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Commentary

Overcoming the Arrogance of Ignorance: Supply-Chain Lessons from COVID-19 for Climate Shocks

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The effects of the coronavirus disease 2019 (COVID-19) pandemic remind us of our arrogance of ignorance. Society has suffered. We are emerging scarred but enlightened. Can COVID-19 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 disease 2019 (COVID-19) 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 have been effective, whereas others have missed the mark. Had the pandemic come out of the blue—what is commonly referred to as a “black swan”—the uncoordinated and experimental global response could have been 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 COVID-19 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 on 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 COVID-19 crisis and of our approach—so far—to climate shocks.

Climate shocks are not black swans either. Over the last 30 years, scientific consensus has emerged on the near- and far-term impacts of climate change. The latest Intergovernmental Panel on Climate Change analysis on the impact of 1.5°C warming¹ and on climate change and land² provides evidence for the climate-related risks for natural and human systems. As mean global temperatures rise to and beyond 1.5°C, the likely impacts on the biodiversity of terrestrial, freshwater, and coastal ecosystems worsen; likewise, risks to health, livelihoods, food security, water supply, and human security increase.

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 COVID-19: 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 COVID-19 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 COVID-19 has 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 resilience to climate shocks in supply chains should not come at the expense of justice and equity. The consequences of the COVID-19 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. Concerns for climate justice 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 COVID-19 pandemic has showcased the diverse and extreme consequences of crisis shocks, causing waves of social, political, economic, environmental, and technological change. Supply chains have been centerstage, and some commentators have noted that sustainable



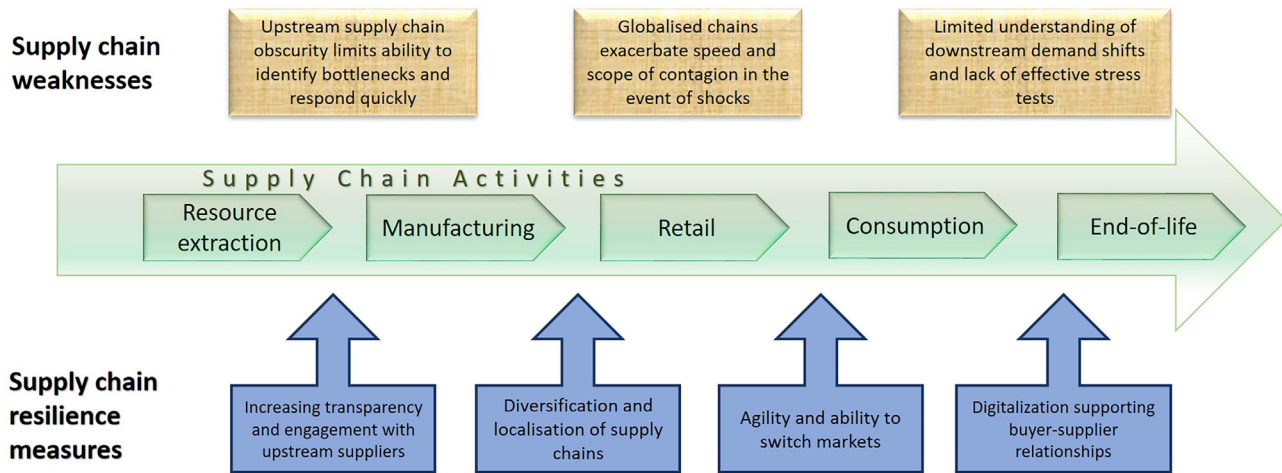


Figure 1. Significant Weaknesses that Can Stress Supply-Chain Activities and Proposed Resilience Measures in Supply-Chain Designs

organizations—for example, those exercising greater stakeholder responsibility—were more resilient (than their less sustainable competitors) in the immediate aftermath of the crisis.³

