Stock or Print? Impact of 3D Printing on Spare Parts Logistics

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Abstract: We present a general framework to analyze and quantify the impact of 3D printing on spare parts logistics. We consider multiple parts facing stochastic demands. To minimize long-run average system cost, our model determines which parts should be printed and which should be stocked and the corresponding base-stock levels. When a demand for a stocked part encounters a stockout, it can either be backlogged or overflowed to the 3D printer. We derive various structural properties and characterize the optimal policy for several special systems, which lead to efficient near-optimal heuristic solutions for the general system. We demonstrate that adopting 3D technology can yield significant cost savings and this impact increases in part variety. Also, “a little flexibility goes a long way” in the sense that allowing both the stock and print options can substantially slash system inventory and cost, while the utilization of the 3D printer is surprisingly low. (Joint work with Yue Zhang)

Bio: Jing-Sheng Song, Professor of Operations Management; PhD (Columbia University)

Professor Song’s expertise is in operations and supply chain management. She studies topics like supply chain coordination mechanisms, global sourcing strategies, socially responsible and sustainable supply chain development, inventory and logistics system design and planning, assemble-to-order systems. She has published numerous articles in leading international academic journals such as Management Science, Manufacturing & Service Operations Management (M&SOM), and Operations Research. Professor Song is the recipient of several research grants from the U.S. National Science Foundation and the Natural Science Foundation of China. In 2003, she was awarded Distinguished Overseas Young Scholar by the Natural Science Foundation of China. In 2009, she was named the Chang Jiang Scholar by the Ministry of Education in China. In 2015, she received Thousand Talents Award from the Organization Department of the CCCPC in China. Professor Song has served on the editorial boards of several leading academic journals, including Area Editor for Operations Research and Department Editor for IIE Transactions, as well as Associate Editor for Management Science, Operations Research, M&SOM, and Naval Research Logistics. She is also a past President of the Manufacturing and Service Operations Management (MSOM) Society of INFORMS. In 2014, she received the MSOM Distinguished Service Award for her many contributions over the years to the society.