and waste reduction.

The pandemic has caused some rethinking of traditional supply chain practices. Figure 1 illustrates some early sustainable supply chain observations [4], including:

1. Supply chains need to be more agile. The ability for supply chains and manufacturers to switch markets—to supply high demand products and materials—has been an important part of the response to COVID19. Examples include Dyson in the UK with ventilators [5] or L’Oreal in Europe switching to hand sanitizers [6].
2. Globalized supply chains have shortcomings—in the short-run. The globalization of production and optimization of supply chains have increased systemic efficiencies in the global economy with observable global economic benefits; but have exacerbated the speed and scope of contagion [7]. COVID19 has prompted calls for supply chains to be closer to key customers; arguments for reshoring and insourcing have been heard [8].
3. Upstream supply chains need greater transparency and visibility. Early in the pandemic, ventilators and other protective equipment were in great demand, but buyers didn’t know the location of upstream bottlenecks. Supply chain obscurity limited the ability to respond.
4. Active engagement with upstream suppliers is critical. When problems manifest, companies need to respond by managing sub-suppliers, levering relational capabilities, imposing new requirements or, ultimately, switching sub-suppliers.
5. *Smart and nimble* supply chains held up. The World Economic Forum has led calls for diversifying supply chains to reduce reliance on single-sourcing models driven exclusively by cost control, for example, away from “China only” towards other manufacturing hubs such as Vietnam, Mexico, India. Going forward, increased digitalization will be an important aspect of supporting better and more flexible buyer-supplier relationships [9].
6. Not fully understanding downstream demand shifts and lack of effective stress tests made supply chains woefully unprepared. Observations 3 and 4 also apply to the downstream supply chain.

**INSERT FIGURE 1 HERE**

Although these observations have been made in relation to COVID19, they are not new. They were noted in previous crises following floods in Thailand, the SARS virus, tsunamis in Japan, and so on. Policy and strategic recommendations followed. The experience with COVID19 suggests that these previous recommendations have been largely ignored.

**Climate shock challenges to supply chains**

Climate shocks include droughts, floods, storms, fires, soil erosion, infestations (invasive species, pests, locusts and swarm intensity), and biodiversity loss. Our food systems are particularly vulnerable. In farming there are *yield shocks*; caused by temperature extremes. Climate shocks create and exacerbate poverty and food insecurity by impacting supply of and access to food. Climate shocks may reverse progress toward a world without hunger [10].

Global warming is increasing the frequency and severity of climate shocks. There are many ways to mitigate shocks. For supply chains we can minimize temporary shock and disruption effects, while building capacity to cope with the long-term shifts. A number of supply chain *hotspots* for potential impacts of climate shocks exist [11]; these hotspots range from physical infrastructure transitions to locational and product concerns.

More so than COVID19, climate shocks are characterized by higher risks of irreversibility. For supply chain players, a climate shock, such as a flood or drought, may mean that it is not only difficult but actually impossible to re-establish pre-shock routines. Relocation, material substitution, fundamental product or process redesign are likely to result from climate shocks.

The ripple effects of these supply chain changes cascade through the global economy with local communities feeling the brunt of adversity. This economic cascading has been the case with COVID19. In response, we have seen massive government bailouts of organizations and workers. The harsh reality is that these government bailouts will perhaps only delay rather than prevent bankruptcy and job loss. It may be unrealistic to expect similar government responses to future climate shocks.

**What are some pragmatic actions?**

Supply chains typically resort to conventional approaches in times of crises. Collaboration and cooperation are examples. Whilst these are important for sustainable supply chain operations, for climate shock mitigation they may not be enough. Ignorance needs to be overcome; we must learn from previous crises. We suggest paying particular attention to the following actions.

Actions to address the immediate concerns of shocks will have foreseen and unforeseen consequences. With climate shocks, we can expect migration concerns, restructuring and reevaluating supply chain structures, and, potentially, increasing inequity. We must develop capabilities to systematically relate actions and outcomes to anticipate the broadest climate shock ramifications.

Existing economic inequalities may be reinforced by kneejerk responses to climate shocks. Developing countries often have limited capacity to recover from shocks on their own, and losses from climate hazards can hamper or even reverse years of development efforts [12].

If we meet calls for localized supply chains—which we acknowledge have some sustainability benefits—global supply chains will lose out. Jobs will be lost for the most vulnerable in developing nations. The vulnerability of these developing nation supply chains can be seen in certain commodity networks. Some responses for developing nations may involve extreme measures to maintain economic stability. Environmental and social sustainability may be ignored.

Before we jump to implementing supply chain resilience measures, we need to anticipate the social and environmental consequences that will follow.

Finger pointing and the nationalistic blame game is not helpful and distracts from identifying real solutions. New models of international and multilateral cooperation are needed to strengthen the political dialogues and responses to climate shocks [13]. Distributed and diversified supply chains add to resilience but having supportive multi-level governance in place is necessary to ensure positive outcomes for all countries. Retreating into nationalistic cages may increase ignorance by focusing too heavily on local needs, losing sight of a global perspective and affecting negatively supply chain resiliency and sustainability.

Climate change will result in eco-scarcity of materials and resources. A systems perspective can help. Circular economy practices in supply chains require, for example, integrated reverse logistics, designing into products remanufacturing and reusability potential, and arranging reclamation routes. Other systemic responses include switching the business model from products to services, deploying the potentials of digitalization, disconnecting material use from profit and growth. These practices can help reduce demand for virgin materials, reduce waste and regenerate natural capital, thereby reducing greenhouse gas emissions along the supply chain [14].