The supply chain contains focal players (such as manufacturers and retailers), their upstream suppliers, and their downstream customers. Sustainable supply-chain activities are consistent with industrial ecology and circular-economy principles, such as the 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.⁴ Figure 1 illustrates some supply-chain weaknesses and potential resilience measures, which include the following:

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 COVID-19. For example, Dyson in the UK started developing ventilators,⁵ and L’Oréal in Europe switched to manufacturing hand sanitizers.⁶
2. Globalized supply chains have shortcomings—in the short run. The globalization of production and the optimization of supply chains have increased systemic efficiencies in the global economy with observable global economic

benefits, but they have exacerbated the speed and scope of contagion.⁷ COVID-19 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, leveraging relational capabilities, imposing new requirements, or ultimately switching sub-suppliers.
5. “Smart and nimble” supply chains hold 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” toward other manufacturing hubs such as Vietnam, Mexico, and 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 a lack

of effective stress tests have left supply chains woefully unprepared. Observations 3 and 4 also apply to the downstream supply chain.

Although these observations have been made in relation to COVID-19, they are not new. They were noted in previous crises following floods in Thailand, the outbreak of the SARS virus, tsunamis in Japan, and so on. Policy and strategic recommendations followed. The experience with COVID-19 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 affecting the supply of and access to food. Climate shocks can 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 with COVID-19, climate shocks are characterized by higher risks of irreversibility. For supply-chain players, a climate shock (such as a flood or drought) could mean that it is not only difficult but also quite impossible to re-establish pre-shock routines. Relocation, material substitution, and 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 such that local communities feel the brunt of the adversity. This economic cascading has been the case with COVID-19. 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 losses. It might 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 crisis. Collaboration and cooperation are examples. Although these are important for sustainable supply-chain operations, they might not be enough for climate-shock mitigation. Ignorance needs to be overcome; we must learn from previous crises. We suggest paying particular attention to the following actions.

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

Existing economic inequalities could 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

Second, 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 nations' supply chains can be seen in certain commodity networks. Some responses for developing nations could involve extreme measures to maintain economic stability. Environmental and social sustainability might be ignored.

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

Third, finger pointing and the nationalistic blame game are not helpful and distract 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 multilevel governance in place is necessary to ensure positive outcomes for all countries. Retreating into nationalistic cages could increase ignorance by focusing too heavily on local needs, losing sight of a global perspective, and negatively affecting supply-chain resiliency and sustainability.

Fourth, 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, design with product remanufacturing and reusability potential in mind, and the arrangement of reclamation routes. Other systemic responses include switching the business model from products to services, deploying the potentials of digitalization, and 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

Fifth, changing our consumption patterns can also help. Our current system of simply buying what we want when we want it because we can—as a result of 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. COVID-19 might 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” among both policymakers and society at large. Policymakers are not simply talking about “building back better” but are implementing interventions to support a green recovery and tying organizational bailouts to sustainability targets. Society at large has experienced some positive changes as a result of lockdown and might not want to return to its old ways. Seizing the opportunity and making interventions to “lock in” change should be pursued.

Sixth, technology solutions to address some problems across sectors do exist. 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 so that short-sighted technological solutions do not hinder sustainability progress.¹⁵ Technology might make activities more efficient, but in the long run, this efficiency could result in greater consumption from longer-term “rebound effects.”

Finally, 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 but benefits accrue more widely. Challenges also arise when we try to equate short-term costs with 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 are now emerging beyond the academic debate¹⁶ by mainstream business initiatives¹⁷ and management consultants.¹⁸

Lifting the Veil of Ignorance

COVID-19 is the latest crisis to test our preparedness and resilience. We will emerge scarred but more enlightened. Although the current crisis has brought

lessons 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 or acrimonious and polarizing debate, which serves as the thread 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.

