

From Models to Implementation: Lessons from Two Industries

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Date: 02.01.2018, Venue: P12 @ 2.00 PM

Abstract:

The talk will focus on research collaborations addressing supply chain challenges from the biomanufacturing and oil and gas equipment manufacturing industries.

In the first part of the talk, we consider trade-offs in manufacturing engineer-to-order proteins used in research and development of new drugs. Biomanufacturing operations involve high risk of failure due to purity and yield trade-offs, uncertainty in process outcomes, and expensive operating costs. In this setting, the biomanufacturer needs to determine how much protein to manufacture in the upstream operations, and then how much of it to waste in each subsequent purification operations because of the purity and yield trade-offs. We use a state aggregation technique within a Markov decision processes framework and characterize the structural properties of the optimal policy. Insights obtained from this optimization framework provide substantial basis for biomanufacturers to communicate their manufacturing challenges with their clients. This research is part of a multi-year collaboration with Aldevron that has contributed to 30% reduction in lead times and a three-fold increase in revenues.

In the second part of the talk, we will analyze strategy tradeoffs in supply chains making complex engineered products for the oil and gas equipment industry. We analyze a setting where individual products can be made either at a shared in-house manufacturing facility or at dedicated facilities of external sub-contractors. The manufacturer and the subcontractor differ in terms of costs, production capacities, rates, and service level capabilities. Using Markov decision process models, we determine the optimal policy and characterize its structure. We derive the set of conditions that partitions the state space into regions and characterize optimal policies in each region. We consider several special cases and prove that the optimal policy has a multi-index structure in each of these cases with dual index type structure as a special case in some cases. This research is part of a multi-year collaboration with National Oilwell Varco that has contributed to multi-million-dollar savings in supply chain operations.

The talk will conclude by summarizing the exciting opportunities for supply chain and operations management research in these different industries.

Speaker Profile:

Ananth Krishnamurthy is a Professor in the Department of Industrial and Systems Engineering at the University of Wisconsin-Madison, USA. His research targets the design and analysis of manufacturing systems and supply chains. Topics of interest include production inventory systems, product variety and customization, warehouse logistics, and quick response manufacturing. His research is supported by federal agencies as well as industry. Dr. Krishnamurthy also serves as the Director of the Center for Quick Response Manufacturing. He is a member of INFORMS, IISE, IEEE, POMS, SME, and APICS.