



manage supply chains for food and other essentials.

Solutions to these logistical puzzles posed by the COVID-19 crisis may lie in operations models used in the [retail sector](#), says Siqian Shen, a researcher at the University of Michigan. She has written a report that pairs COVID-related problems with operations engineering research that may lead to solutions.

"We have a large body of research that has traditionally been used to site retail stores, to optimize inventory and production, to manage stock levels as demand for products varies by season," said Shen, who is an associate professor of industrial operations and engineering and civil and environmental engineering. "The COVID-19 pandemic presents a very similar set of challenges, but the tools to meet those challenges haven't always made it the people who need them. I'm doing what I can to change that."

Shen hopes that making information more freely available will make it easier for decision makers to turn data into decisions in the face of the current crisis. The report includes information on these and other issues:

- Designing and staffing testing facilities, including how many test kits to send to each facility. Commonly used integer programming models can be used to help find the best locations and staffing levels based on factors like population density and prediction of the disease-spread paths.
- How to triage patients and allocate hospital resources; This is a well-researched topic in operations engineering, and Shen offers several studies that can help planners manage hospital admissions to treat patients as effectively as possible and how to manage the flow of patients through emergency rooms.
- Managing the supply of food and other essentials: Shen provides a variety of modeling resources that dissect the relationships

between warehouse location, inventory levels, shipment logistics and other factors, and show how they can be effectively managed to smooth supply chains and get supplies to where they're needed.

In the future, Shen plans to make open-source analytical software freely available online. For now, she suggests that [decision makers](#) who don't already have access to analytical expertise turn to universities, as well as the authors of the resources in her online repository, for help.

## **Mining best practices**

In addition to adapting models from other applications, Shen is tracking COVID-related success stories from around the globe, gleaned from the countries in Asia and Europe that were among the first to deal with the crisis. She believes that those successes can offer lessons for the United States and other second-and third-wave countries.

"One of the things that makes a global crisis so difficult is that every country is different," she said. "Something that works in China may not work here in the United States. But taking a step back and analyzing what works elsewhere can help us design our own solutions more quickly."

Some of the examples she cites include:

- Germany, which has emerged as a leader in how to manage the allocation of ICU resources. Its success at matching patients with the right resources and deciding when to admit and discharge them has helped the country keep its COVID-19 fatality rate around 0.4%, dramatically lower the rates in other European countries like Italy, where fatality rates are nearly 10%. In addition, Germany has eight hospital beds per 1,000 people, as

compared to Italy's 3.18 beds. In the United States, the figure is 2.77 beds per 1,000 people.

- South Korea, whose network of drive-through testing facilities has provided 10,000 tests per day in a country of 50 million by making testing free and universally accessible, and by analyzing test results around the clock. Shen underscores that the extensive testing is a key to demonstrating the spread of the disease and building public support for social distancing measures.
- China, which has implemented a publicly available online system that provides daily updates on the spread of the disease, as well as death and recovery rates. Such tracking has enabled better decisions about how to manage social distancing measures, and has made the public more aware of the effects of those measures.

Shen's trove of ideas is very much a work in progress. She invites industrial operations experts and others to share research and resources that they believe could be helpful to others in the fight against the disease and its consequences.

"I very much encourage people to contact me if they have something from their area of expertise that they believe could be relevant," she said. "I'm glad to add it, to cite their research. My ultimate goal is to make this a very detailed document that pulls together the best resources and successes from across the globe."

**More information:** From Data to Actions, From Observations to Solutions A Summary of Operations Research and Industrial Engineering Tools for Fighting COVID-19: [www-personal.umich.edu/~siqian ... hting-covid19\\_v1.pdf](http://www-personal.umich.edu/~siqian...hting-covid19_v1.pdf)

Provided by University of Michigan

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