REFERENCES

1. Masson-Delmotte, V., Zhai, P., Pörtner, H.-O., Roberts, D., Skea, J., Shukla, P.R., Pirani, A., Moufouma-Okia, W., Péan, C., Pidcock, R., et al. (2018). Global warming of 1.5°C: an IPCC special report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty (Intergovernmental Panel on Climate Change). https://www.ipcc.ch/site/assets/uploads/sites/2/2019/06/SR15_Full_Report_Low_Res.pdf.
2. Shukla, P.R., Skea, J., Calvo Buendia, E., Masson-Delmotte, V., Pörtner, H.-O., Roberts, D.C., Zhai, P., Slade, R., Connors, S., van Diemen, R., et al. (2019). Climate change and land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems (Intergovernmental Panel on Climate Change). <https://www.ipcc.ch/site/assets/uploads/sites/4/2020/02/SRCL-Complete-BOOK-LRES.pdf>.
3. MacDonald-Brown, N., and MacLennan, S. (2020). How have sustainable companies performed during the Covid-19 crisis?, Schrodgers, May 4, 2020 <https://www.schrodgers.com/en/insights/economics/how-have-sustainable-companies-performed-during-the-covid-19-crisis/>.
4. Sarkis, J., Cohen, M.J., Dewick, P., and Schröder, P. (2020). A brave new world: lessons from the COVID-19 pandemic for transitioning to sustainable supply and production. *Resour. Conserv. Recycling* 159, 104894.
5. Dyson (2020). Ventilator update. <https://www.dyson.co.uk/newsroom/overview/update/ventilator-update.html>.
6. L'Oréal (2020). L'Oréal takes part: our response to Covid-19. <https://www.loreal.com/en/articles/group/our-response-to-covid/>.
7. Lee, B., and Preston, F. (2012). Preparing for high-impact, low-probability events lessons from Eyjafjallajökull: a Chatham House report (Chatham House). https://www.chathamhouse.org/sites/default/files/public/Research/Energy%20Environment%20and%20Development/r0112_highimpact.pdf.
8. Frikkee, T. (2020). Covid-19 crisis has laid bare weaknesses in supply chains (Financial Times), May 11, 2020. <https://www.ft.com/content/9bb6939d-6a31-4a33-bb62-ecbf74da8491>.
9. Lin, J., and Lanng, C. (2020). Here's how global supply chains will change after COVID-19 (World Economic Forum), May 6, 2020. <https://www.weforum.org/agenda/2020/05/this-is-what-global-supply-chains-will-look-like-after-covid-19/>.
10. Wheeler, T., and von Braun, J. (2013). Climate change impacts on global food security. *Science* 341, 508–513.
11. L. Lipper, N. McCarthy, D. Zilberman, S. Asfaw, and G. Brana, eds. (2018). *Climate Smart Agriculture: Building Resilience to Climate Change, Food and Agriculture Organization of the United Nations* (Springer).
12. UN Department of Economic and Social Affairs (2020). Chapter 3. Climate change: exacerbating poverty and inequality. In *World Social Report 2020: Inequality in a Rapidly Changing World*. <https://www.un.org/development/desa/dspd/world-social-report/2020-2.html>.
13. Falkner, R. (2015). Towards multilateralism. *Nat. Clim. Chang.* 5, 805–806.
14. Geng, Y., Sarkis, J., and Bleischwitz, R. (2019). How to globalize the circular economy. *Nature* 565, 153–155.
15. Sarkis, J. (2019). Sustainable transitions: technology, resources, and society. *One Earth* 1, 48–50.
16. Bansal, P., Reinecke, J., Suddaby, R., and Langley, A. (2019). Special issue of *Strategic Organization* “Temporal work: the strategic organization of time”. *Strateg. Organ.* 17, 145–149.
17. World Business Council for Sustainable Development (2019). Modernizing governance: ESG challenges and recommendations for corporate directors. https://docs.wbcsd.org/2020/01/WBCSD-Modernizing_governance-key_recommendations_for_boards_to_ensure_business_resilience.pdf.
18. Koller, T., Goedhart, M., and Wessels, D. (2020). *Valuation: Measuring and Managing the Value of Companies Volume 499, Seventh Edition* (John Wiley and Sons).