Predictive 3D Printing with IoT

ABSTRACT
Industry 4.0 marks a new industrial revolution centered around technologies that connect digital and physical realms, revamping how information is used to manage work. Two core enablers are the Internet of Things (IoT) and 3D printing. The former monitors the real-time status of a complex system, and the latter responds to that information with agile manufacturing. Nevertheless, how exactly this can be done remains unclear. To gain insights, we consider the context of a 3D printer supplying a critical part installed in multiple machines embedded with sensors and interconnected via IoT. While it is tempting to perceive that the marriage of 3D printing and IoT would make on-demand printing a reality, our results indicate that the true benefit of the marriage is to enable predictive printing. In particular, it is generally optimal to predictively print-to-stock, triggered by a system-lifetime-status dependent threshold. Whether the optimal policy permits minimum inventory depends crucially on the printing speed. Our framework can be leveraged to help develop scheduling tools for predictive 3D printing.

BIOGRAPHY
Dr. Yue Zhang is an assistant professor of supply chain management in the Department of Supply Chain and Information Systems at Penn State University. She obtained her Ph.D. in operations management from Duke University. She also earned a bachelor in math and physics from Tsinghua University and a master in operations management from Hong Kong University of Science and Technology. Dr. Zhang’s research interests include global inventory planning and sourcing strategies, additive manufacturing and spare parts logistics, digital supply chain, product variety and process design. Dr. Zhang was the awardee of Dr. Robert D. Pashek and Dr. John J. Coyle Early Career Professorship in Supply Chain. Her research work has won best paper awards and have been featured on Additive Manufacturing and 3D Printing Industry. She serves as an Associate Editor for the Decision Sciences Journal.