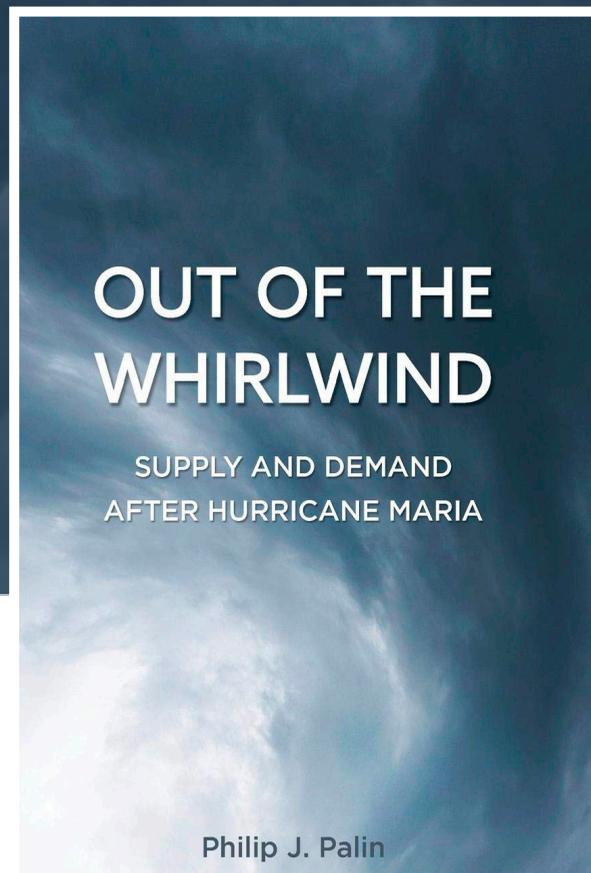


Book Review:

*Out of the Whirlwind; Supply and Demand
After Hurricane Maria* by Philip J. Palin

Reviewed by Kristopher Thornburg



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The 2017 hurricane season left wide swaths of destruction across parts of the southern United States. Puerto Rico was hit the hardest, beginning with a glancing blow from Hurricane Irma and culminating with a direct strike from Hurricane Maria. The Puerto Rican landscape was reshaped by destroyed homes, washed-out roads, floods and landslides. Maria knocked out over 95% of the island's cellular communications capacity. To top it off, Puerto Rico experienced a complete loss of the electrical grid and all utilities that relied on electricity. Recovery from a disaster this complete would require a resilient and robust supply chain to deliver and distribute necessary supplies. In his new book, *Out of the Whirlwind; Supply and Demand After Hurricane Maria*, Philip J. Palin uses a unique narrative approach to examine the post-Maria supply chain. He develops fictional characters amalgamated from interviews and real-world experiences to describe varying supply chain concepts and effects during the post-Maria recovery. The result is an engaging, novel-like narrative that highlights the importance of post-disaster supply-chain resilience.

Palin first introduces the master of the ocean-going tug Cayuco, Captain Paul Alvarado. Captain Alvarado and Cayuco make regular supply runs between Jacksonville, Florida and San Juan, Puerto Rico. On the night before Maria strikes Puerto Rico, Cayuco finds shelter in a Dominican Republic cove. Captain Alvarado is determined to make port as soon as possible after the storm to ensure that the supplies and goods on his barge can be distributed as quickly as possible. The efforts of Captain Alvarado and the challenges he faced to offload cargo in a partially-functioning port serve to illustrate the importance of distribution capability during recovery efforts. In the case of Maria, there was an abundance of supply entering or attempting to enter Puerto Rico ports. However, many cargo-releasing mechanisms in the ports were operated electronically and did not function in the immediate aftermath. Cargo containers made it to port but had to wait for the disused paper-based system to be released for distribution. This bottleneck created insufficient distribution and added uncertainty to an already unpredictable environment.

