SUPPLY CHAIN EXPERT RELIES ON MATH TO MAKE LIFE EASIER

By T.D. Christensen

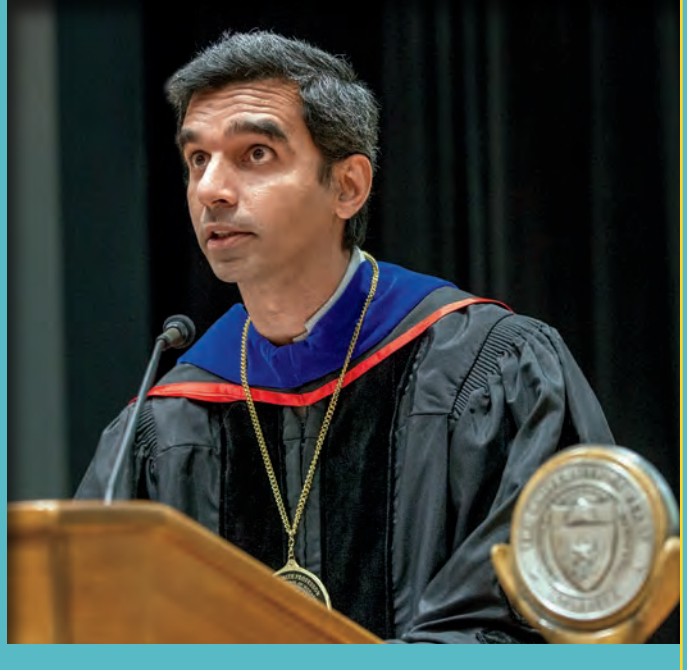
When your grocery store runs out of your favorite cereal but has 30 boxes of another brand you do not like, Ganesh Janakiraman feels your frustration. When a never-ending construction project on your local highway makes you late for work, he understands your anger.

And then he gets excited. Janakiraman's mission as a researcher is to come up with creative mathematical solutions to help organizations make smart choices — not just to maximize profit, but to make life easier for everyone.

"I really like the idea of thinking about 'How can we make decisions that are mathematically sound?' " says Janakiraman, an Ashbel Smith Professor of Operations Management at the Jindal School. "Sometimes we all make curious decisions instead of thinking about it in scientifically rigorous ways."

Growing up in Chennai, India, Janakiraman struggled at first to find his career path. As an engineering student at the Indian Institute of Technology Madras, he realized that he was more interested in mathematics than engineering. Fortunately for him, he found a subject called operations research, which was mathematical, had excellent applications and was taught, he says, "by a phenomenal teacher."

Later, while pursuing advanced degrees at Cornell University, he ran into the opposite problem. "I went in liking math, but there were all these exceptionally talented people doing hard-core math stuff, which I found to be somewhat



Ganesh Janakiraman speaking at the April 7, 2017, investiture ceremony, which officially recognized his appointment to an endowed post.

abstract," he says.

Gradually, he found his true calling in a Cornell class that taught stochastic inventory theory — or to use a broader definition, supply chain management.

As Janakiraman explains stochastic inventory theory, imagine Walmart's management team trying to decide exactly how many models of a specific TV to keep in stock at a specific store. By using algorithms, computer software and tons of forecasting data, the store might decide that 25 is the perfect number of TV sets to keep in stock.

It is Janakiraman's job as a researcher to find new ways to make sure that 25 is the smartest choice possible.

"These decisions can still be quite challenging," he says. "You want the products to float off the shelves, and not sit on the shelves for months, so it's really important for companies to have exactly the right quantity of products that customers are looking for."

Customers, in turn, have to be able to trust that a store will get those calculations right, he says.

"If your favorite bread is out of stock three out of 10 times that you go to your favorite grocery story, that's a pain. … You're going to make another store your favorite store."

While Janakiraman has spent most of his career studying supply chain management, he recently has been exploring other topics, including procurement auctions and mechanism design theory. The theory has been around since the 1960s, but it has taken off in recent years, and in 2007, the Nobel Prize in Economics was awarded to its inventors, Leonid Hurwicz, Eric S. Maskin and Roger B. Myerson.

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In a new study that is in the review stage, Janakiraman and several co-authors looked at how mechanism design and cost-sharing contracts can improve business-to-business transactions. They studied highway construction to figure out how governments can hold auctions with contractors to determine the best price for each contract — as well as the best penalty. They determined that if a contractor fails to build the highway on time, the company has to pay a "cost-sharing" fee.

"The longer the project takes, the more inconvenience there is for the public," Janakiraman says. "In this paper, we study how large that 'public inconvenience cost' should be, and all the factors that cost depends on."

Janakiraman's past research has been published in such respected journals as *Management Services* and *Operations Research*. He also teaches classes at the master's level and advises PhD students, which he finds particularly invigorating.

"I enjoy these interactions tremendously," he says. "I get the opportunity to discuss exciting ideas with a lot of talented young people who all have some common characteristics: They're independent, they don't want a traditional career, and they find research exciting, just like I do."

Janakiraman says he keeps in touch with former PhD students who have gone on to academic careers, including:

- Sandun Perera, PhD 2015, assistant professor of operations and supply chain management at the University of Michigan-Flint;
- Wei Chen, PhD 2015, assistant professor of decision sciences and supply chain management at the University of Kansas;
- Shivam Gupta, PhD 2016, assistant professor of computer information systems and quantitative methods at Texas State University (see *Dissertations Showcase*, page 16).
- Yang Bo, PhD 2017, assistant professor of decision sciences and managerial economics at The Chinese University of Hong Kong;
- Zhen Sun, PhD 2016, assistant professor of information systems and technology management at George Washington University; and
- Manmohan Aseri, now completing his PhD, who will join Carnegie Mellon University this fall.

Janakiraman also keeps his eye on the future of supply chain management as it evolves in the rapidly changing digital age. He says delivery-oriented companies like Amazon and on-demand driver services like Uber present bold new opportunities.

"There's going to be a lot of innovation to allow companies to provide quick deliveries without burning a lot of cash," he says. "How do you combine this on-demand economy with companies like Amazon or Walmart and make it profitable for everyone?"

The answer, he says, will probably be easier than most people imagine.

"When you write out these problems as mathematical models, many of them are indeed very complicated," Janakiraman says. "But one surprising thing I've seen in my research is that the solutions are actually quite simple. That's one goal in my research: To think about good, simple solutions that companies can easily understand and implement."