Changing our consumption patterns can also help. Our current system of simply buying what we want, when we want it, because we can—due to oversupply—is ignoring the risk. Climate shocks will dramatically reduce our ability to consume in the same way—we cannot assume that additional capacity will exist elsewhere. COVID19 may have sharpened the focus here; there is a palpable sense of reservation about whether it is necessary or desirable to return to *normal*.

We see this hesitancy to return to *normalcy* both among policy makers and society-at-large. Policy makers are not simply talking about *building back better* but implementing interventions to support a green recovery and tying organizational bailouts to sustainability targets. Society-at-large may have experienced positive changes as a result of lockdown and do not want to return to their old ways. Seizing the opportunity and making interventions to *lock-in* change should be pursued.

Technology solutions exist to solve some problems across sectors. Technology can help to sense and build resilience to climate shocks. Digitalization is likely to be in the foreground, but automation, 3D printing and cyber-physical systems offer opportunities for dematerialization and mitigating climate change while increasing agility in the supply chain [4].

Climate resilient physical infrastructure and new organizational arrangements are needed to support the diffusion of these technologies. But care should be taken that short-sighted technological solutions do not hinder sustainability progress [16]. Technology may make activities more efficient, but in the long run this efficiency may result in greater consumption from longer-term *rebound effects*.

Our ignorance is underpinned by a reliance on cost-benefit assessments; assessments that are typically myopic and skewed as we overestimate sustainability costs and underestimate their benefits.

Decision making is especially tricky when costs are incurred by the individual actor, while benefits accrue globally. Challenges also arise when we try to equate short term costs and long-term benefits. It is clear that there will be costs in investing in technology and physical assets to ameliorate the challenge of climate shocks. We need new approaches to support decision making, and various promising approaches now also emerge beyond the academic debate [16] by mainstream business initiatives [17] and management consultants [18].

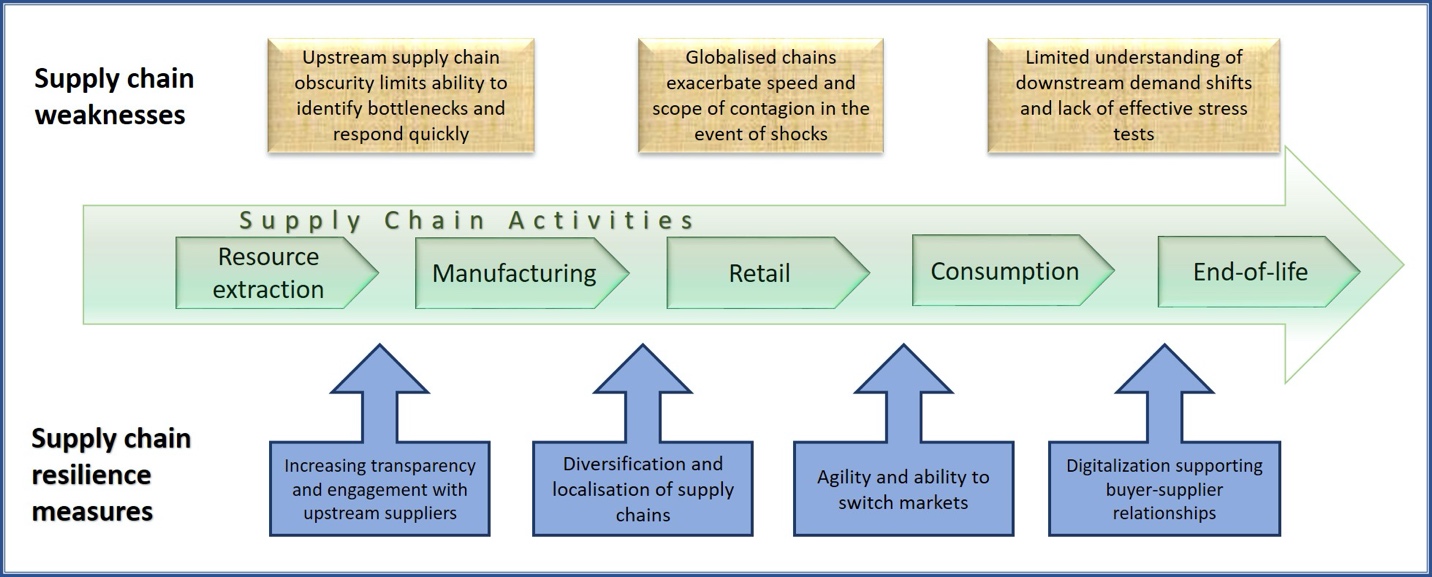
**Lifting the veil of ignorance**

COVID19 is the latest crisis to test our preparedness and resilience. We will emerge scarred from the crisis, but more enlightened. While there are lessons from the current crisis from which we can learn to better prepare our economies and societies for climate shocks, overcoming the *arrogance of ignorance* is a crucial first step.

Supply chains have been in the spotlight during the current crisis. In this Commentary we call for thoughtful effort to redesign our supply chains to cope with increasingly detrimental climate shocks. Thoughtful actions are necessary to protect future generations. Regenerative, restorative, and resilient supply chains are possible. We can transition to a more equitable, just and sustainable society. We can learn from previous crises and past mistakes.

We need to reinforce the intention that policy should not be led by post-truth deconstruction and acrimonious and polarizing debate that serve as the threads for the veil of ignorance. Instead, to overcome the arrogance of ignorance, this transformational effort needs to be guided by science and reason to ensure that the rights and aspirations of future generations are upheld.

**Figure 1. Significant weaknesses that can stress supply chain activities and proposed resilience measures in supply chain designs.**



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