The next protagonists are Jaime and Pepita, cousins and business partners in the grocery business. Together, they operate a small store in a fictional Puerto Rican town in the central mountains. Luckily, Jaime and Pepita are prepared with a diesel-powered generator to supply electricity to the store. However, the communications network is down, preventing bank card and Family Card transactions. The Family Card is the nutritional assistance system in Puerto Rico and is used by 60 percent of Jaime and Pepita's customers. Pepita and Jaime are forced to operate on a cash and credit basis, creating new challenges at the point of sale. To keep the store running, Jaime seeks diesel for the generator and products to resupply the store, driving to various locations on alternating days. Jaime's ingenuity and persistence are key to the grocery's and the community's survival. Within most other areas of Puerto Rico, the same network disruptions for payments were occurring. Suppliers and distributors needed to make drastic shifts in business practices while the whole island experienced distribution challenges.

Additionally, bottlenecks created at certain nodes within the supply chain, despite ample supply in many cases, generated perturbations in diesel deliveries, while inadvertent effects of fuel rationing created artificial shortages in some areas.

Manuel and Esteban, a manager of a gasoline terminal and a grocery distribution executive, respectively, are introduced next. Each illustrates the challenges of an on-island supplier and distributor. For Manuel, the main problem is a significant initial demand without an invoicing or payment system. For Esteban, it is a matter of determining demand from many small, widely-distributed customers. Both develop alternative means of doing business while keeping recovery efforts at the forefront. Initially, both Manuel and Esteban have ample supply for several days. The issues experienced by these suppliers center on the capacity of distribution and the associated enabling mechanisms. Their alternate business practices focus on developing new distribution capacity.

Finally, Palin introduces the General, retired out of the Army and now at FEMA, along with Dr. Kathy Juniper, a professor of supply-chain management to round out the cast. The General is contending with a massive Resource Request Form and reaches out to Dr. Juniper for some ground truth. Through their communications, Palin identifies drawbacks to providing massive amounts of assistance while regular supply is intact. The key for emergency managers, Palin points out, is to determine what actual demand is from a disaster area and to allocate from existing points of distribution to minimize recovery disruptions. Mass mobilization is difficult to stop once started, but emergency managers can take steps to ensure that the mobilization of supplies does not hinder local business and distribution recovery. During disaster response, supply is rarely a problem. Major challenges exist with determining the best flow of supply given the disruption of normal flow routes. Determining the root causes of flow disruptions is key to a resilient supply chain.

The narrative approach is an effective way to illustrate many of the concepts Palin introduced through the overarching Maria disaster on Puerto Rico. Within each chapter, Palin includes more technical discussions with Puerto Rico supply chain data. While informative, the structure combining data and narrative can be hard to follow at times. The book would have benefited from integrating much of this data into figures and visualizations throughout the book. Since the focus of much of the book is on networks and flows, data-centric visualizations would have provided supporting richness to the narratives. Palin also includes Caribbean mythology throughout, which adds color to the narrative but does not help the overall objective discussion of disaster supply-chain resilience and recovery.

These narratives describe, in arresting detail, supply-chain challenges for post-disaster recovery. From the end-point grocer to the distributor, the transporter to the federal coordinator, Palin touches on each level of a supply chain. Each story illustrates vividly not only what happened during the Maria recovery but what can be expected in other similar disasters. In the final chapters, Palin discusses supply chains in terms of networks and flows, introducing concentration, betweenness, and bottlenecks as concepts and measures. Palin's description of these concepts seems to be meant for the layman, but can easily get lost in the novel-like narratives presented earlier in the book. Emergency management practitioners and academics should take a keen interest in these narratives as illustrations of successes, challenges, and future problems within a post-disaster supply chain.

Kristopher Thornburg received his Ph.D. in Industrial Engineering from the University of Iowa in 2010. He served as a postdoctoral associate in the Massachusetts Institute of Technology's Humans and Automation Lab, researching supervisory control systems. In 2012, he was commissioned as an officer in the United States Coast Guard and is currently serving aboard his third ship. He completed a Master of Arts in Security Studies from the Naval Postgraduate School's Center for Homeland Defense and Security in 2019. His thesis, "Disruptive Emergent Systems in Disaster Response," examines emergent responses to hurricanes outside of federally-managed response efforts. He may be reached at thornburg@gmail.com.

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